

sponding numbers, 1, 2, 3 and 4 in the respective sections, Figs. 1360, 1361 and 1362.

Fig. 1364 shows a 1 and 1 fabric having a plain weave on the face and a 2 up 2 down basket on the back. Only a part of the stitchers are favorably placed to reduce the curvature of the stitching thread.

In Fig. 1365 the face is a 2 up 2 down basket, the back a plain weave. The set in both warp and filling is 2 face 1 back (beginning 1 face 1 back). The face-to-back stitchers, which are sinkers indicated by

Fig. 1363.

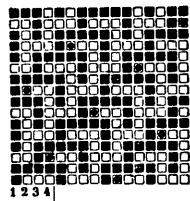


Fig. 1364.

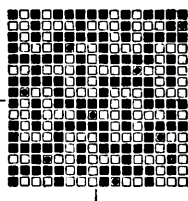


Fig. 1365.

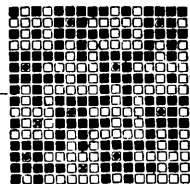
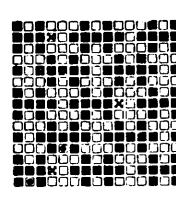


Fig. 1366.

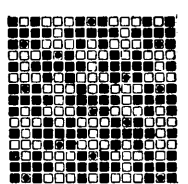


Fig. 1367. Figs. 1368, 1369.

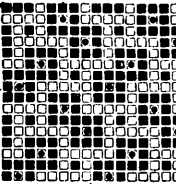


Fig. 1370.

crosses, are favorably placed so that the stitching thread passes below a face, a back and a face pick in succession.

As the face threads work in pairs, being down for two picks in succession, the stitching from face to back is to be preferred. If, however, the low grade of the back filling makes stitching from back to face necessary, the stitchers can be inserted on the dotted squares, threads 2 and 5.

In Fig. 1366 each texture is woven with a 2 up 2 down basket and stitched in both ways. Stitchers from back to face are risers indicated by dotted squares; from face to back, sinkers indicated by crosses.

Fig. 1367 shows a 2 up 2 down basket face and a plain back stitched in modified broken twill order, as in Fig. 1451.

Fig. 1370 shows the two broken twill weaves, Figs. 1368 and 1369 (for back and face respectively) stitched, in broken 4-leaf twill order, 1, 2, 4 and 3. Here each stitcher has risers at the right and left as well as before and after.

Fig. 1371 shows two 3-leaf twills stitched in twill order; the warp set is 1 and 1; the back set, 2 and 1.

FIG. 1371.

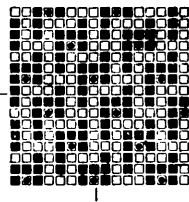


FIG. 1372.

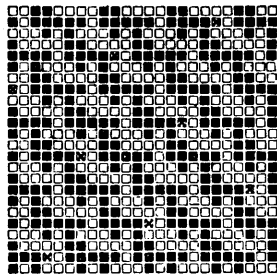


FIG. 1373.

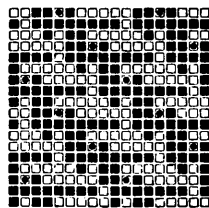
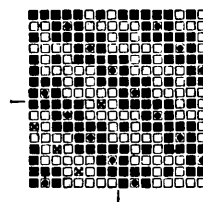


FIG. 1374.

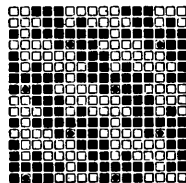


FIG. 1375.

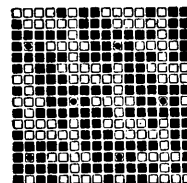


FIG. 1376.

Fig. 1372 shows a 2 up 2 down twill face and plain back, set 2 and 1. The stitching, indicated by crosses, is from face to back in 8-leaf satin order. Such weaves are frequently stitched twice in a 6-thread square, Fig. 1380; or four times in a 12-thread square, Fig. 1381.

Fig. 1373 shows a double 2 up 2 down twill set 1 and 1 in warp and filling. The dotted squares, risers, indicate stitchers from back to face; the crosses, sinkers, are the stitchers from face to back.

In Fig. 1374 the face is a 3 up 3 down twill; the back, a 1 down 2 up twill, the set 2 face 1 back, stitched from back to face.

Fig. 1375 has a 3 up 3 down twill face and plain back; the set is 3 face 1 back; stitched from back to face. A better cover is given to the back of this fabric by setting the filling 2 face 1 back 1 face 1 back with every 2 back picks interlacing the filling alike, as shown at Fig. 1376.

The arrangement of the face and back threads in Figs. 1363 to 1376 is well suited for stitching the two

FIG. 1377.

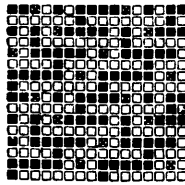


FIG. 1378.

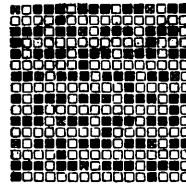
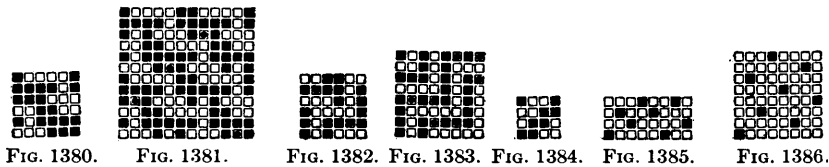
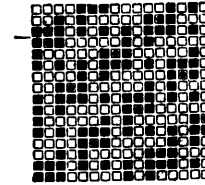


FIG. 1379.



weaves. This would not have been the case if the back weave had been begun at a different place. For example, if in Fig. 1372 the plain back weave, instead of beginning 1 up 1 down, had started with 1 down 1 up, the draft would have been as shown at Fig. 1382, which cannot be stitched to good advantage.

Again, if the twill of the back weave in Fig. 1373 instead of beginning 1 up 2 down 1 up had begun 1 down 2 up 1 down, the draft would have been as shown at Fig. 1383, which offers no good places for stitching.

These examples show the necessity of constructing double weaves so as to leave a favorable place for the insertion of the stitchers.

While desirable, it is nevertheless impossible to draft double weaves by fixed rules. The only general rule that can be given is to bring the risers of the back weave next to the risers of the face weave.

Fig. 1377 is a broken 1 up 3 down twill on the face and a 2 up 2 down twill on the back. The set is 1 and 1 in warp and filling. The face-to-back stitchers are indicated by crosses (\times), sinkers, arranged in broken 4-leaf twill order.

Fig. 1378 is a 6-leaf satin face with a plain weave

FIG. 1387.

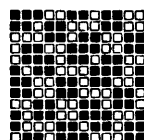


FIG. 1388.



FIG. 1389.



FIG. 1390.

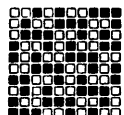
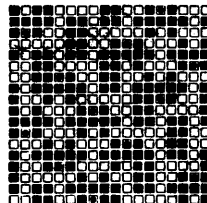


FIG. 1391.



FIG. 1392.



FIG. 1393.

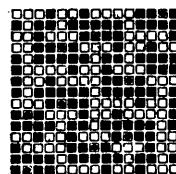


FIG. 1394.

on the back. The warp and filling are set 1 and 1. The face-to-back stitchers (\times), sinkers, are arranged in 6-leaf satin order.

Such weaves are used for plaid backcloths in which the back and face are made of contrasting colors, the face usually one color and the back plaided. The stitchers are from face to back to prevent the back threads from showing on the face.

The weave at Fig. 1379 is adapted for worsted goods having a 2 up 2 down twill face. The back weave is a broken twill, while the stitchers are in-

serted in 8-leaf satin order. The warp is set 1 and 1; the filling, 2 and 1.

For this class of goods the face is often woven with crêpe and similar weaves, while the back weave is so arranged that the warp comes to the surface on the back of the cloth, the back filling being concealed in the center of the fabric.

This construction is shown at Figs. 1379, 1390, 1394, 1398, 1402 and 1406. The face weave, back

FIG. 1395.



FIG. 1396.



FIG. 1397.

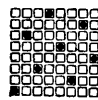


FIG. 1398.

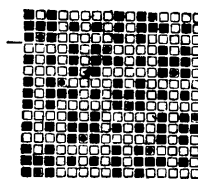


FIG. 1399.



FIG. 1400.

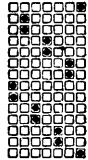


FIG. 1401.

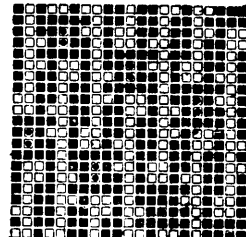


FIG. 1402.

weave and order of stitching for the respective double weaves are shown as follows :

Figs. 1384, 1385 and 1386 for Fig. 1379.

Figs. 1387, 1388 and 1389 for Fig. 1390.

Figs. 1391, 1392 and 1393 for Fig. 1394.

Figs. 1395, 1396 and 1397 for Fig. 1398.

Figs. 1399, 1400 and 1401 for Fig. 1402.

Figs. 1403, 1404 and 1405 for Fig. 1406.

These weaves are set as follows :

Fig. 1379, warp, 1 and 1; filling, 2 and 1.

Fig. 1390, warp and filling, 2 and 1.

Fig. 1394, warp and filling, 2 and 1.

Fig. 1398, warp, 1 and 1 ; filling, 2 and 1.

Fig. 1402, warp and filling, 2 and 1.

Fig. 1406, warp, 1 and 1 ; filling, 2 and 1.

The face and back in Fig. 1402 are stitched by bringing the back warp thread above two adjacent face picks, indicated by dotted squares. This method of joining double weaves should be used only when the back and face warp are of the same quality and color and the stitchers are well covered by warp risers on either side, as in Fig. 1402, which is suited for worsted cloths.

The back weave is often plain when the cloth is made with a worsted face and woolen back. This is

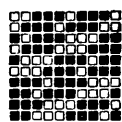


FIG. 1403.

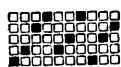


FIG. 1404.

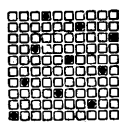


FIG. 1405.

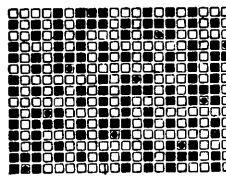


FIG. 1406.

the usual course when both face and back are woolen, the object being to make the fabric firmer. At Figs. 1410 and 1414 are shown two weaves in which the face is crêpe and the back plain. The face and back weaves and order of stitching for Fig. 1410 are shown at Figs. 1407, 1408 and 1409 ; for Fig. 1414, at Figs. 1411, 1412 and 1413.

Attention is called to two other weaves for heavy woolen fabrics, the army tricot, Fig. 1415, and the army diagonal, Fig. 1416.

The first, Fig. 1415, is the tricot long, Fig. 1320, with a plain back. The warp is set 4 face 1 back ; the filling, 2 face 1 back ; stitched from face to back.

The face of the army diagonal, Fig. 1416, is the diagonal shown at Fig. 313, the back being woven with the cross-rib weave, Fig. 208. The warp is set 4 face

1 back; the filling, 2 face 1 back; the stitching is from back to face.

Warp weaves, preferably the broken 3 up 1 down twill, are used for the face of face-finished goods. The back is often woven plain and the stitching so arranged that 2 stitchers come in each square of 6 threads, 4 stitchers in a 12-thread square or 8 stitchers in a

FIG. 1407.



FIG. 1408.



FIG. 1409.

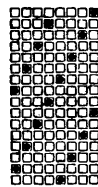


FIG. 1410.

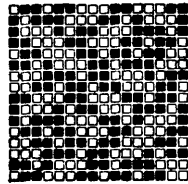
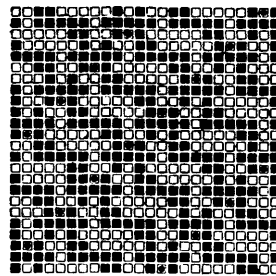


FIG. 1411.

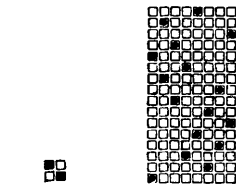


FIG. 1412.

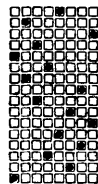


FIG. 1413.

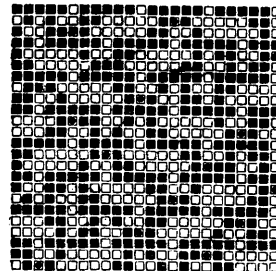


FIG. 1414.

24-thread square, as shown in Figs. 1418, 1425 and 1429, respectively.

The face and back weaves and stitching order for Fig. 1418 are shown at Figs. 1419, 1420 and 1421; for Fig. 1425, at Figs. 1422, 1423 and 1424; for Fig. 1429, at Figs. 1426, 1427 and 1428; for Fig. 1439, at Figs. 1430, 1431 and 1432; for Fig. 1440, at Figs. 1433, 1434 and 1435; for Fig. 1441 at Figs. 1436, 1437 and 1438; for Fig. 1451, at Figs. 1442, 1443 and 1444; for Fig. 1452, at Figs. 1445, 1446 and 1447; for Fig. 1453, at Figs. 1448, 1449 and 1450.

Lighter fabrics are sometimes woven with a 3-leaf twill face and plain back, as shown at Fig. 1417. The order of stitching covers 6 back warp threads and 12 face picks.

The heavy overcoating cloth known as double satin, president and Eskimo cloth, is woven with a broken 3 up 1 down twill or a 5-leaf warp satin on both face and back. The two weaves are stitched tightly, but so carefully and regularly that the smoothness of the face is not affected. A stitcher with a riser at both right and left is inserted at each face pick. Figs. 1430 to 1453 show examples of these weaves. Figs. 1452 and 1453 are better adapted for goods of lighter

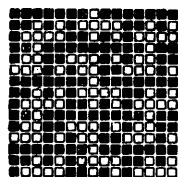


FIG. 1415.

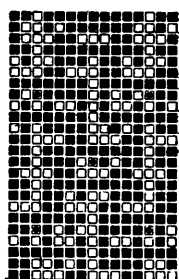


FIG. 1416.

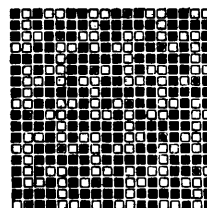


FIG. 1417.

weight, on account of the greater firmness resulting from the plain back with which they are woven.

The warp in each of these six weaves is 2 face 1 back. The filling in Fig. 1439 is set 1 face 1 back; in Fig. 1441, 3 face 1 back; in the others, 2 face 1 back.

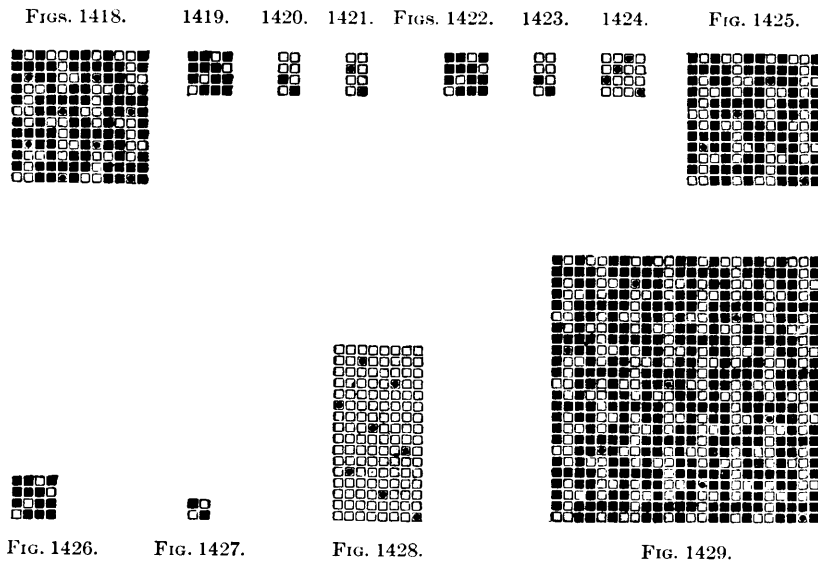
The warp of these fabrics is sometimes set 3 or 4 face to 1 back, as shown at Figs. 1454 and 1455, in order to obtain a closer set on the face. The filling in these two weaves is set 2 face 1 back.

Two combinations of 5-leaf satin weaves for Eskimo overcoating cloths are shown at Figs. 1456 and 1457.

Fig. 1456 has a warp satin on back and face. Fig. 1457 has a warp satin on the face and a filling satin on the back, which is made double to avoid the long filling floats.

Two back weaves for beaver cloths are shown at Figs. 1460 and 1461, with blank spaces showing the position of the face picks. Fig. 1460 is a rib, Fig. 208; Fig. 1461 shows a double 5-leaf warp satin. The filling is set 2 face 2 back, the two face picks being inserted between two back picks woven alike. This arrangement is sometimes adopted when a thick nap is wanted on the back.

Overcoating cloths with curled or looped effects on the face resembling Persian lamb skins are made with



carded woolen warp and back filling, the face filling being made by doubling a fine thread with a coarse thread of luster wool. In twisting the ply yarn, the coarse thread is run slack on the fine thread as a base, thus forming loops or curls. About two inches of the coarse thread is twisted on every inch of the fine yarn. A very fine thread, called the binder, is twisted in the opposite direction around the other two and develops the loop.

The face is usually woven with a broken 4-leaf filling twill or a filling satin, the back with a 2 up 2 down

twill or a weave which throws the filling on the back. Fig. 1458 is a weave of this kind with a broken 1 up 3 down twill on the face, and a 2 up 2 down twill on the back. It is set 1 and 1 in the warp, and 1 face 2 back in the filling.

Fig. 1462 is woven 1 face 2 back in the warp and 1 face 3 back in the filling. The weave is a 4-leaf broken filling twill on the face, and a 2 up 2 down twill

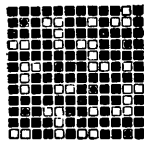
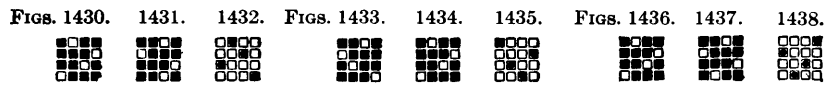


FIG. 1439.

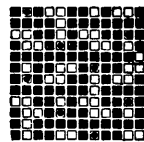


FIG. 1440.

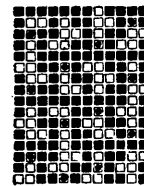


FIG. 1441.

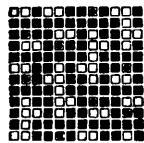
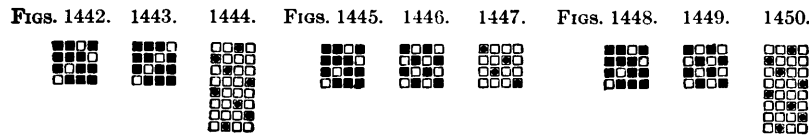


FIG. 1451.

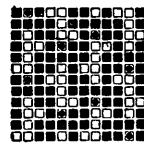


FIG. 1452.

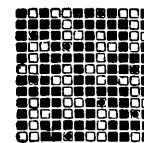


FIG. 1453.

on the back. Both weaves should be stitched from face to back, as shown in the draft, in which the stitchers, sinkers, are indicated by crosses (×).

In Fig. 1463 the face filling is woven with an 8-leaf satin; the back filling, with a modified broken twill; filling, 1 face 2 back. This is a single fabric woven with a back filling, and not a regular double fabric.

The illustrations that have been given show the method of constructing double weaves, of which the number is unlimited. The principal difficulty in draft-

ing double cloths is in stitching the face and back fabrics together. The rules already given should be strictly observed and care taken when drafting a new weave for a double texture to have the stitchers in the right place.

The divided drawing-in draft, No. 8, Figs. 25 and 26, is best for double cloths, the face and back warp coming on separate sets of shafts.

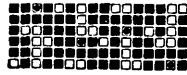


FIG. 1454.

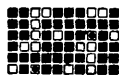


FIG. 1455.

In some mills it is customary to draw in the warp straight, using as many shafts

as there are threads in the weave pattern. It is usually better, however, to draw the back warp and face warp on separate groups of shafts. In many cases this enables the warp to be drawn on a less number of shafts than with a straight draft.

Fig. 1459 shows a double cloth weave, 2 face, 1 back in warp and filling, a broken 4-leaf warp twill on the face, and plain weave on the back, with the face and back warp drawn on separate groups of shafts.

FIG. 1456.

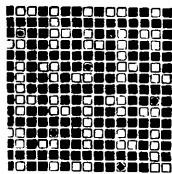


FIG. 1457.

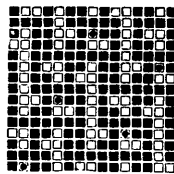


FIG. 1458.

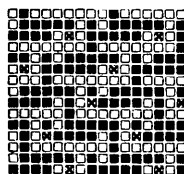


FIG. 1459.

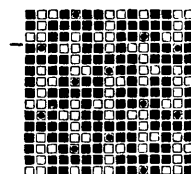


FIG. 1460.

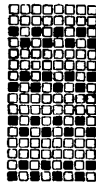


FIG. 1461.

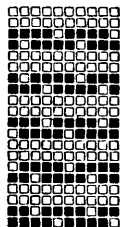


FIG. 1462.

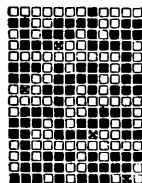
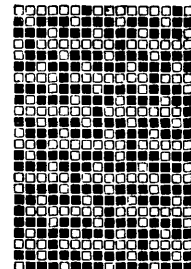


FIG. 1463.



So far as possible the warp of double cloths should be reeded as follows :

- 1 face 1 back : 4, 6 or 8 threads per dent.
- 2 face 1 back : 3 threads (1 face 1 back 1 face) per dent; 4 and 5 alternate per dent; or, 6, 9 or 12 threads per dent.
- 3 face 1 back : 4 threads (1 face 1 back 2 face) per dent; or 8 threads per dent.

When there are 2 or more face threads for 1 back thread, the back thread should not come first or last in the dent.

DOUBLE CLOTHS WITH STUFFING THREADS

Stuffing threads are inserted in the cloth when the requisite weight and thickness cannot be obtained with the

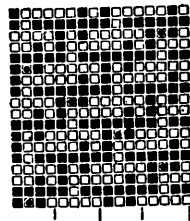


FIG. 1464.

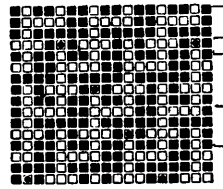


FIG. 1465.

regular double weaves. These stuffing threads, which may be in warp or filling, lie between the face and back. They do not come to the surface on either side of the cloth and can, therefore, be of any color or quality desired, provided the contrast is not so sharp that the color of the inner threads shows to an objectionable extent on the face or back. These stuffing threads often serve to increase the prominence of stripes and figured effects as in piqué and matelassé.

Stuffing warp threads lie above every back pick and below every face pick. If the stuffing threads are in the filling, all face warp threads must be raised above and all back warp threads lowered below each

stuffing pick. Fig. 1464 shows stuffing warp threads in a double cloth with a 2 up 2 down twill face and plain back. Fig. 1465 shows the same face and back weaves woven with a stuffing pick. In both cases the order is 1 face 1 back 1 face 1 stuffing thread.

THREE OR MORE PLY CLOTHS

Three or more fabrics are woven one above the other and stitched together when very thick and heavy goods are to be made.

In drafting a 3-ply weave the procedure is as follows:

The position of the threads for each fabric, face, center and back is first indicated on the draft.

The face weave is then drafted on the face threads, the center and back threads being left blank.

The face warp threads are now raised above all the center picks.

The center weave is drafted, the back threads being left blank.

The face and center warp threads are raised above all the back picks, and the draft is completed by drafting the back weave. The stitching can be effected in various ways:

1. From back to center and from center to face.
2. From face to center and from center to back.
3. From back to center and from face to center.
4. From center to face and from center to back.

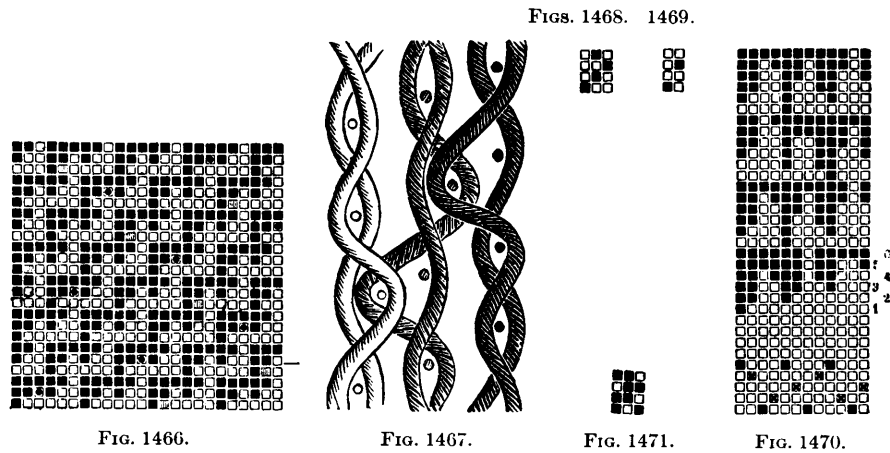
Fig. 1466 shows a 3-ply weave, each fabric woven plain, and stitched in 8-leaf satin order, according to the first method given above. Warp and filling are set 1 face 1 center 1 back.

Fig. 1467 is a longitudinal section of the same weave and shows plainly the construction of the fabric.

Fig. 1470 shows a ply weave used for drying-felt for cotton cloth, also for belting. Five sets of warp and 6 sets of filling threads lie over each other. The sixth set of filling is in fact a back filling on the 5-ply

fabric. The first or face fabric is stitched to the second; the second is stitched to the third; the third, to the fourth; and the fourth, to the fifth. The two outside fabrics (1 and 5) have the same set and weave, broken 4-leaf twill, except that the risers of one weave correspond to the sinkers of the other.

Of each 12 warp threads, 3 belong to the first or face weave, 3 to the back weave, and 2 to each of the three interior weaves. Fig. 1468 is the weave for the face; Fig. 1469, the weave for the second, third and fourth fabrics; and Fig. 1471 the weave for the back texture.



The complete draft is shown at Fig. 1470. The division and distribution of the warp threads are indicated at the bottom of the draft; of the filling threads, by the figures 1 to 6 at the side. The warp is reeded 12 threads in a dent. A fabric that is quite common is woven with this weave and reeded with $13\frac{1}{2}$ dents per inch.

THREE OR MORE PLY CLOTHS STITCHED WITH EXTRA WARP OR FILLING

The ordinary method of stitching 3 or more ply cloths tend to solidify the fabric by drawing the separate textures together. This method is satisfactory when a firm and durable cloth is desired.

For thick, bulky goods, it is sometimes necessary to weave separately each of the textures that form the cloth and without interlacing the threads of one fabric with those of another. The different textures are stitched together by extra warp or filling threads, which pass by degrees from one side of the cloth to the other. An extra warp beam is required for these extra threads if they are introduced in the warp.

This method of stitching is frequently used for cloaking fabrics, of which the face color is plain or fancy, and the back plaided. The binding thread is fine cotton yarn. One stitching thread is usually inserted

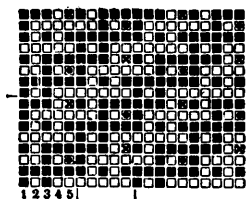


FIG. 1472.



FIG. 1473.

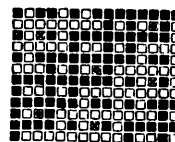


FIG. 1474.

after every four of the regular threads. The stitching threads are raised above a face pick and lowered below a back pick, thus binding the separate fabrics together. When not so raised or lowered, they lie between the upper and lower textures.

Weaves for these fabrics are drafted by first coloring the stitching warp threads on the draft to distinguish them.

The weaves for the different textures are then drafted in the remaining spaces.

The stitching warp threads are then raised above all the back picks.

These stitching threads are next raised above certain face picks (dotted squares), and lowered below certain back picks, so as to bind face and back together.

If the stitching threads are in the filling, all of the face warp threads are first raised above them. Then a back warp thread is raised and a face warp thread lowered below a stitching pick to bind the face and back fabrics together. These stitchers are brought to face or back only where the adjacent threads are in a position to conceal them.

Figs. 1472 to 1484 show different weaves of this class. The accompanying cross sections make the construction clearer. The dotted squares indicate risers; the crosses, sinkers.

Fig. 1472 is a double cloth, each weave being a 2 up 2 down twill. After every group of 2 face and

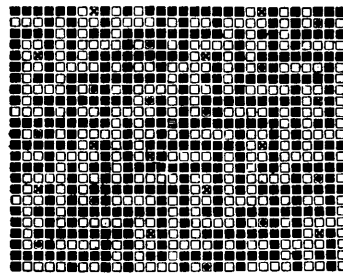


FIG. 1475.

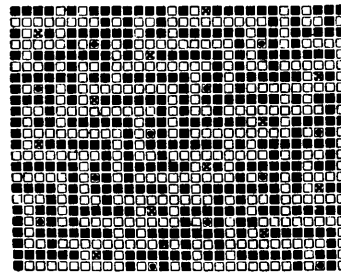


FIG. 1476.

2 back warp threads, a binding thread is inserted. The numbers of the warp threads in the longitudinal section, Fig. 1473, correspond with the numbers in Fig. 1472. The dotted line, not numbered, is the second binding thread, which is the tenth thread in Fig. 1472.

Fig. 1474 shows two 3 up 3 down twill weaves stitched with 1 binding warp thread after every group of 2 face and 2 back threads.

Fig. 1475 shows a 3 up 1 down twill face and 3 up 3 down twill back stitched with 1 binding warp thread after every group of 2 face and 2 back threads.

Fig. 1476 shows a 3 up 3 down twill face and 2 up 2 down twill back stitched with 1 binding warp thread after every group of 2 face and 2 back threads.

Fig. 1478 and the corresponding cross section, Fig. 1477, show two 2 up 2 down twills stitched together with an extra pick following every group of 2 face and 2 back picks. The picks are numbered the same in both draft and section.

Fig. 1479 is a ply weave for a very thick cloth. Four picks lie one above the other. The face and back weaves are 6-leaf satin with back filling. The fifth pick serves as a binding thread, as shown by the cross section, Fig. 1482. The first 5 picks are numbered to correspond with the first 5 picks at Fig. 1479. The

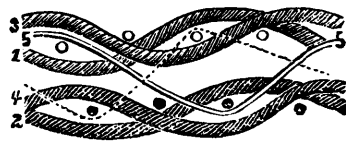


FIG. 1477.

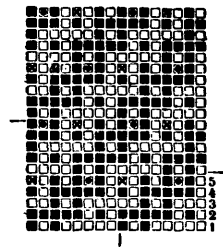


FIG. 1478.

FIG. 1479.

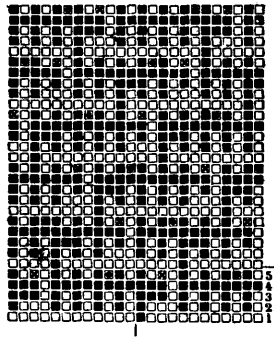


FIG. 1480.

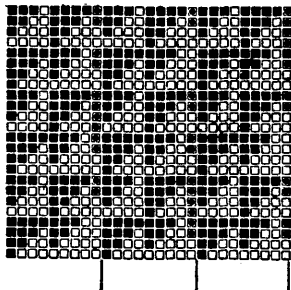


FIG. 1481.

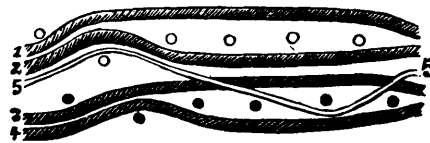
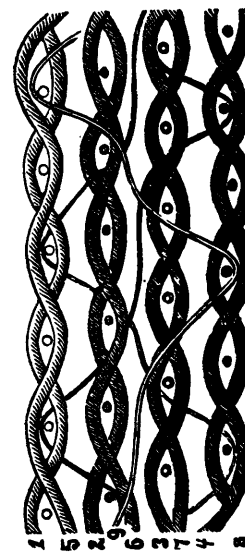


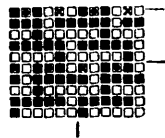
FIG. 1482.

face warp is indicated by the outline circles; the back warp, by the black circles. This cloth, which is from $\frac{1}{5}$ to $\frac{1}{4}$ inch thick and used for piano felt, is also made with six sets of filling; of which the sixth is a stuffing pick lying between the face and back, as at Fig. 1465.

Fig. 1480 is a weave for a 4-ply fabric with extra binding threads in the warp. Each of the four separate textures is woven with a plain weave. The position of the stitching warp is shown in the longitudinal section, Fig. 1481, in which the threads are numbered to correspond with the first 9 warp threads of Fig. 1480.

An excellent weave for woven felt is shown at Fig. 1483. The face weave is a broken 3-leaf filling twill;

FIG. 1483.



Figs. 1485. 1486.

FIG. 1484.



Figs. 1487. 1488.

the back weave, a broken 3-leaf warp twill. This causes the face filling to predominate on the face, and the back filling to predominate on the back, making both sides of the cloth alike.

Every four regular picks are followed by one extra or stitching pick indicated by a straight line at the right. The stitching is effected by lowering a face warp thread below (crossed squares) and raising a back warp thread above (dotted squares) the stitching pick, thus binding both textures to this extra pick.

Another equally good weave for heavy felt is shown at Fig. 1484. Face and back are each woven with a broken 4-leaf twill, the face is 1 up 3 down; the back 3 up 1 down. After 1 face and 1 back pick of the regular weaves, there is a binding pick to which both face

and back textures are bound, as in Fig. 1483. The stitchers are indicated by crosses (\times), sinkers, and dotted squares, risers, on the binding pick.

Figs. 1485 and 1486 are the face and back weaves for Fig. 1483; Figs. 1487 and 1488, the face and back weaves for Fig. 1484.

WEAVES FOR WOVEN BELTING

Woven belting consists of several separate textures, which are more closely stitched together than the ply fabrics that have been described. In the belting fabrics a separate set of warp threads alternate on face and back, making a through and through fabric. This

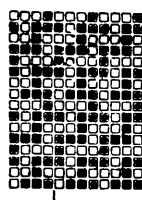


FIG. 1489.

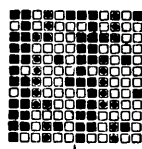


FIG. 1490.

results in a closer union of the different textures, and makes the whole fabric more solid and compact.

In the double plain weave, Fig. 1489, threads 1 and 4 alternate on face and back; thread 2 being on the back and thread 3 on the face continuously. The first warp thread passes under the first pick to the back, and above the fourth pick to the face, thus forming a part of both face and back textures. The fourth warp thread, on the other hand, passes below the fifth pick to the back, and above the eighth pick to the face, likewise forming a part of both the face and back. The threads are thus arranged as follows: warp, 1 binder 1 back 1 face 1 binder, bringing two binder threads together; filling, 1 back 1 face.

A similar weave is shown at Fig. 1490 and is used for cotton banding. It consists of two 3-leaf twills; 2 up 1 down for the face, 1 up 2 down for the back, making the back and face of the cloth alike. Warp threads 1 and 2 are face; 5 and 6, back threads. Threads 3 and 4 alternate on face and back, taking

the place of the third thread of the face twill and also of the back twill. Thread 3, for example, passes below picks 2 and 12 to the back, and above picks 5 and 7 to the face. Thread 4, on the other hand, passes above picks 1 and 11 to the face, and below picks 6 and 8 to the back.

Following are several weaves and lay-outs for belting fabrics :

(a) Double Banding, $4\frac{3}{4}$ inches wide. Weave, Fig. 1491. Warp, 6-ply No. 10 cotton. Filling, 8-ply No. 6 cotton, 410 ends in warp, 2 ends in each heddle, making 210 double ends. Four shafts, straight draft, beginning with shaft 2. Reeded, first dent (at left)

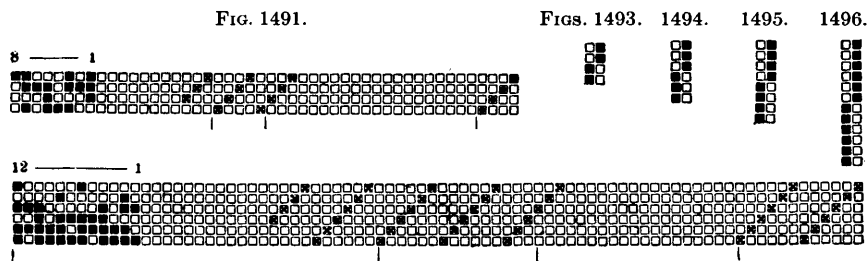


FIG. 1492.

3 double ends, then 5 and 6 alternate for 36 dents, ending with 4 ends in last dent.

(b) Cotton Banding, $3\frac{9}{10}$ inches wide. Weave, Fig. 1492. Warp, 9-ply No. 16 cotton. Filling, 6-ply No. 10 cotton. 442 ends in warp. Six shafts, straight draft, beginning with shaft 3. Reeded, first dent (at left) 10 ends, then 15 ends in each of the next 28 dents, and 12 ends in last dent.

Certain kinds of double cloth, used for banding, belting, etc., are stitched by a separate set of threads introduced in the warp at intervals, each one passing alternately to the back and face so that when one passes to the face the other passes to the back, thus binding the two textures together.

Figs. 1493, 1494, 1495 and 1496 show four methods of interlacing these threads with the filling. These extra

threads must be woven from a separate beam, and dressed considerably longer than the ground warp on account of the greater take-up. Following are several examples of this construction.

(c) 4-Ply Cotton Belting, $5\frac{3}{10}$ inches wide. Weave, Fig. 1497. Ground warp, 10-ply No. 16 cotton. Filling, 10-ply No. 6 cotton. 684 ends in ground warp; 54 ends of binding warp; making a total of 738 ends. 8 ground and 2 stitching shafts. Reeded, first dent (at left) 8 ends, second dent 24 ends, then 26 ends in each of the following 27 dents; last dent, 4 ends.

FIG. 1497.

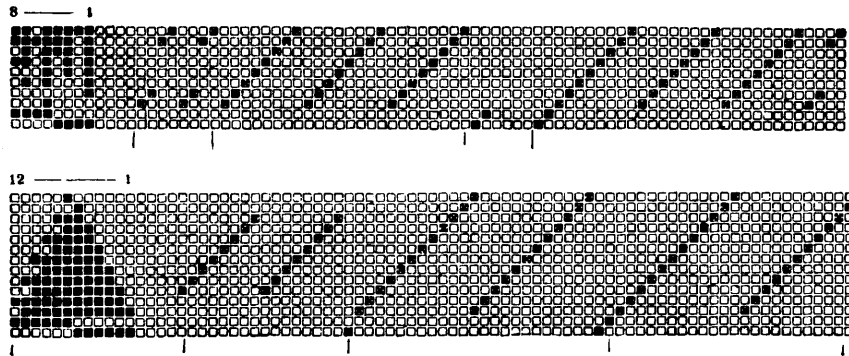


FIG. 1498.

Reed, 28 dents in 5 inches. The take-up of the ground warp is 22 per cent. Twenty-three yards of the binding warp is required for 10 yards of the ground warp.

(d) 6-Ply Hemp Belting, $5\frac{9}{10}$ inches wide. Weave, Fig. 1498. 664 ends 3-ply No. 8 hemp yarn in the ground warp; 53 ends double 3-ply No. 8 hemp yarn in binding warp; making a total of 717 ends. Twelve ground and 2 stitching shafts. Reeded, first dent 16 ground threads and 1 stitching thread, then 24 ground and 2 stitching threads in each of the next 26 dents, last dent 24 ground threads. Reed, 19 dents in 4 inches, $6\frac{3}{10}$ inches high. Take-up of ground warp, 22 per cent. From 25 to 26 yards of the binding warp is required for each 10 yards of the ground warp.

CORDED WEAVES

These are corrugated effects, or raised stripes running in the direction of either warp or filling.

CORDED STRIPES

The warp cords are usually produced by letting one pick float on the back under 4 to 16 ends, then raising it above one or two (seldom more than two) ends.

FIG. 1499.

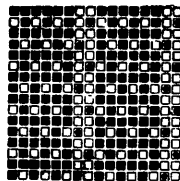


FIG. 1500.

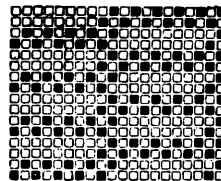


FIG. 1501.

while the next pick interlaces the warp with a plain, twill or other weave.

In ladies' corded dress goods it is customary to let two floating picks alternate with two binding picks, Fig. 1501.

The warp threads under which the floating picks pass are pressed upward and form an arch, as shown in the cross section, Fig. 1499. If a woolen cloth woven in this way is well fullled, the raised stripe is made more prominent, because the floating picks shrink rapidly, while the other picks, being woven closely into the warp, full more slowly.

The weave at Fig. 1500 corresponds to the cross section at Fig. 1499. The raised stripe contains 6 ends; under which the floating picks lie, the latter being stitched plain on 2 warp threads.

Fig. 1501 shows the same weave as used for ladies' dress goods, the risers being indicated by the white squares; the sinkers, by the black squares.

In Fig. 1502 the raised cord is formed with 8 threads woven with a 2 up 2 down basket, while 2 threads form the recess or depression between the cords.

Fig. 1503 shows 10 threads woven with a 2 up 2 down twill, alternating with 2 recess threads. The twill runs alternately to the right and left, as shown.

In Fig. 1504 the warp is arranged as follows: 8

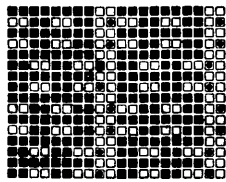


FIG. 1502.

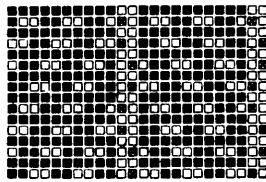


FIG. 1503.

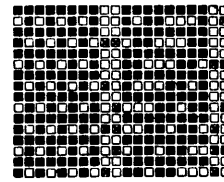


FIG. 1504.

threads woven plain, 2 recess threads, 8 threads woven with an 8-leaf diagonal, 2 recess threads; total, 20 threads.

If the face weave does not allow the weave for the recess threads to be drafted regularly, care must be taken to place the risers in the recess where they will break with the cord weave. A recess riser is inserted next to each cord sinker adjoining the recess, as shown at Fig. 1504.

Corded stripes can be woven without recess threads by making each pick float alternately on the back and interlace with the warp of the raised cord. In one stripe it floats on the back and in the next stripe it is woven on the face. The order is reversed on the next pick. Very pronounced corded patterns can be obtained in this way, as shown by the cross section, Fig. 1505, for which the weave is shown at Fig. 1506.

Each stripe is made with 8 threads woven plain on alternate picks.

Fig. 1507 shows a similar pattern with a 2 up 2 down twill substituted for the plain weave. The twill is reversed at each stripe.

Fig. 1508 shows a corded pattern, each stripe composed of 4 threads, a 2 up 2 down twill alternating with a plain weave.

Stuffing threads are introduced when a very full, round cord is wanted. In Fig. 1509 the cord is made with 6 ends woven plain and 4 stuffing ends. The latter are indicated by dotted squares and marked

FIG. 1505.

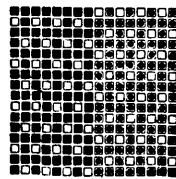


FIG. 1506.

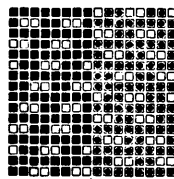


FIG. 1507.

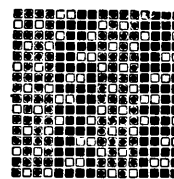


FIG. 1508.

with a line at the top of the draft. The recess is formed by 2 threads.

The durability of a corded cloth is increased by interlacing the stuffing threads with the picks floating on the back. In Fig. 1510 the stuffing threads and floating picks are woven plain. In other respects the pattern is the same as Fig. 1509.

A similar pattern is shown at Fig. 1511, in which a wide, 4-leaf basket cord alternates with a narrow twill cord, the two being separated by 2 recess threads. The back of the cord is woven plain.

Stitching the stuffing thread to the back or floating picks makes the cord less pronounced and results in two textures, one above the other.

Corded patterns without recess threads, Figs. 1506, 1507 and 1508, can be made with stuffing threads, if desired.

CROSS CORDS

These are usually made by letting every second or third warp thread float on the back for 4, 6, 8 or 10 picks while the other warp threads are woven with a plain weave, twill or similar weave. All the warp threads floating on the back are raised above the next one or two picks, thus producing a pronounced cross

FIG. 1509.

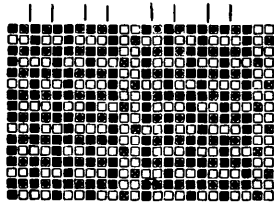


FIG. 1510.

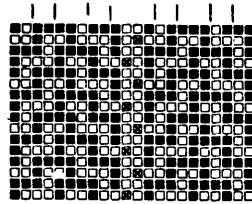


FIG. 1511.

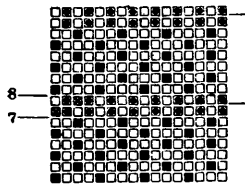
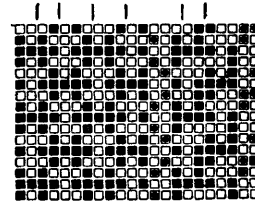


FIG. 1512.

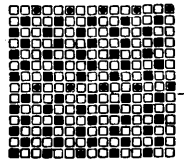


FIG. 1513.

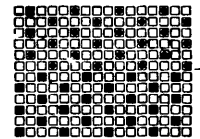


FIG. 1514.

cord. This effect is made still more marked if the back warp threads are woven from a separate beam under greater tension than that on the face threads. In the cross-cord weave, Fig. 1512, threads 2, 4, 6, 8, etc., float on the back for 6 picks, and then rise above 2 recess picks. The other threads, 1, 3, 5, 7, etc., are woven plain for the first 6 picks, then passing under two recess picks, 7 and 8. The face warp can be interlaced with the recess picks, as shown by the crosses on threads 1 and 3, if desired.

In Fig. 1513, two warp threads are woven plain for six picks, then passing under 1 recess pick. Every

third warp thread floats back of the six picks forming the cord, and then rises above the recess pick.

The recess is made finer by dispensing with recess threads and letting each warp thread float alternately back of the cord and interlace the filling, as shown at Fig. 1514.

The raised parts of filling cords are made more pronounced by introducing stuffing picks between

FIG. 1515.

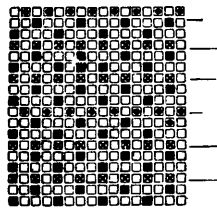


FIG. 1516.

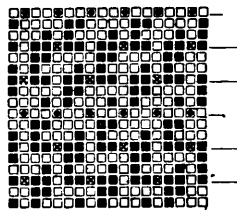


FIG. 1517.

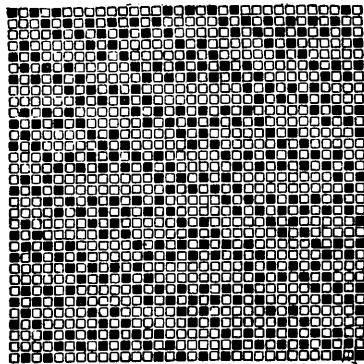
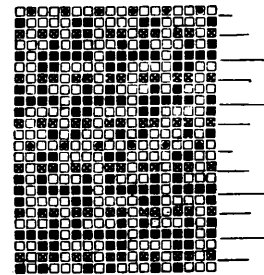


FIG. 1518.

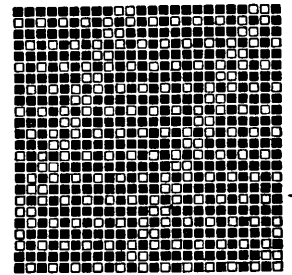


FIG. 1519.

back and face, as shown at Fig. 1515. The risers over the stuffing picks are indicated by crosses; those over the recess picks, by the dotted squares.

The durability of the cloth is increased by interlacing the back warp with the stuffing picks. An example is shown at Fig. 1516, in which the back warp and stuffing picks are woven plain. The face warp is woven with a 2 up 2 down twill for 6 picks, followed by one recess pick.

A very pronounced filling cord can be obtained on thick fabrics by using both stitched and unstitched stuffing picks, as shown at Fig. 1517. The shortest lines at the left of the draft indicate the recess picks; the next longer lines, the unstitched stuffing picks; the longest lines, the stitched stuffing picks. In other respects this weave is the same as Fig. 1516.

DIAGONAL CORDS

In these effects the back or floating picks do not all float under the same face threads and intersect the

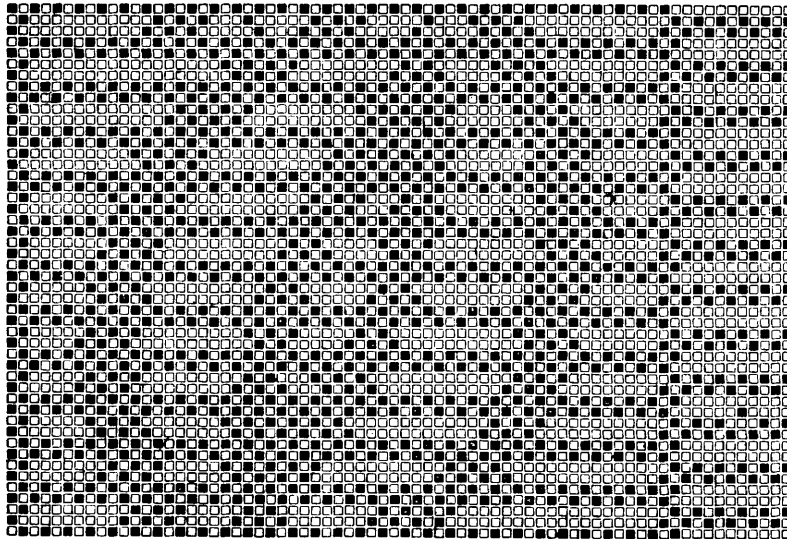


FIG. 1520.

same recess threads, but are arranged in twill order, as shown at Fig. 1519.

The raised effects obtained with corded weaves can be arranged to produce figured patterns, two examples being given at Figs. 1518 and 1520. The white squares are risers; the black squares, sinkers. The oval figure in Fig. 1520 is offset one half and inclined in the opposite direction in every other stripe.

DOUBLE WEAVES STITCHED TO FORM THE PATTERNS (MATELASSÉ)

Closely related to corded weaves, already described, are double weaves known as *matelassé* in which the

Fig. 1521.

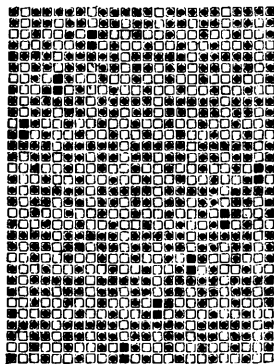


Fig. 1522.

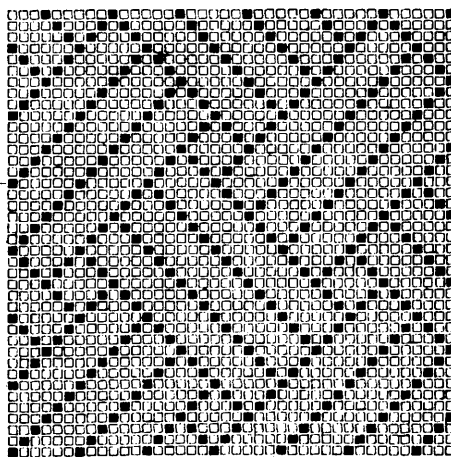


Fig. 1523.

stitching forms the pattern. To this class belong the so-called piqué weaves. As a rule both warp and filling are set 2 face 1 back and stitched by raising the back warp above two adjacent face picks.

The double plain weave constructed in this way and shown at Fig. 1522 is set 2 face 1 back in the warp, 2 face 1 stuffing pick 1 back pick in the filling. The motif for the pattern is shown at Fig. 1521.

It is evident that a depression will be caused where the two textures are stitched, while the surface where the cloth is unstitched will be raised. The effect is heightened when the back or stitching warp is woven

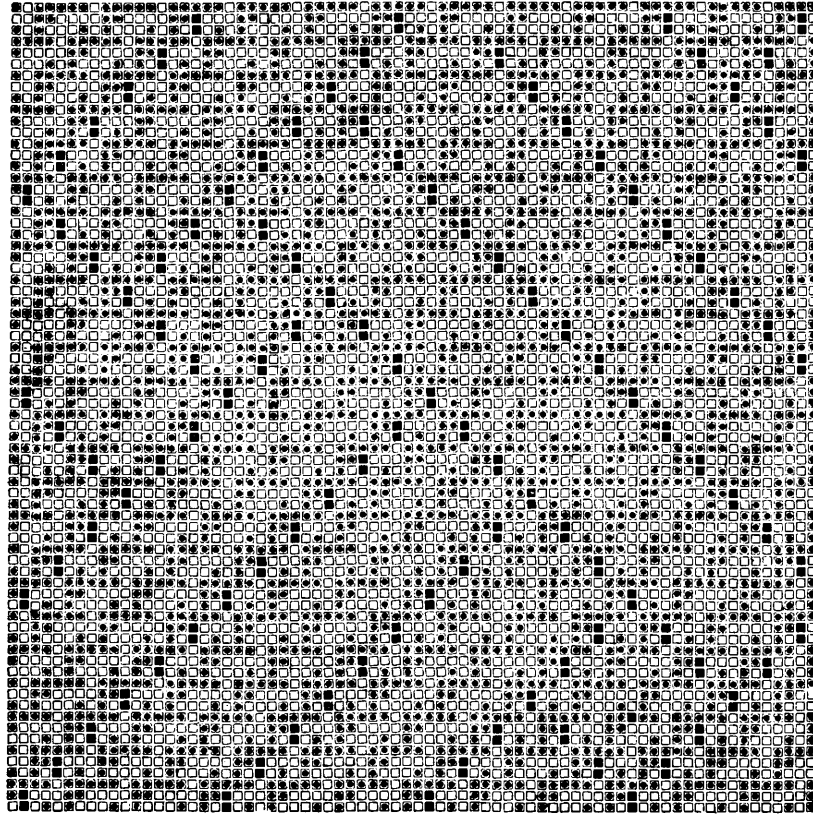


FIG. 1524.

FIG. 1525.

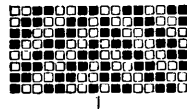


FIG. 1527

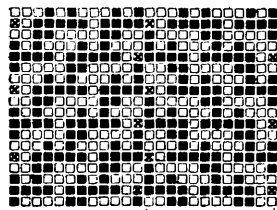
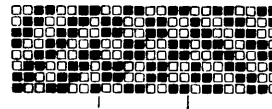


FIG. 1526.

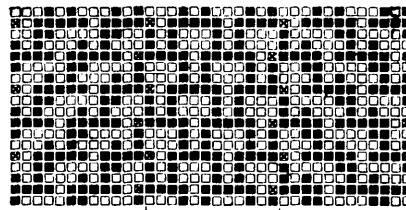


FIG. 1528.

from a separate beam under greater tension than is placed on the face warp. This raised effect is made more pronounced by introducing a stuffing pick of

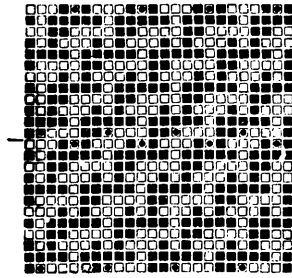


FIG. 1529.

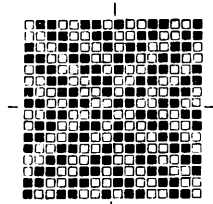


FIG. 1530.

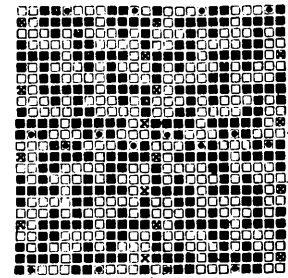


FIG. 1531.

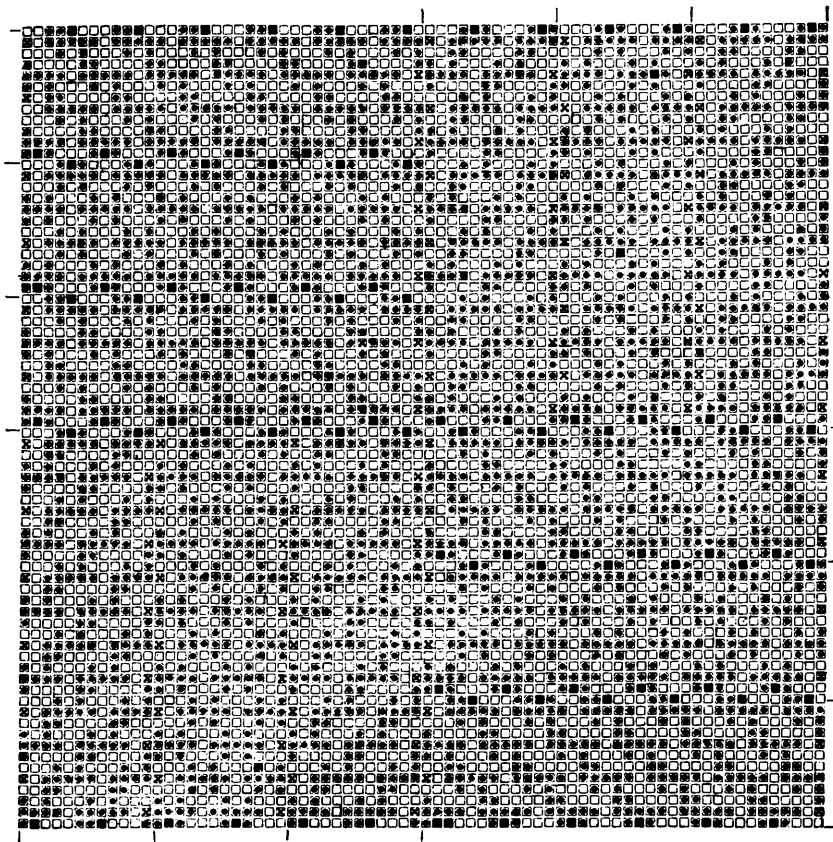


FIG. 1532.

coarser yarn, which, as shown by Fig. 1522, lies between the face and back.

The face is often woven with a twill, basket or similar weave; the back weave is usually plain. Fig. 1524 shows a 2 up 2 down twill on the face with a

FIG. 1533.

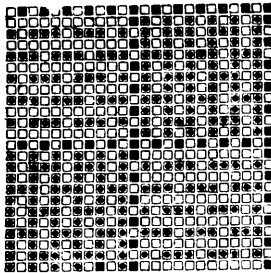


FIG. 1534.

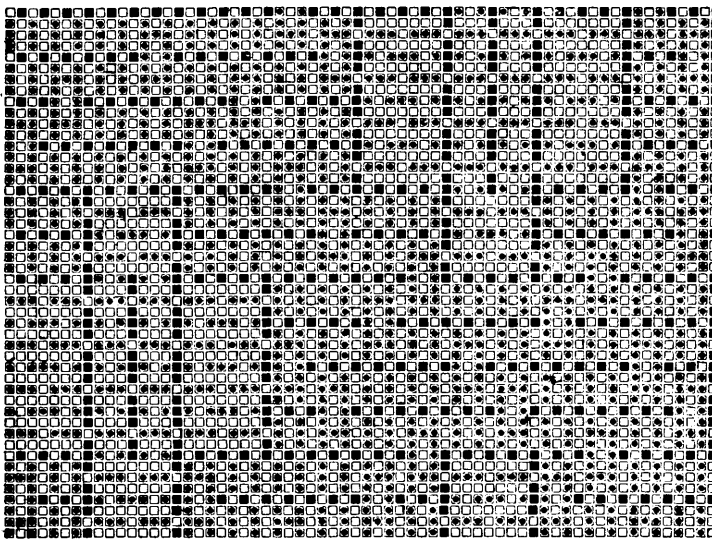
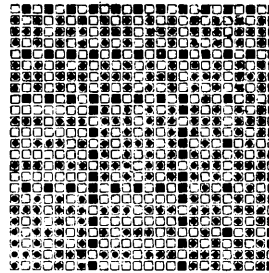


FIG. 1535.

plain back. The motif for the pattern is shown at Fig. 1523. The stitchers in Figs. 1522 and 1524 are indicated by the black squares, risers, on the back warp threads.

Many woolen and worsted cloths of this kind are stitched to produce a striped effect. The last face

thread of one stripe and the first face thread of the next stripe are stitched in plain order by passing under every alternate back pick.

This construction is shown at Figs. 1526 and 1528, the back in both cases being plain. The crosses represent the stitchers, which are sinkers. Fig. 1525 is the face weave of Fig. 1526; Fig. 1527 is the face weave of Fig. 1528.

To run this matelassé effect across or filling ways of the cloth, the back warp is interlaced in plain weave order with two adjacent picks, as shown at Fig. 1529, in which the dotted squares represent the stitching risers.

Patterns are frequently made by stitching along both warp and filling lines to produce squares, cubes, braided and other effects. The weave of this kind, shown at Fig. 1531, consists of a twill face and a plain back. The stitching risers are shown by the dotted squares; the stitching sinkers, by the crosses. Fig. 1530 is the face weave.

In Fig. 1532 the warp and filling lines of stitchers form a checkerboard pattern. The face weave pattern is obtained by a combination of a 2 up 2 down twill with a 2 up 2 down basket. The back is a plain weave. The construction of these patterns is sometimes simplified by weaving the stitching threads in the warp or filling in 3 up 3 down order.

Figs. 1533, 1534 and 1535 show weaves frequently used for the so-called relief patterns in silk and worsted fabrics.

MONTAGNAC

The face of the montagnac fabric, used for over-coatings, is covered with loops of soft stock, part of which are intact while the others have been broken in finishing to form tufts of fibers. The fabric is loose and bulky, these qualities being obtained by the sacrifice of durability.

The warp has an open set to allow a large quantity



FIG. 1536.

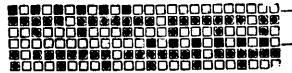


FIG. 1539.

FIG. 1537.



FIG. 1538.



FIG. 1540.



FIG. 1541.



of filling to be driven into the cloth, which is woven narrow, as little, if any, fulling is required. The warp plays a subordinate part in the make-up, being almost completely hidden on both face and back. The ordinary grades of these goods are made with ground and effect filling; the better grades with ground, back and effect filling.

The effect filling, which is to form the tufts or loops on the face, is from 2- to 5-ply yarn and has only enough twist to stand the process of weaving. The effect pick floats over a number of face warp threads

FIG. 1542.

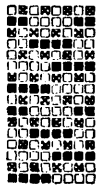


FIG. 1543.

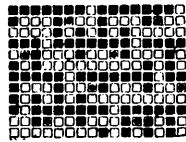
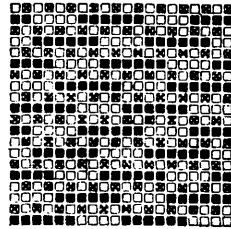


FIG. 1544.

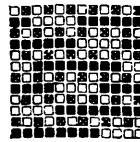


FIG. 1545.

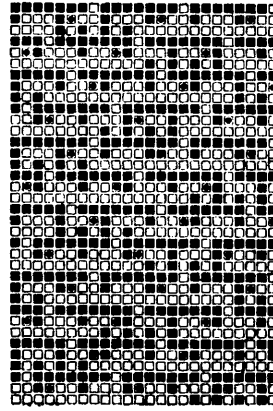


FIG. 1546.

and is then either stitched in plain weave order for a few warp threads or passed under them; the latter method is shown by the cross section at Fig. 1537.

The ground filling serves to bind the fabric together and give it durability, while the back filling increases the thickness of the cloth and enables a fluffy finish to be obtained on the back.

The slack twisted effect filling floating on the face is torn apart in the giggering or napping process at the points indicated by the arrows, Fig. 1537. The subsequent operations of beating and brushing raise the

loose tufts and form them into clusters, which produce the well-known montagnac finish.

Fig. 1538 is a cross section of the cloth at Fig. 1537 after the effect filling has been torn apart and the tufts made to rise from the surface of the goods. A portion of the weave for this fabric is shown without

FIG. 1547.

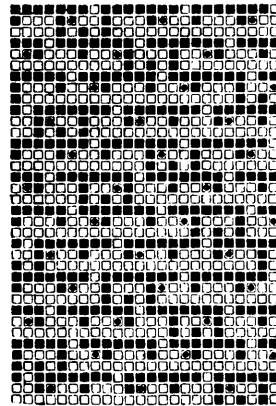
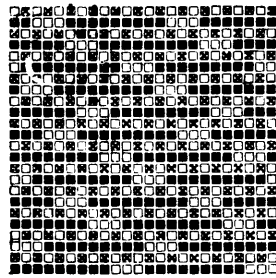


FIG. 1548.

stitchers at Fig. 1536, in which the filling is 1 ground 1 back 1 effect pick.

To increase the flaky effect and cover the face better, the effect picks are sometimes woven as shown at Fig. 1540, where each effect pick passes under the warp threads over which the preceding effect pick floated. This brings the tufts closer together, the face of the cloth being entirely covered with the effect filling. This construction is illustrated by Figs. 1540 and 1541, the first showing the woven cloth; the second, the giggered cloth. The weave is shown without stitchers at Fig. 1539. The effect picks are indicated by the short lines at the right of the draft.

The ground filling is usually woven plain. A plain weave, a 2 up 2 down twill, a 3 up 1 down twill or a 4-leaf broken twill is used for the back.

When it is desired to scatter the flakes or tufts irregularly over the face, the effect picks are woven with a 4-leaf broken twill or a 6-leaf satin weave. Striped montagnacs are made by arranging the effect floats in the form illustrated by Figs. 203, 204, 231 and 233. The effect floats are also arranged in straight, broken and herringbone twill order.

Figs. 1542 to 1548 are frequently used for montagnacs and correspond to the class of weaves shown at Fig. 1537 and 1538. None of them is constructed like Fig. 1540. The ground weave of each is plain; a broken 4-leaf twill or other suitable weave can, however, be used. In most cases a separate back texture is employed, the back filling interlacing with the back warp. Fig. 1542 is the face weave for Fig. 1543, the effect filling being woven in broken 4-leaf twill order.

In Figs. 1542, 1543, 1545 and 1547, the white

Fig. 1549.

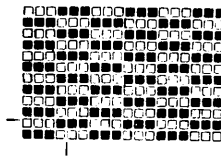


Fig. 1550.

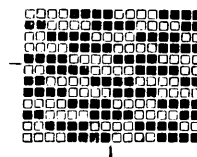


Fig. 1551.

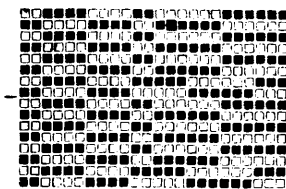
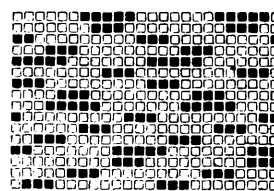


Fig. 1552.

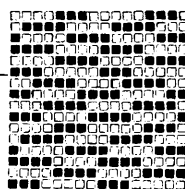


Fig. 1553.

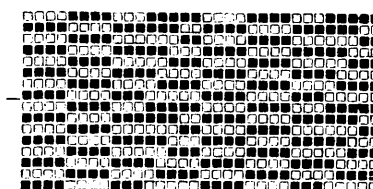


Fig. 1554.

squares are warp risers; the marked squares (black and crosses) are warp sinkers.

In Fig. 1544 the back weave is a broken 3 up 1 down twill; the stitching is in the same order. The face weave is shown at Fig. 1542, the effect floats being distributed in broken 4-leaf twill order.

Fig. 1543 is a montagnac face weave, the effect floats being scattered in satin order.

In Fig. 1546 the back weave is a broken 3 up 1 down twill; the stitching is in the same order.

Fig. 1545 is the face weave for Fig. 1546. The effect floats are scattered in satin order.

Fig. 1547 is the face weave for Fig. 1548. The effect floats are scattered irregularly over 12 threads.

At Fig. 1548 the back weave is a broken 3 up 1 down twill. The weave is stitched from back to face in broken 1 up 3 down twill order.

Contrary to the usual custom, the marked squares in Figs. 1542, 1543, 1545 and 1547 indicate sinkers. The white or unmarked squares indicate risers. These four drafts are for the face only.

Figs. 1549 to 1558 show various arrangements of the effect picks only, with the construction illustrated

FIG. 1555.

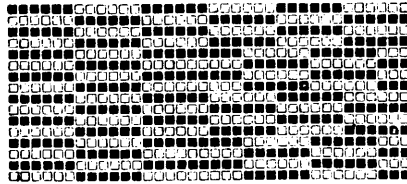


FIG. 1556.

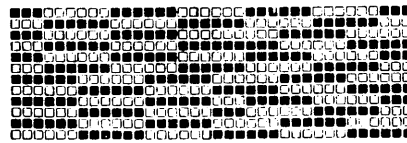
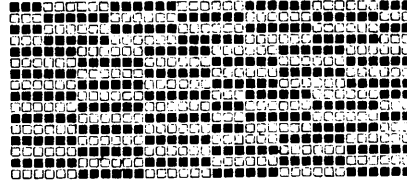


FIG. 1557.

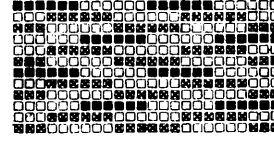


FIG. 1558.

at Fig. 1540, which, as already explained, is used to cover the face more completely with the tufts or flakes.

This construction is better adapted for stripes, but can be used without difficulty for the production of checkerboard, twill, herringbone and other effects.

Usually an effect pick is followed by 1 ground and 1 back pick. Frequently two effect picks are woven before the ground pick.

In a third variety of montagnacs the ground filling is omitted. Instead, the effect pick is alternately floated on the face and woven plain, as shown at Fig. 1559, which shows the effect picks only. Every two

adjacent effect picks form a plain pick and a continuous floating pick.

In drafting a weave of this kind it is advisable first to draft the motif for the design in the form of an ordinary weave, as shown at Fig. 1561. This motif is then transferred to the full-sized draft by leaving 2 unmarked warp threads next to each vertical line of the motif, and by alternating 2 vacant picks with 2 others corresponding to each horizontal line of the motif. Fig. 1560 shows the 8-thread motif at Fig. 1561 thus enlarged.

This enlarged sketch, Fig. 1560, is a plan for the drafting of the effect picks.

Each of the picks of every pair is made to float over the warp threads on which the other pick is woven plain; thus each pair forms a continuous floating pick and a continuous plain pick. The risers on the plan, Fig. 1560, are not transferred to the draft, Fig. 1562, but serve merely to indicate where the float and plain interlacing are transposed. The draft is completed by stitching the back picks, one form being shown at Fig. 1562.

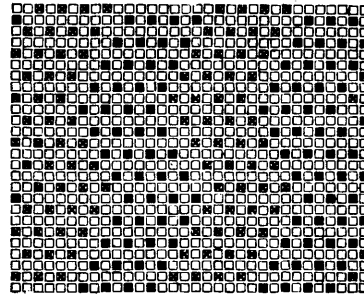


FIG. 1559.

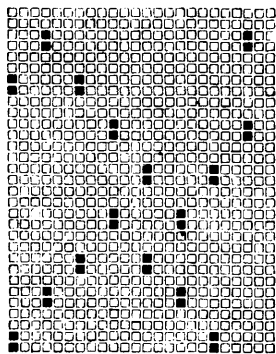


FIG. 1560.

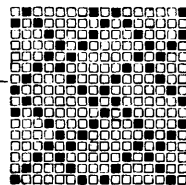


FIG. 1561.

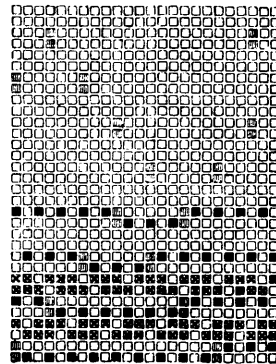


FIG. 1562.

Weaves with a broken 1 up 3 down twill, filling satin or similar weave on the face are also used for montagnacs. These are made either with a separate back texture, as shown at Fig. 1563, which is a broken 4-leaf twill on face and back, set 1 and 1 and stitched

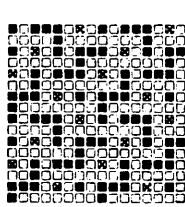


FIG. 1563.

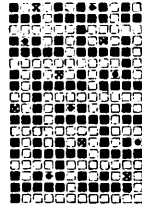


FIG. 1564.

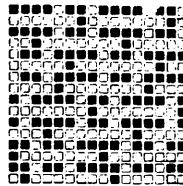


FIG. 1565.

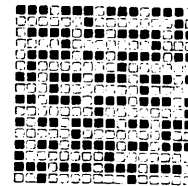


FIG. 1566.

from face to back; or are made with a stuffing pick, Fig. 1564, in which the face is a 6-leaf satin, the back, a 3-leaf pointed twill. The warp is set 1 and 1; filling, 1 face 1 stuffing 1 back pick. Some fabrics are made with a single warp and a face and back filling, as shown at Figs. 1565 and 1566, in which the face is

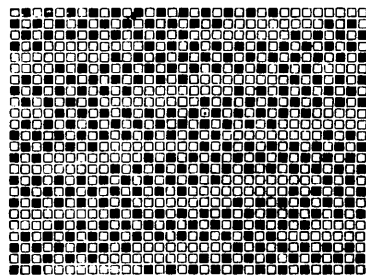


FIG. 1567.

a modified satin; the filling is set 1 face 1 back, two successive back picks interlacing the warp in the same order.

Fig. 1564 is stitched by extra inner picks, as shown at Figs. 1477, 1478, 1479, 1482 and 1483. The stuffing pick passes above a

face warp and under a back warp thread, thus fastening both face and back to the stuffing pick.

The crosses in Figs. 1563 and 1564 are sinkers.

A modification of the montagnac fabric is the fulled bouclé cloth in which the filling is alternately floated and stitched plain for a considerable number of threads. The warp is usually cotton; the filling, mohair or similar stock. During the fulling the floating picks

are formed into ringlets on the face of the cloth. Two weaves for this construction are shown at Figs. 1567 and 1568.

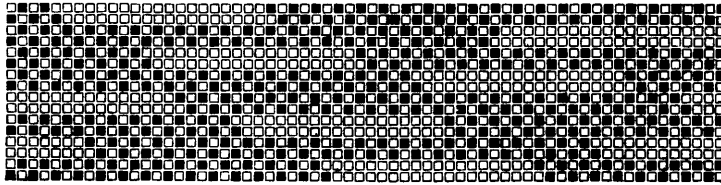


FIG. 1568.

COMBINATION WEAVES

Under this head are included all weave patterns in which two or more weaves are combined. In view of the vast number of weaves it is evident that only the general principles applicable to their combination can be illustrated.

Combination weaves may be divided into six classes :
1. Longitudinal stripes ; 2, Cross stripes ; 3, Plaids ;
4, Checkerboard effects ; 5, Broché patterns ; 6, Transposed double cloths.

These classifications relate only to weave patterns and do not include color effects on a smooth face with a single weave.

LONGITUDINAL STRIPES

When two or more weaves are combined, care must be taken to have them break with each other at the line of junction. The risers of the first and last threads of each weave stripe should come opposite sinkers of the adjoining thread of the adjacent weave stripe. In this way the distinctive character and limits of each weave are preserved in the finished cloth as in the woven fabric.

If the two adjacent threads belonging to different weaves do not break with each other, the stripes are made irregular in width, owing to the floating of the threads across the dividing line, and the desired stripe effect is lost. In fulled goods an imperfect junction of two weaves may cause a thick or raised place in the cloth.

A break of a twill with a twill, or of a satin with a satin is effected by setting the twill line or ridge of

each so that the risers of one come opposite the sinkers of the other, Figs. 1581 and 1582. This is a general rule which it is not always possible to follow exactly.

Fig. 1569 shows a plain weave for the ground with a rib stripe. It is not possible to obtain a perfect break between the two weave stripes, but the close

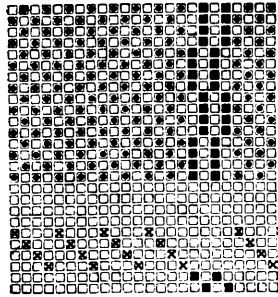


FIG. 1569.

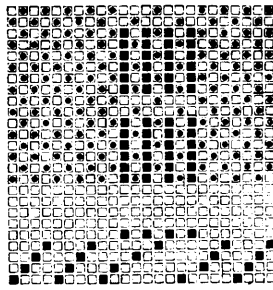


FIG. 1570.

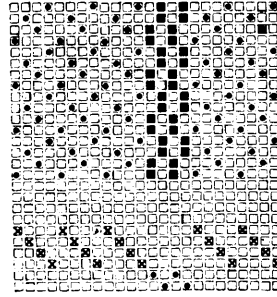


FIG. 1571.

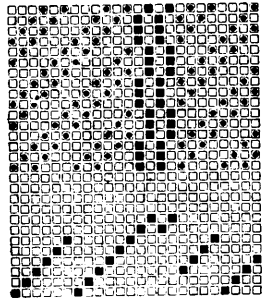


FIG. 1572.

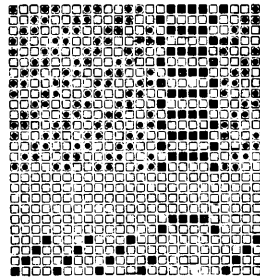


FIG. 1573.

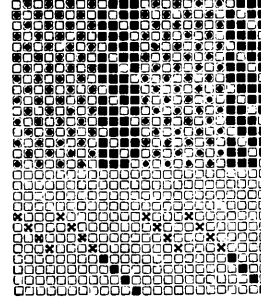


FIG. 1574.

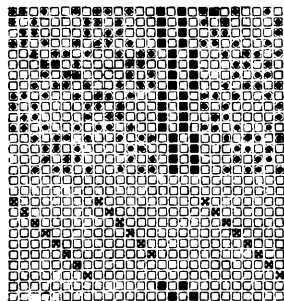


FIG. 1575.

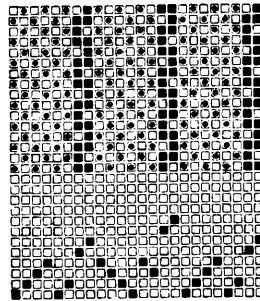


FIG. 1576.

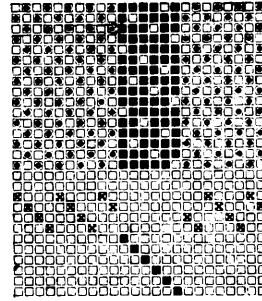


FIG. 1577.

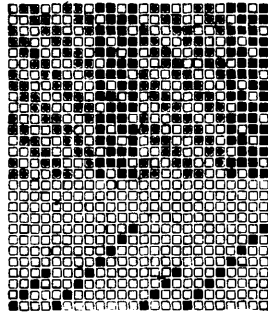


FIG. 1578.

interlacing of the plain weave prevents any serious irregularity.

Fig. 1570 is a plain ground with another form of rib stripe. In these patterns there are twice as many threads per dent in the stripe as in the ground. Thus if the ground is reeded 2 in a dent, the stripe will have 4 in a dent.

Figs. 1569 to 1584 show examples of weaves combined as follows:

Fig. 1569, plain and rib.

Fig. 1570, plain and rib.

Fig. 1571, broken 4-leaf twill and rib.

Fig. 1572, twill and rib.

FIG. 1579.

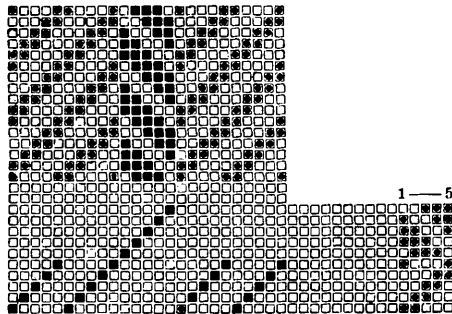


FIG. 1580.

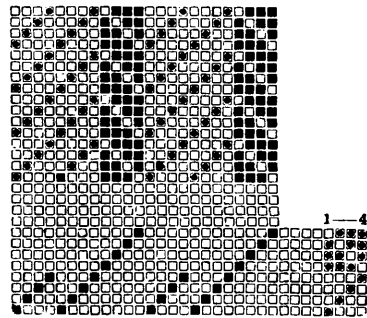
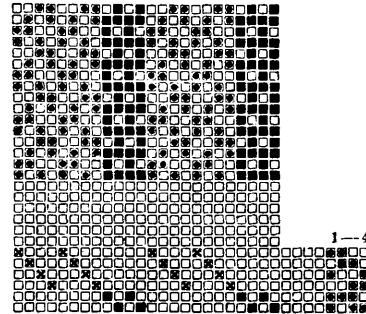


FIG. 1581.

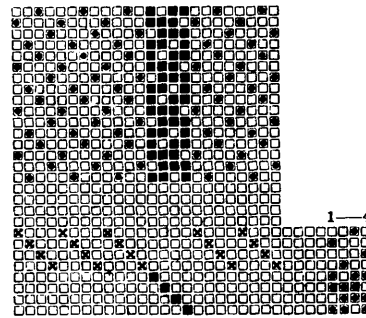


FIG. 1582.

- Fig. 1573, twill and filling rib.
- Fig. 1574, plain and twill.
- Fig. 1575, figured and rib.
- Fig. 1576, plain and broken twill.
- Fig. 1577, plain and 6-leaf satin.
- Fig. 1578, twill and broken twill.
- Fig. 1579, twill and twill.
- Fig. 1580, broken twill and plain with floating picks.
- Fig. 1581, filling twill and warp twill.
- Fig. 1582, broken filling twill and broken warp twill.
- Fig. 1583, 5-leaf filling satin and 5-leaf warp satin.
- Fig. 1584, 6-leaf filling satin and 6-leaf warp satin.

The figures in Figs. 1579 to 1591, Fig. 1593 and Fig. 1594 indicate in each case the first and last picks in the chain draft.

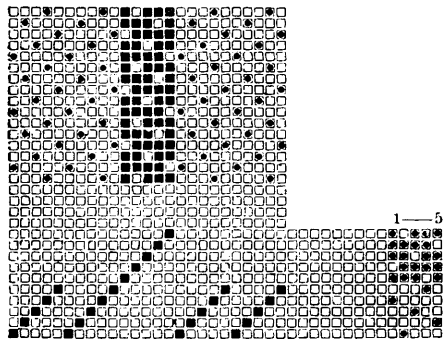


FIG. 1583.

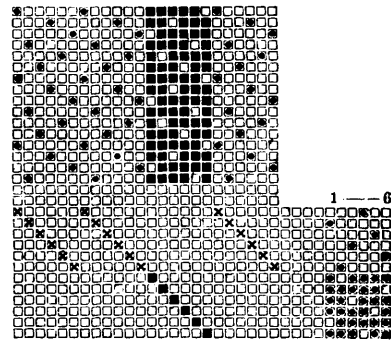


FIG. 1584.

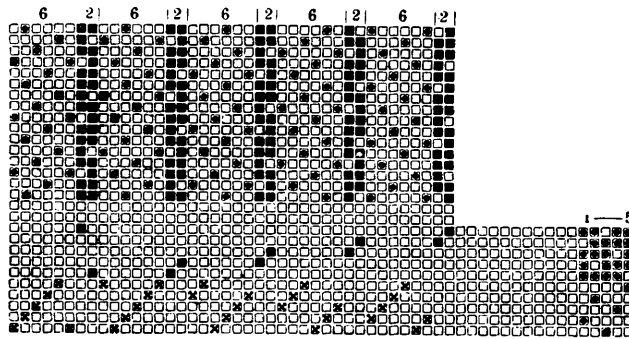


FIG. 1585.

It is more difficult to make satin weaves break with each other when the stripe does not include an even number of weave patterns.

When a warp satin is combined with a filling satin to form stripes of equal width, or of which one is a multiple of the other, the face float (sinkers) at the end of each weave should come opposite to the adjacent back float (risers) of the succeeding weave, as shown at Fig. 1583. If a certain number of warp threads, say 2, for example, are omitted at the end of the filling stripe, the break of the two weaves will be preserved if the same number of threads (2) are omitted at the beginning of the adjacent warp stripe.

If the threads in each stripe comprise an even number of weaves, each stripe is drawn in straight. If,

FIG. 1586.

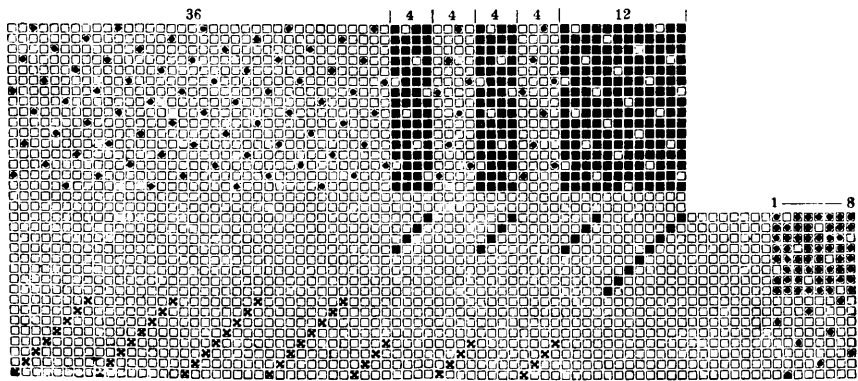
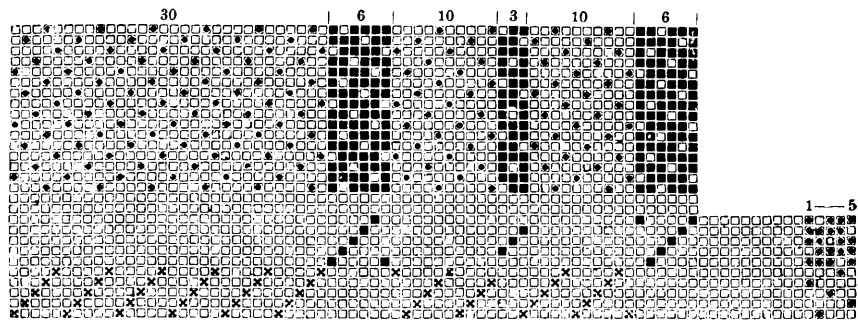


FIG. 1587.

however, a number of threads are lacking to complete the last course of a stripe, an equal number of shafts belonging to the other weave are skipped before beginning the drawing-in of the next stripe. Figs. 1585, 1586, 1587 and 1594 are examples of this construction and show the method of drawing-in as well as the resulting break of the combined weaves.

FIG. 1594.

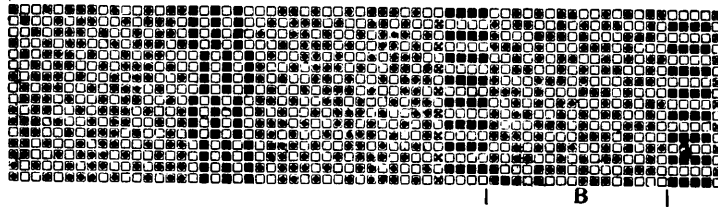
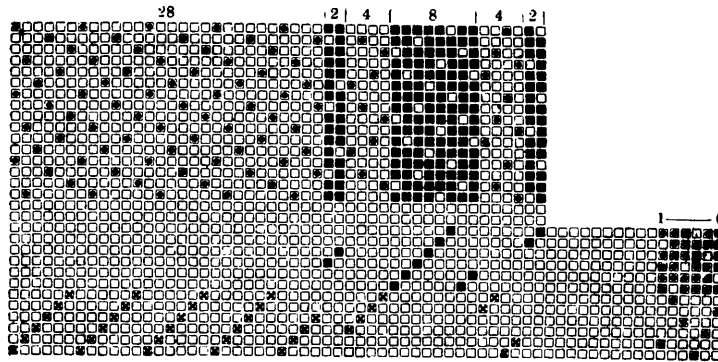


FIG. 1595.

Various stripes obtained by combining weaves are shown at Figs. 1585 to 1607:

Fig. 1585, 5-leaf filling satin and 5-leaf warp satin.

Fig. 1586, 5-leaf filling satin and 5-leaf warp satin.

Fig. 1587, 8-leaf filling satin and 8-leaf warp satin.

Fig. 1588, 5-leaf diagonal and 10-leaf diagonal.

Fig. 1589, double plain, filling rib and plain with stuffing pick.

Fig. 1590, 5-leaf diagonal, filling rib and twill.

Fig. 1591, double plain, filling rib and twill with floating picks.

Fig. 1592, 5-leaf warp satin, warp rib and filling rib.

Fig. 1593, double plain, filling rib and twill.

Fig. 1594, 6-leaf satin and 6-leaf satin.

Fig. 1595, diagonal warp rib and filling rib.

If a twill, satin, crêpe or other weave is to be combined with a filling rib, extra points are inserted to separate the rib from the weave with which it is combined, or an extra thread woven plain is inserted between the rib and adjacent stripe. The latter method is shown at Figs. 1573, 1590 and 1593.

Other combinations of weaves are shown at Figs.

FIG. 1596.

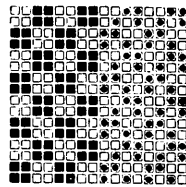


FIG. 1597.

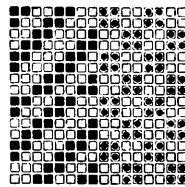


FIG. 1598.

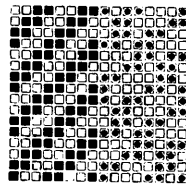
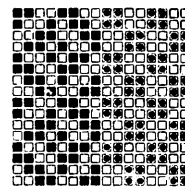


FIG. 1599.

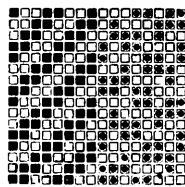


FIG. 1600.

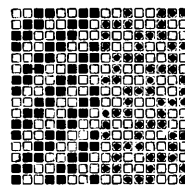


FIG. 1601.

1596 to 1607, only eight threads of each weave being shown in each case.

It is evident that the threads of each weave in a combination weave must be drawn on a separate set of shafts when the weaves are of a distinctly different character. The shafts of the closer weaves, that is, those with more frequent intersections, should be placed in front next to the reed.

The number of picks or bars in the filling chain must embrace a whole number of each of the weave patterns. Thus, if a 3-pick and a 4-pick weave are com-

bined, the filling chain must have at least 12 picks, as this is the least common multiple of 3 and 4. Again, if the separate weaves are 8-pick and 12-pick respectively, the filling chain must have at least 24 bars. In Fig. 1592 the filling pattern must cover at least 40 picks, since this is the smallest number that will include a whole number of each of the two separate weaves, which have 5 and 8 picks respectively.

In selecting weaves for combination, care should be taken to have them of such sizes that an excessively long filling chain may not be necessary. In Fig. 1595

FIG. 1602.

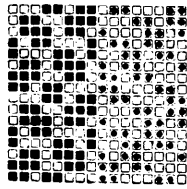


FIG. 1603.

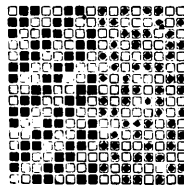


FIG. 1604.

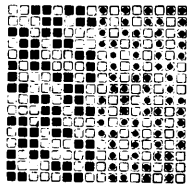
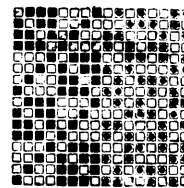


FIG. 1605.

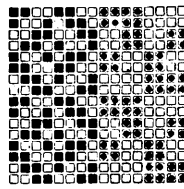


FIG. 1606.

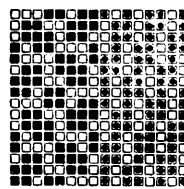


FIG. 1607.

the sizes of the different weaves, 2, 8 and 15 picks respectively, necessitate at least 120 bars in the filling chain in order to include a whole number of repeats of each weave. If, however, a 16-pick weave is substituted for the one with 15 picks, the pattern can be woven with 16 bars on the chain and without affecting the appearance of the cloth.

CROSS STRIPES

The rules already given for forming longitudinal stripes with combination weaves apply also to cross

stripes. The different weaves must, so far as possible, break against each other at the line of contact. In longitudinal stripes raised effects are produced by warp weaves and depressed effects by filling weaves. The conditions are reversed in cross stripes, the filling weaves giving raised effects and the warp weaves depressed stripes. Especially pronounced and arched

FIG. 1608.

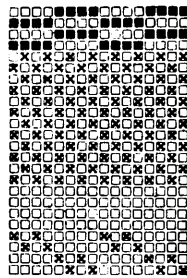


FIG. 1609.

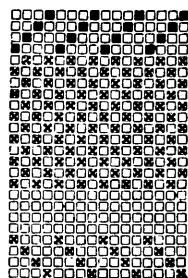


FIG. 1610.

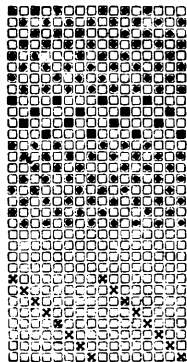
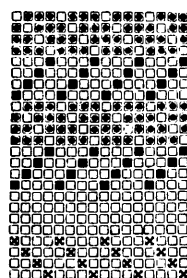


FIG. 1611.

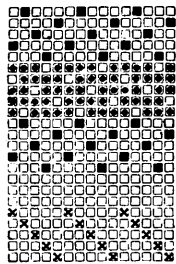


FIG. 1612.

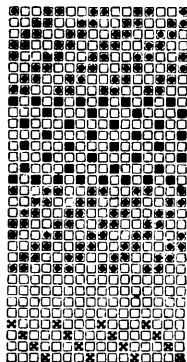


FIG. 1613.

cross stripes are obtained with the cross ribs, Figs. 1512 to 1517. Several examples of cross stripes in combination weaves are shown at Figs. 1608 to 1615.

- Fig. 1608 plain and rib
- Fig. 1609 plain and twill
- Fig. 1610 twill and twill
- Fig. 1611 crêpe and twill
- Fig. 1612 satin and satin

Fig. 1613 . . . twill and plain with floating warp threads

Fig. 1614 . . . double warp satin and double filling satin

The cross stripe in Fig. 1615 is made by removing points from the ground weave, which is a 13-shaft satin.

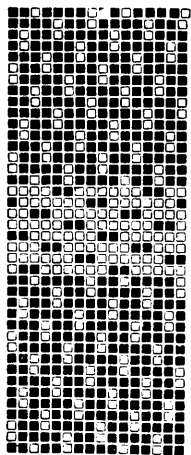


Fig. 1614.

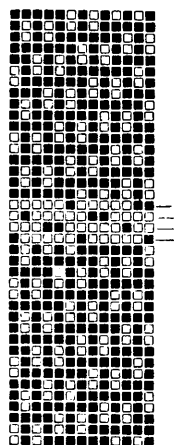


Fig. 1615.

This method of construction is especially useful when the cross stripe is made with but a few picks. If the weaves used for cross stripes cover an unequal number of warp threads, the combination weave must be extended until the different weaves end with the same thread. For example, a 4-shaft

and a 5-shaft weave in a transverse stripe require 20 threads; a 5- and an 8-shaft weave, 40 threads.

PLAIDS

Plaided weave patterns are combinations of longitudinal and transverse stripes, and call for the application of the rules already explained.

No general directions can be laid down for adjusting the stripes to form plaids. The weave patterns must be drafted so that as far as possible the weaves will break with each other along all lines of contact. An unlimited number of patterns can be made. A few typical examples are given at Figs. 1616 to 1633.

Fig. 1616 consists of a 2 up 2 down twill ground with a 2 up 2 down basket stripe. To obtain a break on each side of the stripe the ground must comprise

one thread more than an even number of twills. In this way the first and last threads of the ground are alike and break with the basket stripe.

If the twill ground is made the exact size desired, irrespective of the difficulty in effecting a break, it often becomes necessary to repeat the entire pattern several times before a break between the last and

FIG. 1616.

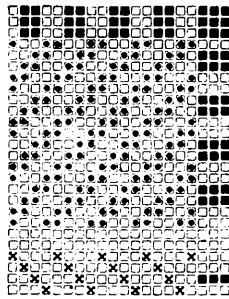


FIG. 1617.

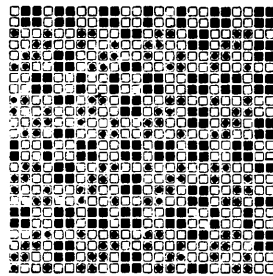


FIG. 1618.

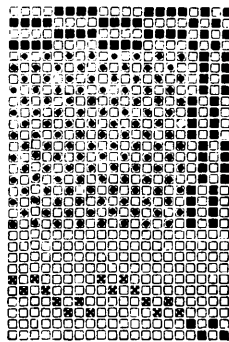
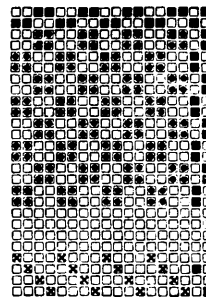


FIG. 1619.

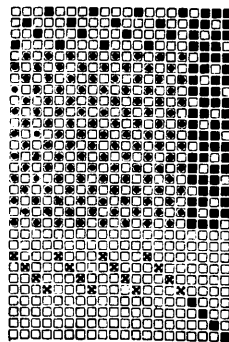


FIG. 1620.

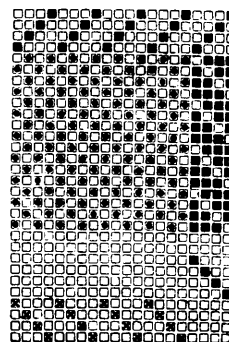


FIG. 1621.

first threads is obtained. A case of this kind is shown at Fig. 1617, in which a 2 up 2 down twill ground is combined with a panama weave, and the pattern repeated four times before the desired break is reached.

Fig. 1618 is a panama ground with a rib plaiding. The plaiding is made with a material or color different from that of the ground.

Fig. 1624 shows a 2 up 2 down twill ground checked with 2 up 2 down basket stripes. The square formed

at the intersection of the warp and filling stripes is woven in various ways. Thus in Fig. 1624 it is woven with the 2 up 2 down basket. When the weave of the warp stripe is different from that of the filling, the space at the intersection may be filled by a continuation of the warp stripe as in Fig. 1620; by the continuation of the filling stripe as in Fig. 1621; or with a weave different from either stripe as in Fig. 1619, in which the ground weave is used. The last-named method is usually adopted when the stripe weave tends to make the cloth thicker than the ground.

In combining a panama made of complete basket patterns with a 2 up 2 down twill weave the break is obtained more easily when the twill ground contains one thread less than an even number of twills; for

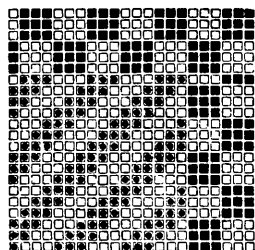


FIG. 1622.

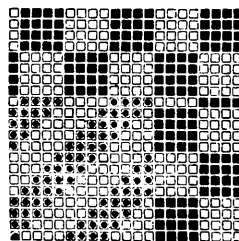


FIG. 1623.

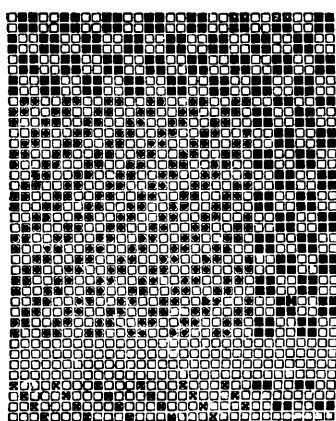


FIG. 1624.

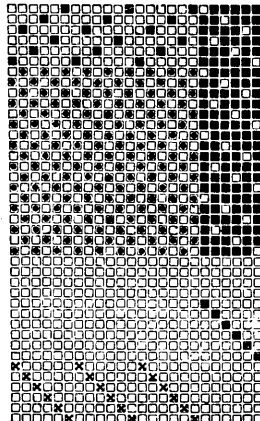


FIG. 1625.

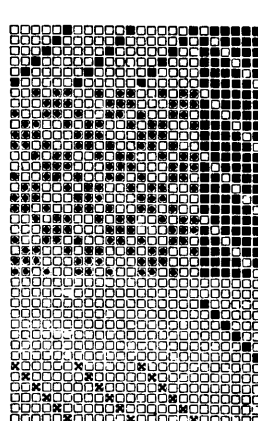


FIG. 1626.

example, 7, 11, 15, 19 or 23 ground threads, the last-named number being shown at Fig. 1624.

With a 6-leaf 3 up 3 down twill combined with a

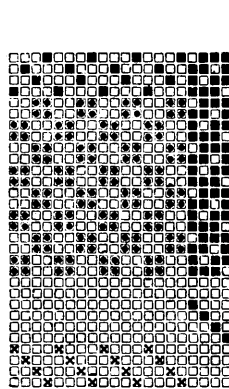


FIG. 1627.

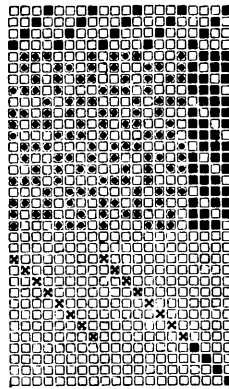


FIG. 1628.

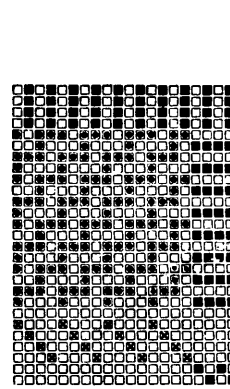


FIG. 1629.

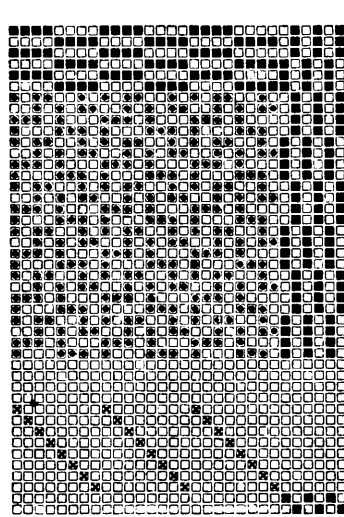


FIG. 1630.

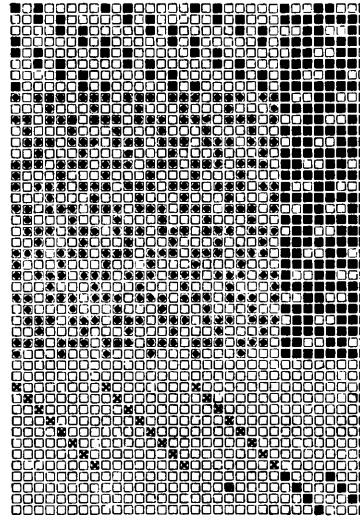


FIG. 1631.

6-leaf panama stripe 2 threads should be omitted from the last twill, the threads in the twill portion numbering 10, 16, 22, 28, etc. With an 8-leaf 4 up 4 down twill, 3 threads should be dropped, the number of

twill threads being 13, 21, 29, 37, etc. These rules are illustrated at Figs. 1622 and 1623.

In Fig. 1619 the ground is a plain weave, the checking a 4 up 4 down rib, while the intersection of the rib lines is woven plain.

Fig. 1625 shows a plain weave checked with 6-leaf satin stripe. To facilitate the breaking of the two weaves the 6-leaf satin is drafted 6, 4, 2, 5, 3, 1.

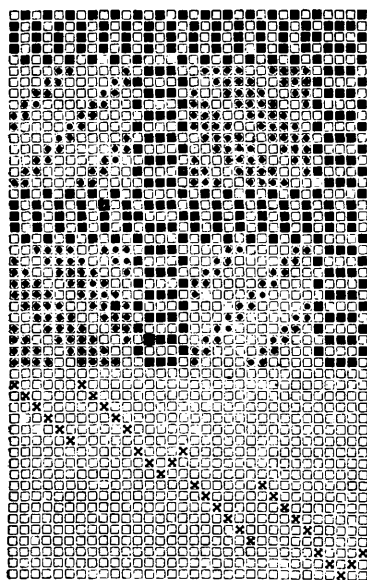


FIG. 1632.

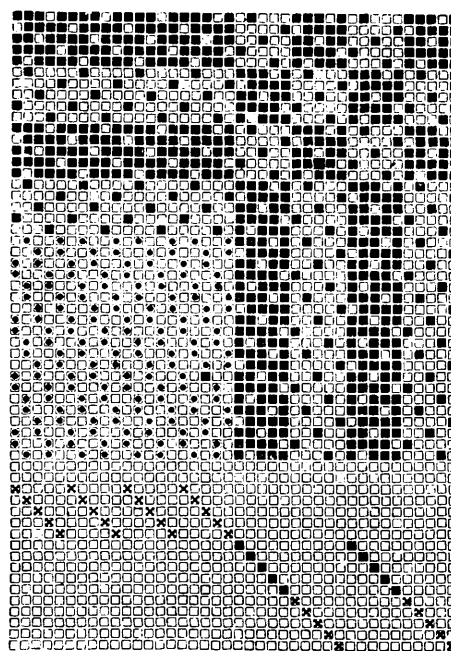


FIG. 1633.

Fig. 1627 shows a panama ground and 4-leaf broken twill checking. Fig. 1628 is made with an 8-leaf crêpe ground and a 4-leaf twill plaiding, while Fig. 1626 is made with a 6-leaf crêpe ground checked with a 6-leaf twill checking.

Figs. 1629 to 1631 are weaves for heavier goods. Fig. 1629 has a double plain ground and rib overcheck. When, as in this weave, the longitudinal stripe is a filling rib, the cross stripe is made with a warp rib.

In Fig. 1630 the ground is a tricot long, the check,

a 4 up 4 down rib. At the intersection of the stripes the warp rib is continued, but changed to 3 up 3 down to match the width of the cross stripe.

In Fig. 1631 the ground is a broken 4-leaf twill with back filling. The overchecking is a 4-leaf twill with warp threads floating under the cross stripe and filling threads floating under the longitudinal stripe.

Fig. 1632 shows a pattern in which a 4 up 2 down twill alternates with a 2 up 4 down twill in the ground, the stripe being formed by a rib weave, which is separated from the ground by plain threads in both warp and filling.

At Fig. 1633 the overchecking is formed by alternate stripes of warp and filling satin weaves, the square at the intersection of these stripes being a checkerboard pattern.

CHECKERBOARD WEAVES

Combination weaves for checkerboard patterns are as interesting as the three groups that have been described. A sharp breaking of the weaves with each other is an essential feature. This is easily effected in twills and satins by running the twills of the warp and filling weaves in opposite directions.

In drafting satin weaves for checkerboard effects the warp stitcher on the first pick of each square should be as far from the first warp thread at the left as the warp stitcher on the last pick is from the last warp thread at the right. In the 5-leaf satin checkerboard effect at Fig. 1635, the first pick of the filling satin is stitched on the third warp thread counting from left to right, while the last pick is stitched on the third warp thread counting from right to left. By this arrangement each square of the same weave begins and ends in such a way that a perfect break is obtained between the warp and filling weaves.

Following is the order to be followed for 5-, 6-, and 8-leaf satin checkerboard effects:

5-leaf satin, 4, 1, 3, 5, 2.

6-leaf satin, 2, 6, 4, 1, 3, 5.

8-leaf satin, 6, 1, 4, 7, 2, 5, 8, 3.

FIG. 1634.

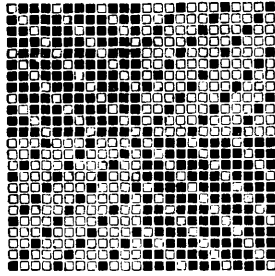


FIG. 1635.

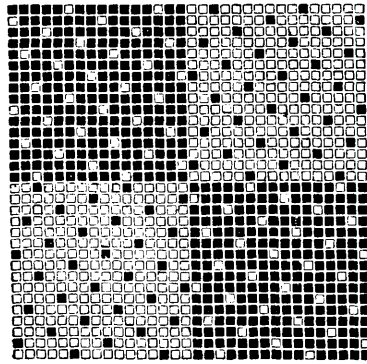
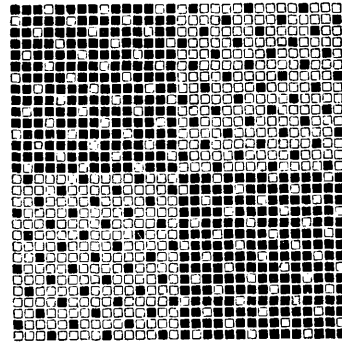


FIG. 1636.

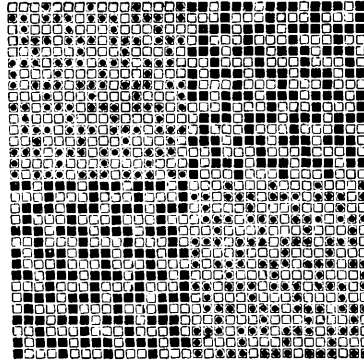


FIG. 1637.

With the 5-leaf satin the warp stitcher (4) on the first pick is as far to the right of the first thread as the warp stitcher (2) on the last pick is to the left of the last thread.

With the 6-leaf satin the warp stitcher (2) on the first pick is as far to the right of the first thread as the warp stitcher (5) on the last pick is to the left of the last thread.

With the 8-leaf satin the warp stitcher (6) on the first pick is as far to the right of the first thread as the

warp stitcher (3) on the last pick is to the left of the last thread.

Fig. 1634 shows 12 threads of a 4-leaf filling twill alternating with 12 threads of a 4-leaf warp twill.

Fig. 1635 shows 15 threads of a 5-leaf warp satin alternating with 15 threads of a 5-leaf warp twill.

FIG. 1638.

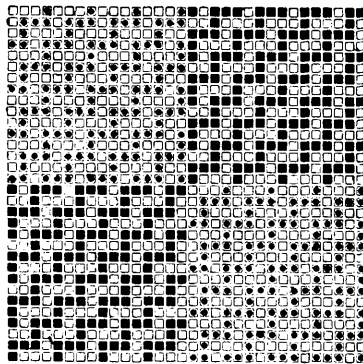


FIG. 1639.

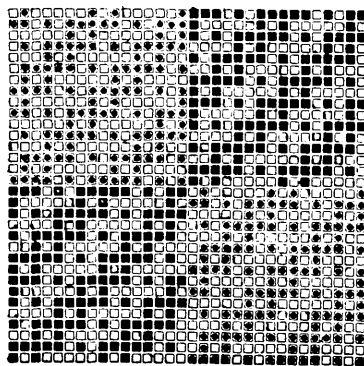
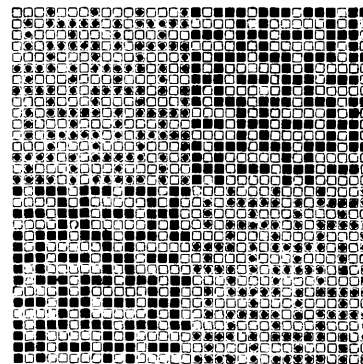


FIG. 1640.

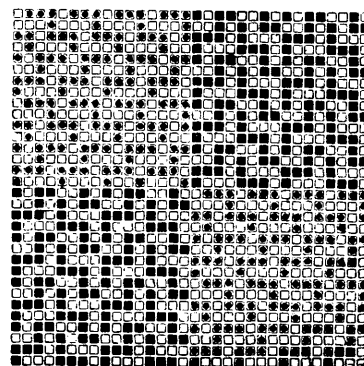


FIG. 1641.

Fig. 1636 shows 16 threads of an 8-leaf warp satin alternating with 16 threads of an 8-leaf filling satin.

For bed blankets the squares are frequently made with a 4-leaf broken twill with back filling, woven 1 light 1 dark. The warp is often made of cotton, the filling of carded woolen, shoddy or silk waste. A

weave for this class of goods is shown at Fig. 1637, in which the face and back picks are transposed at the beginning and end of every square of 16 threads.

Checkerboard patterns for heavy wearing apparel are usually made with a regular double weave, 1 back 1 face in both warp and filling, the two textures alternating on back and face to form the pattern. The color pattern is 1 light 1 dark, the two shades alternating on face and back.

Four examples are shown at Figs. 1638, 1639, 1640 and 1641.

Fig. 1638 shows two plain weaves transposed in a double cloth to produce a checkerboard effect.

At Fig. 1639 a plain weave is combined with a 2 up 2 down basket, the two being transposed to form the squares. The drawing-in draft for Fig. 1638 on 8 shafts is 1 to 4 four times and 5 to 8 four times, a total of 32 threads.

For Fig. 1639 on 8 shafts the following drawing-in draft is required: 1, 3, 1, 4, 2, 3, 2, 4 twice; 5, 7, 5, 8, 6, 7, 6, 8, twice.

Fig. 1640 consists of two 2 up 2 down twill weaves alternating on face and back.

A very attractive checkerboard pattern is shown at Fig. 1641 and is made by a combination of a cross tricot with a tricot long.

BROCHÉ FABRICS

Under this head are included cloths in which special threads are introduced in warp and filling to decorate the goods without forming a constituent part of the fabric. These threads are brought to the face only at isolated spots, being otherwise hidden from view. The ground weave and color predominate on the face where the broché effect does not appear.

If the ground and broché warp have the same set, they must be woven 1 ground, 1 broché, or 2 ground, 2 broché, the last-named order being usually employed with twill and satin weaves. If the broché warp is set more open, 1 broché thread alternates with 2 or more ground threads.

When the broché figure requires several adjacent threads of different colors, it is sometimes necessary to alternate 1 ground with 2 to 6 broché threads.

The set of the ground fabric remains uniform, and the broché threads are introduced as extra threads. For example, if the ground fabric is set 75 threads per inch and the broché and ground threads are woven 1 broché and 1 ground, the set for the warp where the broché effect is introduced would be 150 threads per inch. If the broché threads are in the warp, they are drawn in the reed as extra threads.

If a special broché attachment is used, the broché filling threads are passed over only the spots at which they are to appear in the cloth. The cloth is woven

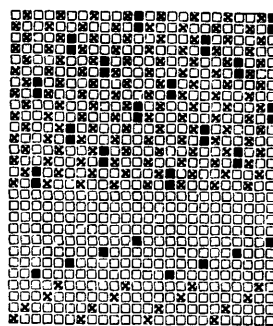


FIG. 1642.

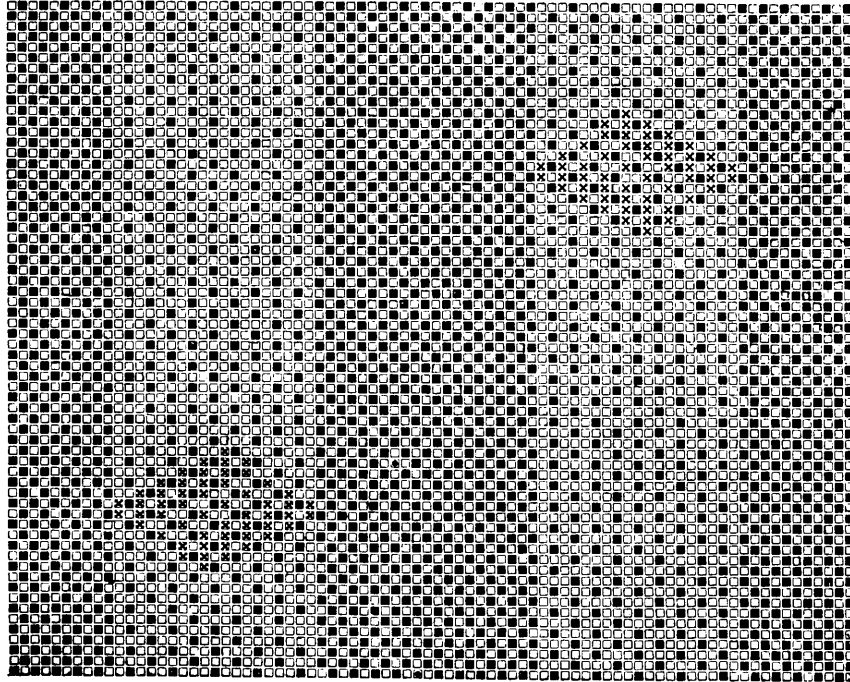


FIG. 1643.

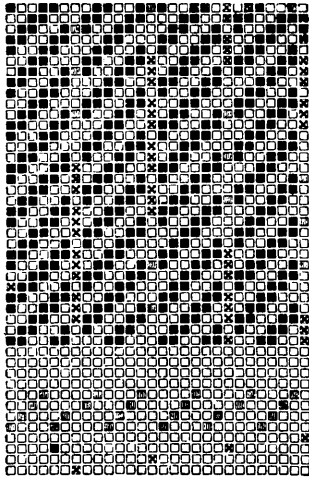


FIG. 1644.

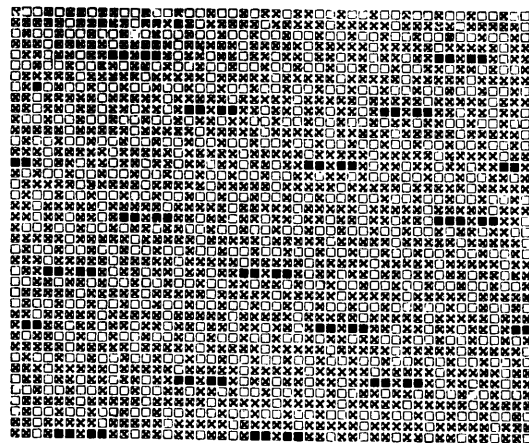


FIG. 1645.

with the face down. The effect threads are usually stitched tighter at the edge of the spot in order to increase the durability of this part of the design.

In many cases the effect threads float loosely on the back side of the cloth when not shown on the face. These loose threads are often cut from the back of very thin fabrics, otherwise the color of the effect yarn would show on the face.

In medium and heavy cloths the broché threads are stitched occasionally during the float on the back from one spot where they show on the face to another.

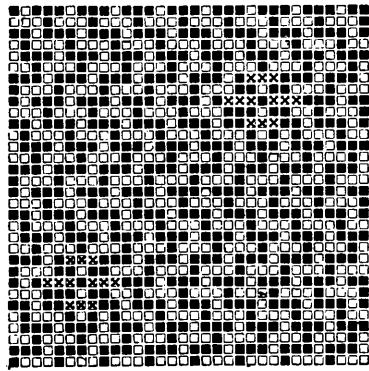


FIG. 1646.

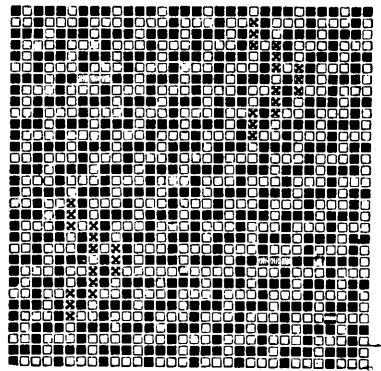


FIG. 1647.

These stitchers are inserted in such a way that the broché thread will not be visible on the face.

In double fabrics the broché thread is preferably concealed by being passed like a stuffing thread, between back and face.

Fig. 1642 shows broché warp threads on a plain ground. The motif for the design is a broken 1 up 3 down twill. As the broché threads float but a short distance, no stitching is necessary.

At Fig. 1643 broché warp threads are woven on a plain ground. Owing to the long float, the effect threads are woven from a separate beam.

The ground weave in Fig. 1644 is a 2 up 2 down twill. The figure threads form short lines which are

arranged in the form of a 2 up 2 down broken twill. These broché threads are stitched at intervals when floating on the back, as shown by the shaded squares.

The broché effect in Fig. 1648 is formed by extra threads in both warp and filling. The motif for the

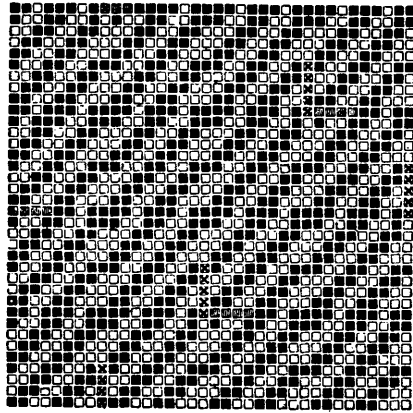


FIG. 1648.

warp or filling twill, the stitching of an adjacent ground thread is changed so that the broché spot may not be obscured. An example is found at Fig. 1649, in which the ground weave is a 3 up 3 down twill.

A similar modification of the ground weave to make

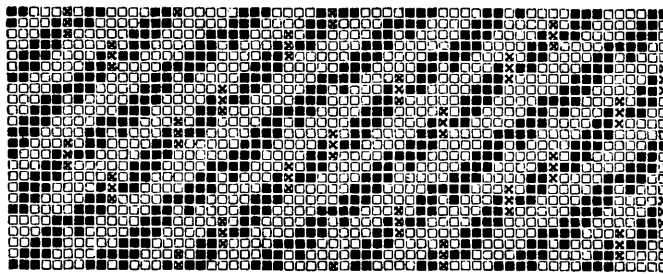


FIG. 1649.

the effect thread show plainly is shown at Fig. 1645, in which the broché threads are in the filling. The black squares indicate sinkers. Extra warp risers are inserted on the face pick adjacent to the broché float, causing the latter to stand out more prominently.

design is a broken 1 up 3 down twill. The ground weave is a 2 up 2 down twill. The shaded squares are sinkers.

When the float of the ground weave covers 2 or 3 threads, the broché float to be effective must cover 3, 4 or even 5 threads. When the broché float comes in a

The ground is woven with a 3-leaf broken twill for the face and a 6-leaf weave for the back filling. The broché effect is stitched in 3-leaf order and is concealed by the back filling.

In double cloths the back filling threads sometimes serve as broché picks. The back picks that form the

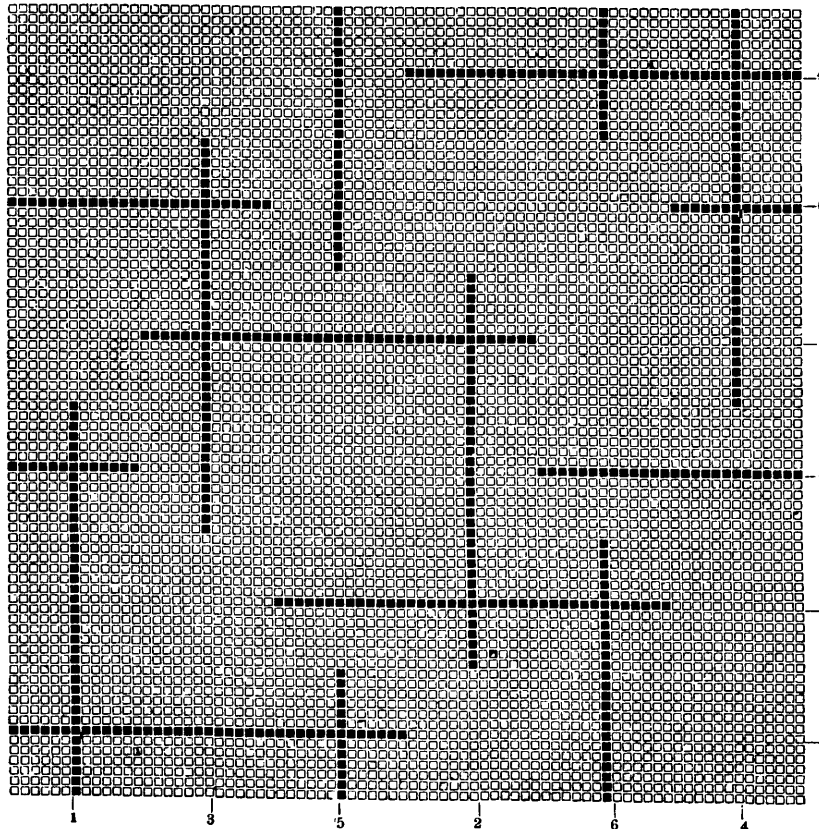


FIG. 1650.

pattern are usually of a different color from that of the face in order to produce a more marked effect. An example is shown at Fig. 1646. The crosses indicate sinkers. The ground weave is a broken 1 up 3 down twill with back filling. As the back pick floats over but three threads, the same as the regular float

of the face pick, it is necessary to modify the adjacent face picks to make the spot distinct.

Fig. 1647 shows a double plain cloth in which both back warp and back filling are utilized to form the broché effect. The plain face threads cannot obscure the broché float of the back threads over two face

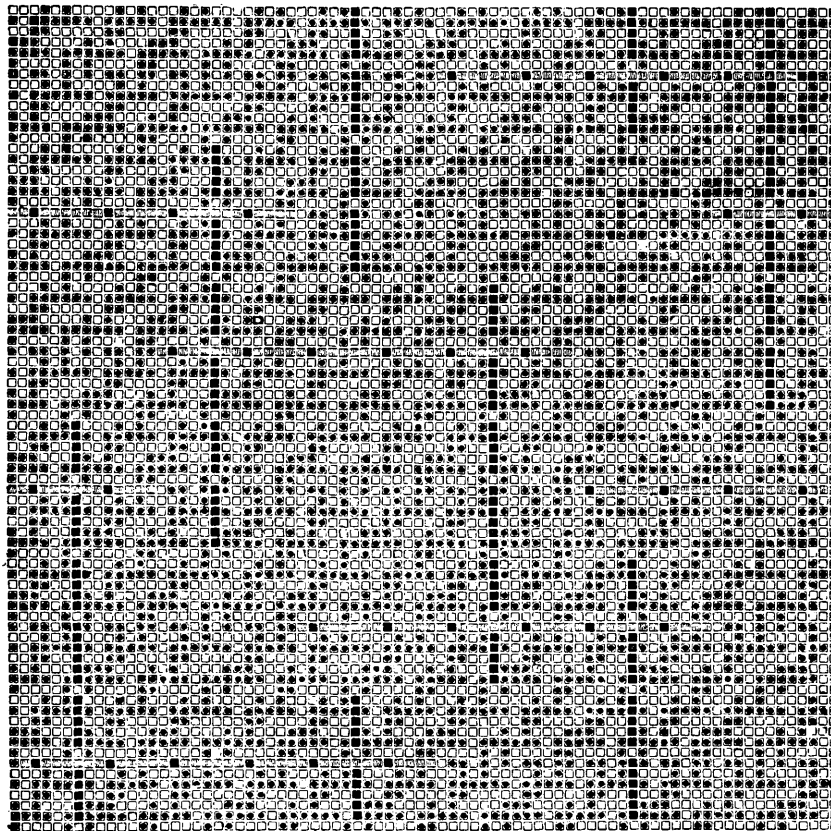


Fig. 1651.

threads and consequently no modification of the face weave is necessary. The shaded squares are sinkers.

If a mixed-up effect is desired, the broché lines are arranged in accordance with a motif having a scattered or promiscuous arrangement of the spots. A 6-leaf satin answers well for this purpose, each riser corre-

sponding to a broché spot, as shown at Fig. 1650, in which both horizontal and upright lines are arranged in 1, 3, 5, 2, 6, 4 order. The ground and broché weaves are then drafted to conform to the motif, as shown in the completed draft, Fig. 1651. This is a double cloth with a 2 up 2 down twill on the face and a plain back. Warp and filling are each set 1 face 1 back 1 face. The broché threads when not on the face lie between the back and face.

DOUBLE TRANSPOSED TEXTURES

In many heavy cloths, such as cotton vestings, table covers and suitings, the pattern is often produced by bringing each of the two textures of the double fabric alternately to the face and back. The face fabric in the groundwork is on the back where the figured effect is formed, while the back fabric of the groundwork becomes the face of the figured effect.

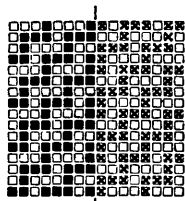


FIG. 1652.

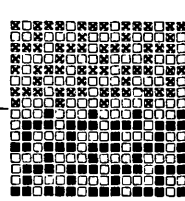


FIG. 1653.

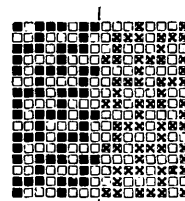


FIG. 1654.

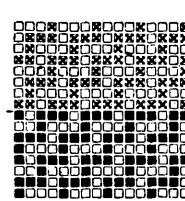


FIG. 1655.

FIG. 1656.

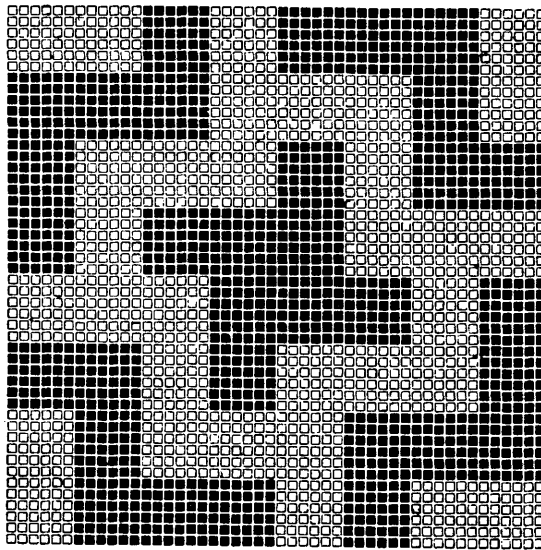
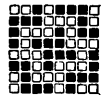


FIG. 1657.

Usually face and back are set alike, 1 face 1 back. The draft is very simple where each weave is plain. The exchange of face and back threads is then made by offsetting the stair effect for one thread, as shown in Figs. 1652 to 1655 and Fig. 1658.

Either 2 face or 2 back threads come together when the back and face textures exchange places. Thus in Fig. 1652, one transposition of face and back takes place at threads 1 and 16, both of which are on the back.

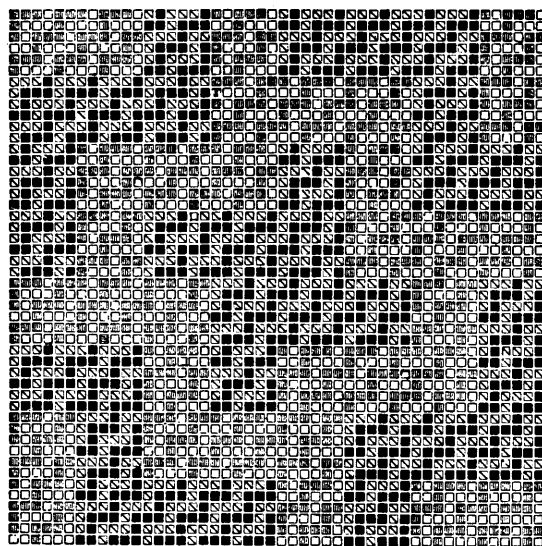


Fig. 1658.

The other transposition occurs at threads 8 and 9, both of which are on the face.

When large designs are to be made in a double plain weave, a motif, as shown at Fig. 1656, is transferred to the full-sized draft, Fig. 1657, from which the weave is then drafted, as shown at Fig. 1658.

If, for example, the complete draft is to consist of 48 threads, and to be developed from an 8-leaf motif, Fig. 1656, each thread of the motif will correspond to six threads of the full-sized pattern, Fig. 1657. The pattern is indicated on the draft by some bright color, usually yellow. The two weaves are then transposed,

as shown in Fig. 1658, in accordance with this enlarged motif.

Each thread in a motif corresponds to at least two threads (1 face and 1 back) of the completed draft.

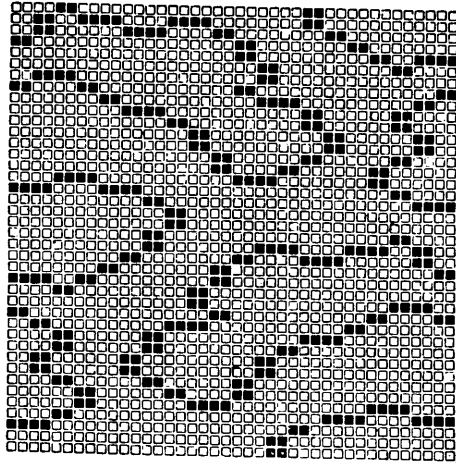


FIG. 1659.

Fig. 1660 shows the lower half of the motif at Fig. 1659 enlarged in the proportion of 2 to 1. This 2 to 1 enlargement gives the smallest pattern that can be obtained by developing a motif.

If the motif contains many single risers, it is difficult to draft the weaves in the right order for transposing the textures. In such a case the ground is filled in with the plain or stair pattern, and when a figure space is reached, the same weave is counted off, but the points are not inserted until the figure space is passed. When the ground is again reached, the points are in-

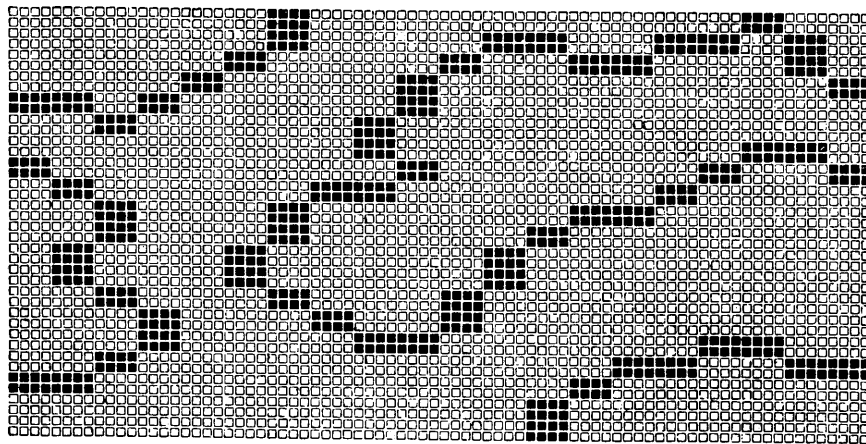


FIG. 1660.

serted in the position they would occupy if the figure space formed a portion of the ground and points had been inserted without interruption. The figure is then filled in by the same method, offsetting the figure weave to make the required transposition of face and back.

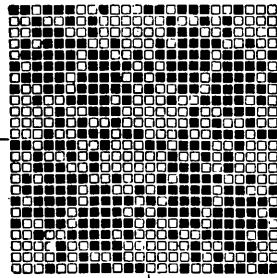


FIG. 1661.

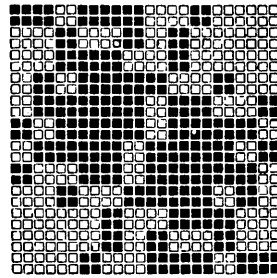


FIG. 1662.

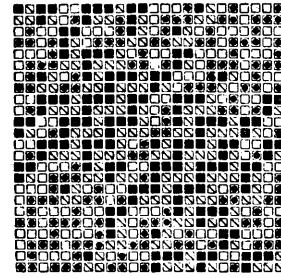


FIG. 1663.

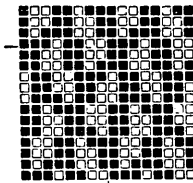


FIG. 1664.

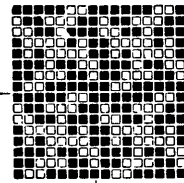


FIG. 1665.

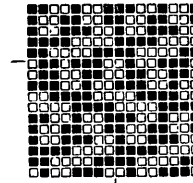


FIG. 1666.

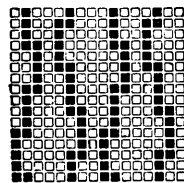


FIG. 1667.

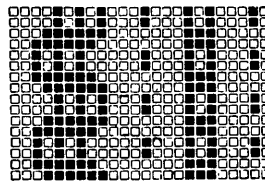


FIG. 1668.

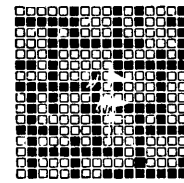


FIG. 1669.

An example is shown at Fig. 1663, which is the weave draft for the motif at Fig. 1661, enlarged at Fig. 1662.

The motifs for transposed weave patterns may be of any desired form. Several motifs for this class of weave patterns are shown at Figs. 1664 to 1673.

Usually the weave for the face is the same as for the back, as in Figs. 1652 to 1663, in which the ground

and figure are each drafted with the respective weave as if that weave covered the whole draft. The operations of drafting are as follows:

1. The face warp threads are filled in throughout

FIG. 1670.

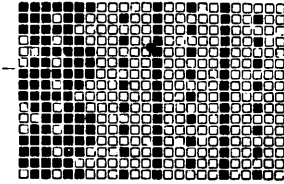


FIG. 1671.

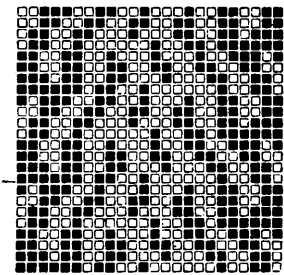
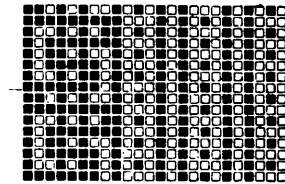


FIG. 1672.

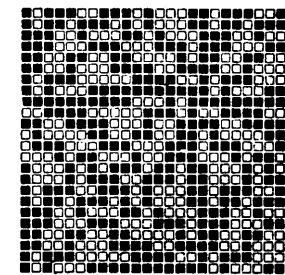


FIG. 1673.

the entire draft with the required weave on the face picks. Risers are then inserted to bring the back warp threads to conform to the figure of the motif. Fig. 1674 is the motif. Fig. 1675 shows a plain weave (dotted squares) on the face warp and face filling, the back warp threads being raised (black squares) to correspond with the figure of the motif.

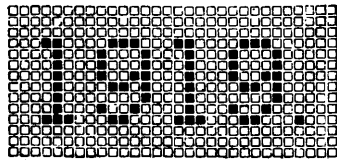


FIG. 1674.

2. The back warp threads are next filled in with the required weave on the back filling, and the face warp threads raised above the

back picks to correspond with the blank space on the motif. Fig. 1676 shows a plain weave (crosses) on the back picks, and the face warp threads raised (black squares) above these picks to correspond with the blank squares of the motif, Fig. 1674.

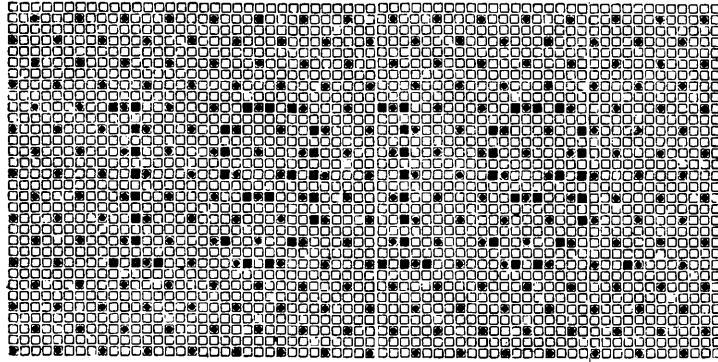


FIG. 1675.

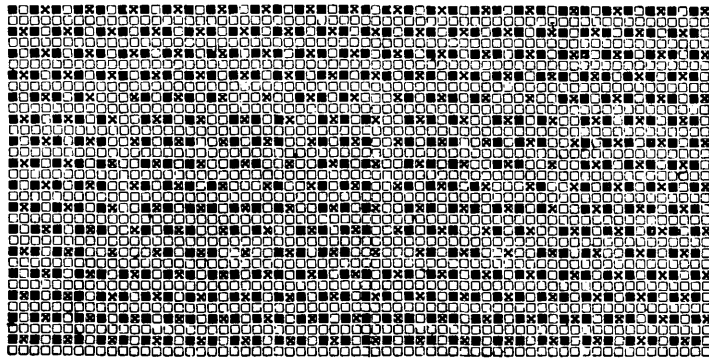


FIG. 1676.

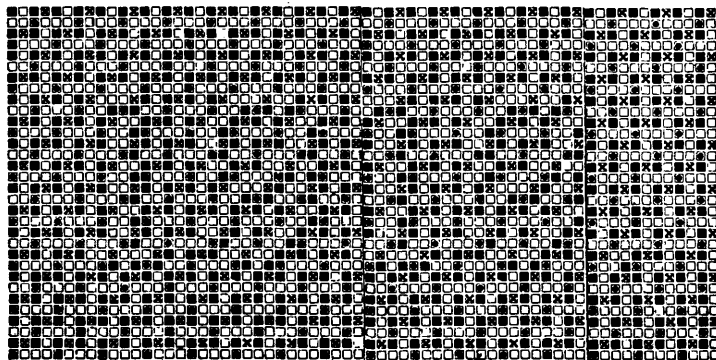


FIG. 1677.

Figs. 1675 and 1676 belong to the same pattern and are shown separately in order to illustrate the method of construction. The completed weave, Fig. 1677, shows that the transposition of the two textures and

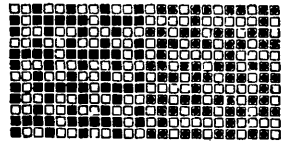


FIG. 1678.



FIG. 1679.

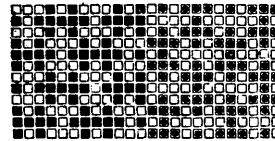


FIG. 1680.

the drafting of the weaves are the same as in Figs. 1652 to 1663.

When the warp and filling are set 2 face 1 back or 2 back 1 face and each texture is brought alternately to back and face without changing the weave, the method shown at Figs. 1678, 1680 and 1681 is adopted.

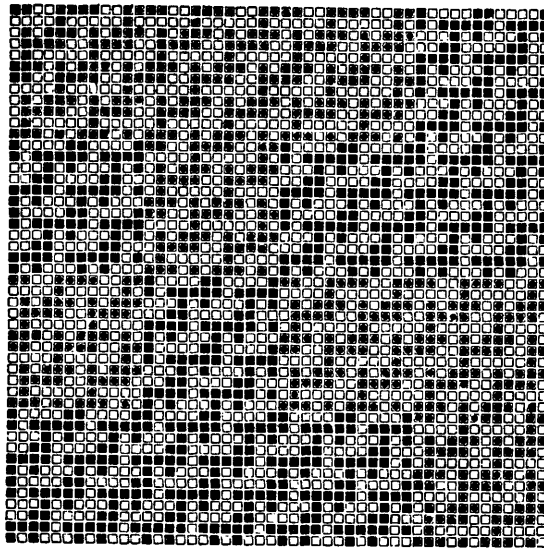


FIG. 1681.

At Fig. 1678 both face and back are woven plain. Fig. 1680 shows a basket and a plain weave. Fig. 1681 is a complete draft in which one texture is plain, the other a 2 up 1 down twill. The motif for Fig. 1681

is shown at Fig. 1679. These fabrics are usually set 1 fine, 1 coarse, 1 fine thread, or 1 worsted, 1 mohair, 1 worsted.

If the cloth is set 1 face 1 back, the weaves are arranged as already illustrated at Figs. 1638, 1639 and 1640.

There are transposed weaves in which each fabric is not woven with the same weave throughout, the weave being changed when the fabric is carried to the

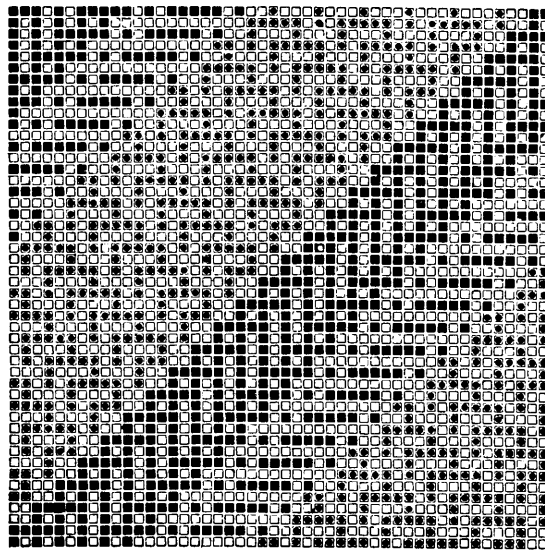


FIG. 1682.

opposite side of the cloth. Each fabric appears alternately on back and face, but shows in each case a different weave. No fixed rule can be laid down for drafting such weaves, the aim being to bring the transposition of the fabrics and the different weaves in the required order. The operation of drafting is facilitated by coloring the draft to indicate each weave.

An example of the last-named construction is seen at Fig. 1682. This is a 48-thread diagonal, of which 24 threads belong to each texture. One texture is woven with a 6 up 6 down twill when on the face and

a 2 up 2 down twill when on the back, both twills running to the right, as the face of the cloth is held before the observer. The other texture is woven with a plain weave when on the face and with a 2 up 2 down twill to the left when on the back. On the face a plain weave alternates with a 6 up 6 down twill. On the back a 2 up 2 down twill to the right alternates with a 2 up 2 down twill to the left. Fig. 1683 represents the face and Fig. 1684 the back of this fabric.

Each of the transposed double textures thus far shown consists of two fabrics, each of which preserves its identity while passing alternately to the back and the face of the fabric. Each thread in the cloth be-

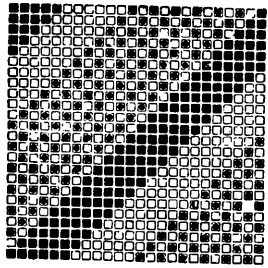


FIG. 1683.

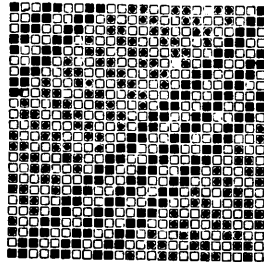


FIG. 1684.

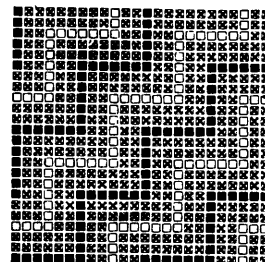


FIG. 1685.

longs to one of the two textures and does not pass to the other. This arrangement permits of but two shades to appear on either side of the cloth.

There are cloths, however, which are partially transposed fabrics, in which a portion of the threads of one texture change places, as it were, with threads of the other texture. By this arrangement it is possible to obtain three shades. For example, we may have one shade made by the crossing of black warp and filling, a second shade by crossing white warp and filling, while a third shade is a gray obtained by carrying the white warp across the black filling or black warp across the white filling. A tiger-skin pattern can be made in this way, the ground being a mixed shade, while the spots are made with light and dark colors.

An illustration of two plain weaves combined and transposed in this way is shown at Fig. 1686. The ground is a mixed shade, while the stair pattern alternates with a light and a dark shade. The motif is seen at Fig. 1685, each line of which corresponds to four threads in the complete draft.

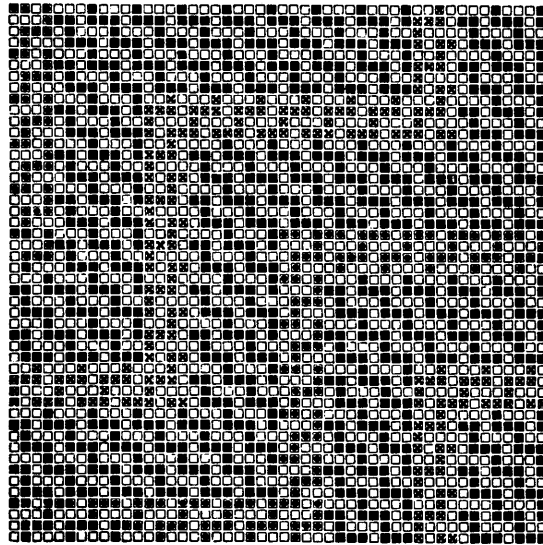


FIG. 1686.

CALCULATING THE NUMBER OF HEDDLES

When the warp is drawn in straight, the same number of heddles are placed on each shaft. For example, if 2400 threads are drawn straight on 8 shafts, each

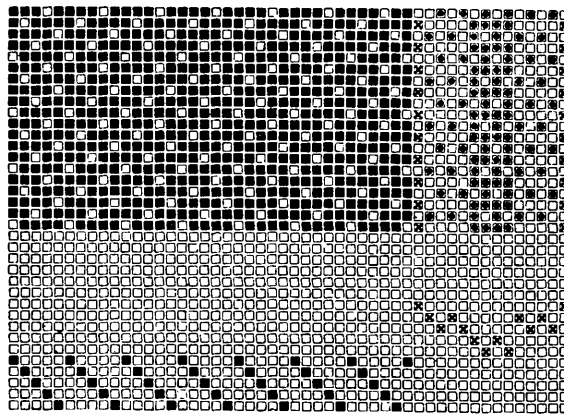


FIG. 1687.

shaft will carry 300 heddles. With many drawing-in drafts, however, it is necessary to vary the number of heddles on the different shafts to correspond with the draft. The number of heddles on each shaft is calculated as follows :

(1) Divide the total number of ends in the warp by the ends in a pattern to find the number of patterns in the full width.

(2) Multiply the number of patterns in the warp by the number of threads drawn on each harness in one pattern.

This method is illustrated by the following calculation based on the drawing-in draft shown at Fig. 1687, in which there are 50 threads in the pattern and 4000

CALCULATING THE NUMBER OF HEDDLES 349

threads in the warp, making 80 patterns in the full width:

Shaft 1,	80 × 2	. . . . .	160 heddles
Shaft 2,	80 × 4	. . . . .	320 heddles
Shaft 3,	80 × 4	. . . . .	320 heddles
Shaft 4,	80 × 2	. . . . .	160 heddles
Shaft 5,	80 × 2	. . . . .	160 heddles
Shaft 6,	80 × 8	. . . . .	640 heddles
Shaft 7,	80 × 7	. . . . .	560 heddles
Shaft 8,	80 × 7	. . . . .	560 heddles
Shaft 9,	80 × 7	. . . . .	560 heddles
Shaft 10,	80 × 7	. . . . .	560 heddles
Total,	80 × 50	. . . . .	4000 heddles

THE INFLUENCE OF THE WEAVE AND COLOR PATTERN ON THE COLOR EFFECT

Patterns for cloth may be divided into three classes :

1. Color Patterns. A smooth, uniform weave with the pattern produced by an arrangement of threads of contrasting colors in either warp or filling, or both.

2. Weave Patterns. Warp and filling of the same color, the pattern being produced entirely by the weave.

3. Weave and Color Patterns. These are produced by combining weave and color patterns in the same cloth.

Varied and interesting effects are obtained by combinations of weaves and color patterns. Such combinations often change the appearance of the cloth completely so that the resulting pattern does not resemble in the slightest degree either the weave pattern or the color pattern which have been combined.

In sketching color effects the weave is drafted in the usual way. Then all warp risers on the dark threads are colored black. If, for example, the warp is dressed 1 dark 1 light, the risers on the first or black warp thread are colored black. The risers on the second or light warp thread are either left uncolored or colored a shade other than black, say red. The filling colors are next indicated by painting black the blank squares (sinkers) on the black picks. The blank squares on the light-colored picks are painted red.

The black color now indicates the black in both warp and filling, while the red indicates the light shade.

The effect depends upon the position and order of the differently colored threads. Frequently it is possible to obtain an entirely different pattern simply by changing the position of the filling colors so that the dark pick will come in the shed previously occupied by the light color. This enables many different patterns to be produced by simply changing the position of the color in the weave pattern.

As color effects are in extensive demand and designers are constantly called upon to supply new designs and combinations, it has been considered advisable to give a large number of examples, Figs. 1688 to 1874. In all of these drafts the warp colors are indicated at the top, the filling colors at the side.

Figs. 1688 to 1705 show color effects on a plain weave.

Figs. 1706 to 1741 are color effects on twill weaves.

Figs. 1742 to 1749 are color effects on basket weaves.

Figs. 1750 to 1873 show color effects on crêpe and similar weaves.

In many of these drafts the weave is shown at the bottom; the warp pattern at the top; the filling pattern at the left; and the color effect in the center. Following is a list of corresponding weaves and color effects which are shown separately:

COLOR EFFECT	WEAVE
Fig. 1692	Fig. 1693
Fig. 1712	Fig. 1711
Fig. 1715	Fig. 1714
Fig. 1735	Fig. 1734
Fig. 1751	Fig. 1750
Fig. 1753	Fig. 1752
Fig. 1754	Fig. 1755
Fig. 1756	Fig. 1757

Fig. 1760	Fig. 1759
Fig. 1761	Fig. 1762
Fig. 1763	Fig. 1764
Fig. 1765	Fig. 1766
Fig. 1767	Fig. 1768
Fig. 1769	Fig. 1770
Fig. 1771	Fig. 1772
Fig. 1773	Fig. 1774
Fig. 1775	Fig. 1776

FIG. 1688.

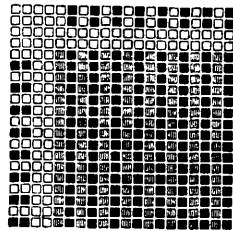


FIG. 1689.

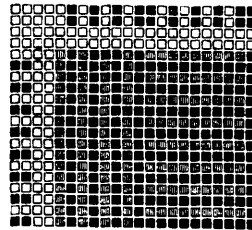
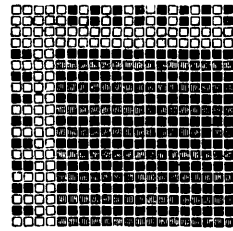


FIG. 1690.

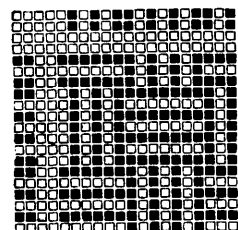


FIG. 1691.

Fig. 1777	Fig. 1778
Fig. 1779	Fig. 1780
Fig. 1781	Fig. 1782
Fig. 1783	Fig. 1784
Fig. 1785	Fig. 1786
Fig. 1787	Fig. 1788
Fig. 1789	Fig. 1790
Fig. 1791	Fig. 1792
Fig. 1793	Fig. 1794
Fig. 1795	Fig. 1796
Fig. 1798	Fig. 1797

Fig. 1805	Fig. 1806
Fig. 1808	Fig. 1807
Fig. 1804	Fig. 1803
Fig. 1813	Fig. 1814
Fig. 1818	Fig. 1817
Fig. 1819	Fig. 1817
Fig. 1822	Fig. 1823
Fig. 1824	Fig. 1825
Fig. 1826	Fig. 1827
Fig. 1828	Fig. 1829
Fig. 1834	Fig. 1835
Fig. 1838	Fig. 1837
Fig. 1839	Fig. 1836
Fig. 1840	Fig. 1836
Fig. 1841	Fig. 1842
Fig. 1844	Fig. 1843

COLOR EFFECTS ON A PLAIN WEAVE

The plain weave is often used for the production of colored stripes. Fine hair lines running warpways

FIG. 1692.

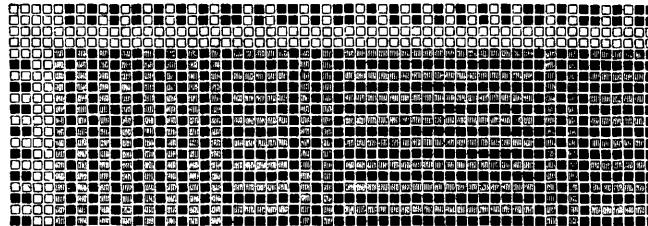


FIG. 1693.

are obtained by warping and weaving 1 light 1 dark, bringing the light pick in the shed where the light warp is lowered and the dark warp is raised, Fig. 1688.

The lines are made to run filling ways by weaving the same warp pattern so that the light pick is inserted

when the light warp is raised and the dark warp lowered, Fig. 1689.

To alternate long with cross stripes, it is merely necessary to introduce two threads of one color and then continue the pattern 1 and 1 as far as desired, when the cross stripe can be changed to a longitudinal stripe by again inserting two threads of one color. For example, the color effects shown at Figs. 1690 and 1692 are produced on a plain weave by the following arrangement of colors:

WARP PATTERN FOR
FIG. 1690

$$3 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ 1 \text{ light} \end{cases}$$

$$\frac{2 \text{ dark}}{9}$$

WARP PATTERN FOR
FIG. 1692

$$7 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ 1 \text{ light} \\ 2 \text{ dark} \end{cases}$$

$$2 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ 1 \text{ light} \\ 2 \text{ dark} \end{cases}$$

$$\frac{27}{27}$$

Both Fig. 1690 and Fig. 1692 are woven 1 dark pick 1 light pick.

By placing two warp threads of one color side by side it is evident that in the succeeding 1 and 1 pattern the light color will be brought on the shaft that carried the dark threads before the change, the dark color coming on the shaft that previously carried the light threads.

This is illustrated by Fig. 1693, which shows two picks of a plain weave for the color pattern at Fig. 1692. The crosses represent risers on the light-colored warp threads. The black squares are risers on the dark-colored warp threads. The first pick is a dark thread which comes to the face at the white squares. The second pick is a light-colored thread which comes

to the face at the white squares. It is evident that for sixteen warp threads the warp risers and filling floats of the same color will come in a perpendicular line to produce a hair line effect. Then the two dark warp threads cause a change by which the warp risers and filling floats of the same color come in a horizontal line to produce a hair line effect, which continues until another group of two warp threads of the same color

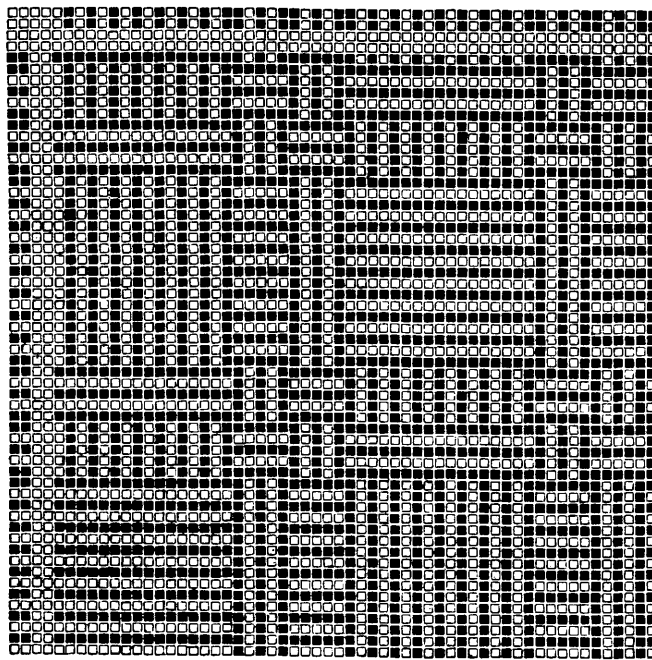


FIG. 1694.

changes the hair line from horizontal back to perpendicular. There are six changes of this kind in the pattern, producing three stripes of perpendicular lines and three stripes of horizontal lines, as shown at Fig. 1692.

The reversal of the lines lengthways as well as crossways can be effected by introducing two picks of one color and then continuing the 1 and 1 pattern. This method is illustrated at Figs. 1691 and 1694, for which the warp and filling colors are arranged as follows:

FIG. 1695.

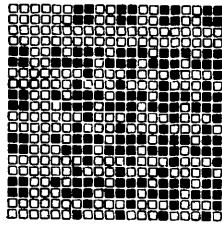


FIG. 1696.

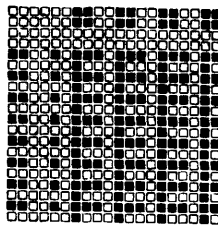


FIG. 1697.

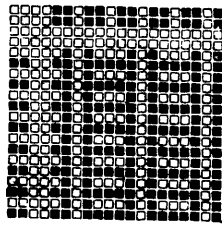
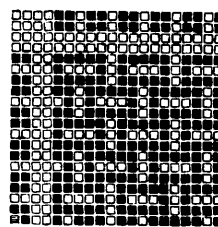


FIG. 1698.

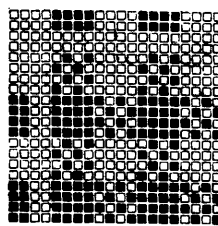


FIG. 1699.

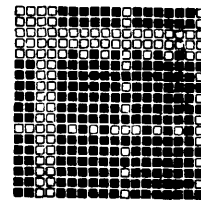


FIG. 1700.

FIG. 1701.

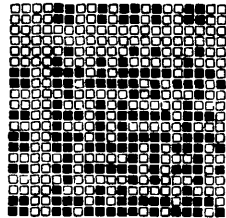


FIG. 1702.

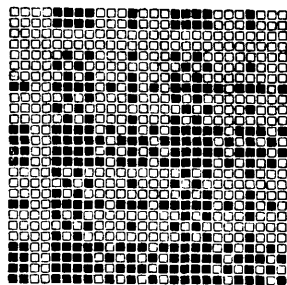
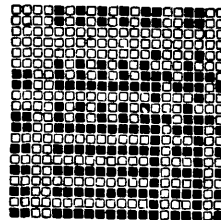


FIG. 1703.

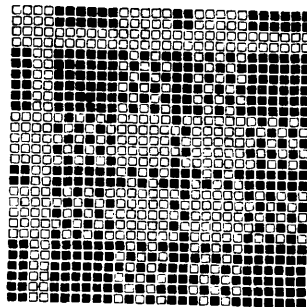


FIG. 1704.

WARP AND FILLING PAT-
TERN FOR FIG. 1691

$$2 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ 1 \text{ light} \\ \underline{2 \text{ dark}} \\ 7 \end{cases}$$

WARP AND FILLING PAT-
TERN FOR FIG. 1694

$$7 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ 1 \text{ light} \\ \underline{2 \text{ dark}} \end{cases}$$

$$2 \times \begin{cases} 1 \text{ light} \\ 1 \text{ dark} \\ \underline{1 \text{ light}} \\ \underline{2 \text{ dark}} \\ 27 \end{cases}$$

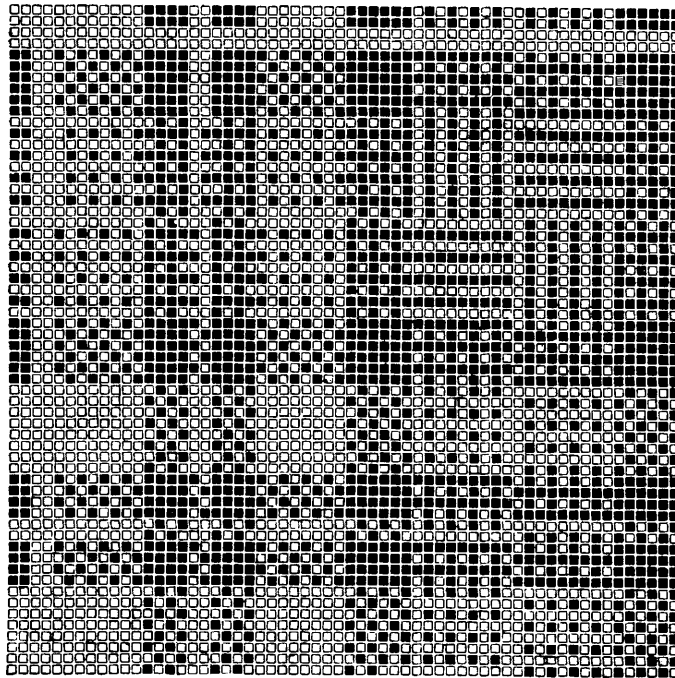


FIG. 1705.

Every pattern in which the lines are run in both directions, lengthways and crossways, must contain an odd number of threads, as in the examples given.

Other effects obtained with a plain weave are shown at Figs. 1695 to 1705.

COLOR EFFECTS ON TWILL WEAVES

The 3-leaf warp twill is used for stripes in which a thread of a contrasting color follows two threads of the ground color. The filling pattern is the same, the

FIG. 1706.

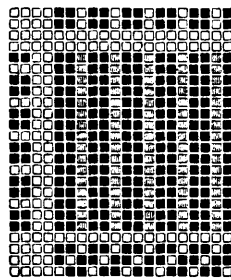


FIG. 1707.

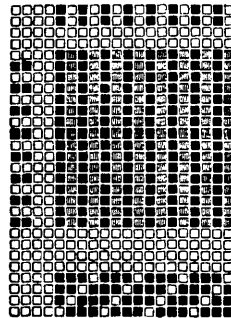
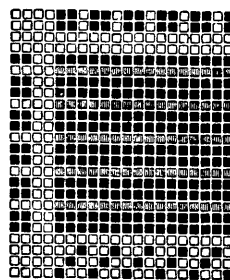


FIG. 1708.

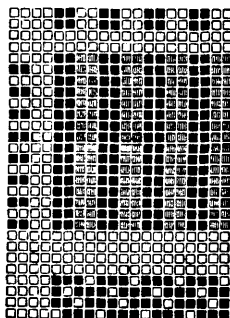


FIG. 1709.

single pick going in when the single warp thread of the same color is down, Fig. 1706.

Cross stripes of this kind are made on a 3-leaf filling twill, the light-colored pick being inserted when the light-colored warp thread is raised, Fig. 1707.

In all 2 and 1 stripe patterns the single striping threads should come in the center of the pattern, which begins 1 dark 1 light 1 dark, the weave and pattern being adjusted accordingly, as shown at Fig. 1710, on which the weave is shown at the bottom. Fig.

1711 is the weave for the color effect shown at Fig. 1712.

In drafting large patterns the motif sketched on a smaller scale is first enlarged on the draft to the full size, a certain number of threads, depending on the enlargement desired, being made to correspond to each line of the motif.

Fine stripes or hair lines are often made on a 3 up 1 down twill by alternating 1 light thread with 1 dark thread in both warp and filling, as shown at Fig. 1708. The light pick is inserted when the light thread is down.

For a 2 and 2 stripe a broken 4-leaf twill is used, the warp dressed 2 and 2, the filling 1 and 1, Fig. 1709.

The 2 up 2 down twill is used for most of the color effects with twills. A stair effect, Fig. 1713, is produced by a 1 light 1 dark pattern in both warp and filling. Figured effects can be obtained with this stair effect by reversing the twill in either warp or

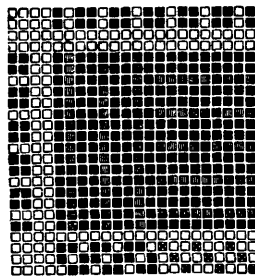


FIG. 1710.

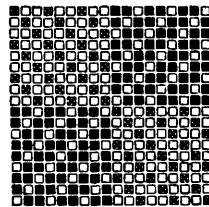


FIG. 1711.

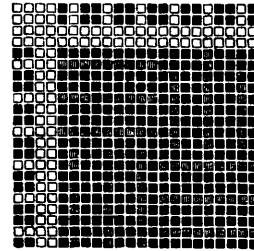


FIG. 1712.

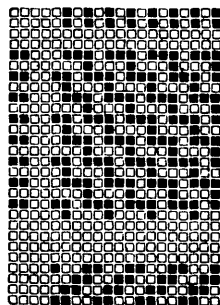


FIG. 1713.

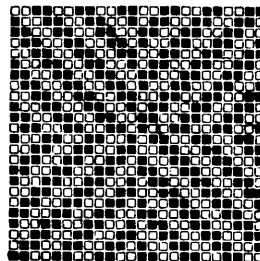


FIG. 1714.

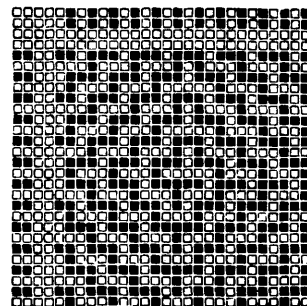


FIG. 1715.

filling or in both directions, as shown at Fig. 1715, the weave draft being shown at Fig. 1714.

The color effect produced by a combination of a 2 up 2 down twill and a 3 up 1 down twill, with a 1 light 1 dark pattern in both warp and filling, is shown at Fig. 1716.

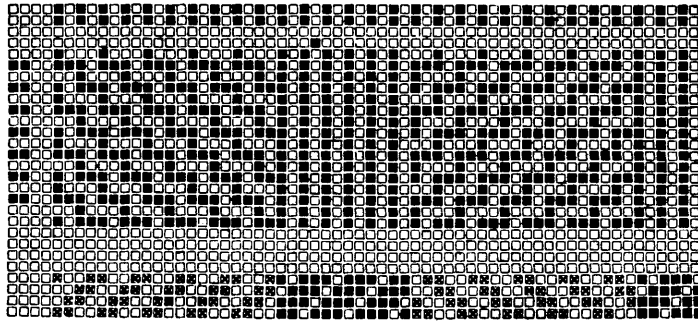


FIG. 1716.

FIG. 1719.

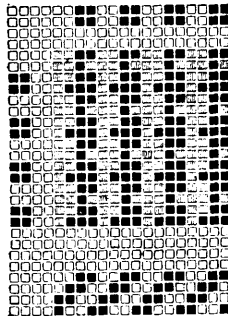


FIG. 1720.

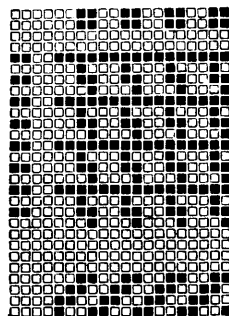
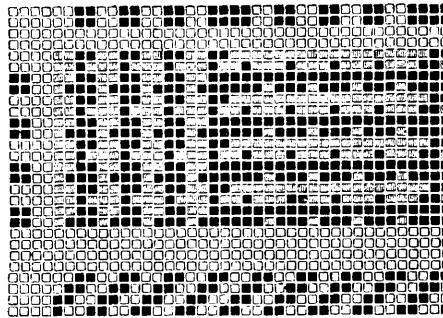


FIG. 1717.

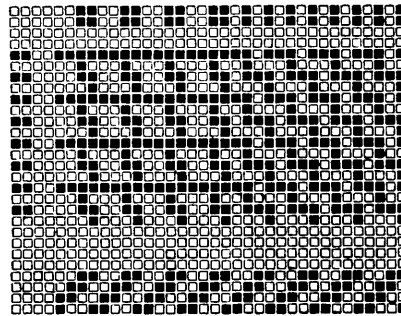


FIG. 1718.

Frequently a 2 and 2 warp pattern is combined with a 1 and 1 filling pattern on a 2 up 2 down twill, producing the effect shown at Fig. 1717.

Pleasing effects are obtained by alternating a 1 and 1 group with a 2 and 2 group of threads in the warp to produce stripes, or in both warp and filling to produce plaid effects. An example of the former is shown at Fig. 1718.

Longitudinal stripes are obtained with a 2 and 2 pattern in both warp and filling on a 2 up 2 down twill by laying one of the light picks in the shed when both light warp threads are down, Fig. 1719. Cross stripes are produced by the opposite order, in which one of the light picks is laid in the shed when the two dark threads are down. These two effects can be obtained in the same pattern by inserting 4 threads of one color where the change from one effect to the other is desired, as shown at Fig. 1720.

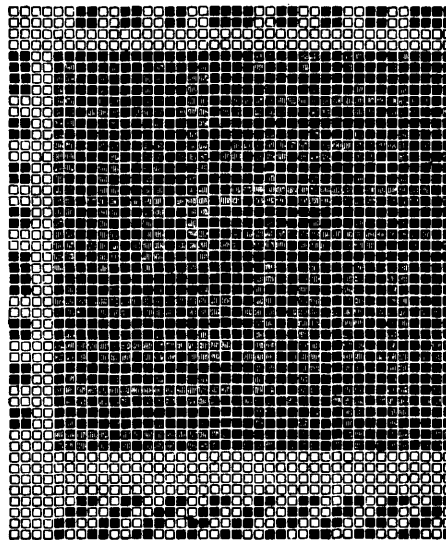


FIG. 1721.

Checked patterns can be produced by introducing 4 threads of one color at intervals in both warp and filling, as shown at Fig. 1721. The pattern which is marked at both top and sides is complete in 18 threads, while the color effect covers 36 threads.

In this class of patterns the 2 and 2 group can be made of any desired size. It is not necessary that 4 threads should be of the same color; the pattern may be 1 light 1 dark 1 light 1 dark, or 2 light 1 fancy 1 light.

An interesting effect is produced by introducing 3 threads of one color after a group in which the color pattern is 2 light 2 dark, as shown at Fig. 1722. Here the pattern in warp and filling is as follows:

$$2 \times \begin{cases} 2 \text{ dark} \\ 2 \text{ light} \\ 2 \text{ dark} \\ \underline{3 \text{ light}} \\ 13 \end{cases}$$

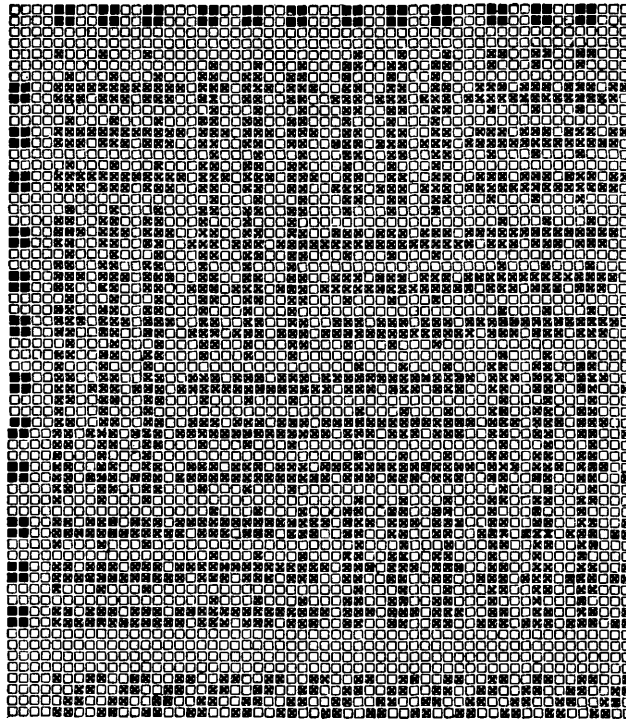


Fig. 1722.

Nearly the same effect is obtained by a 3 and 3 pattern in the warp and a 2 and 2 pattern in the filling on the weave shown at Fig. 1188.

Figs. 1723 to 1733 show various color effects produced on a 2 up 2 down twill with different color patterns.

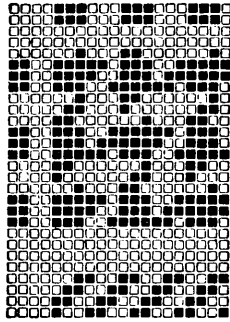


FIG. 1723.

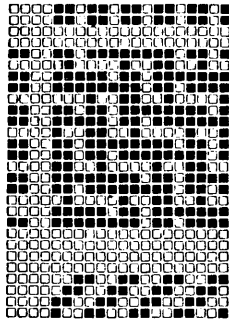


FIG. 1724.

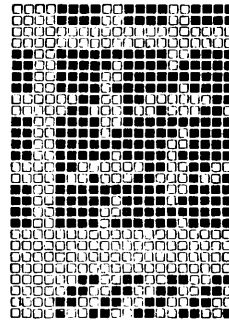


FIG. 1725.

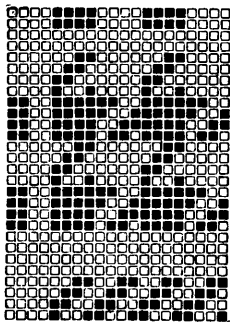


FIG. 1726.

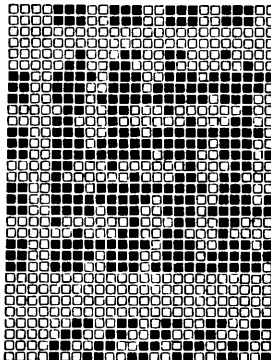


FIG. 1727.

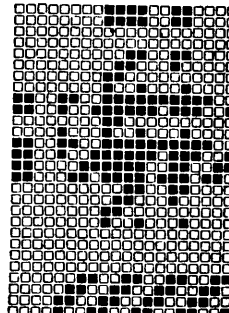


FIG. 1728.

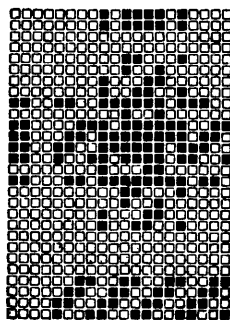


FIG. 1729.

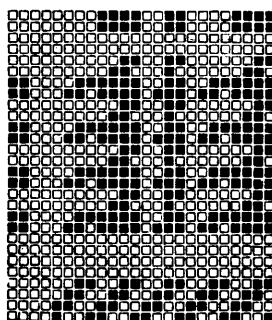


FIG. 1730.

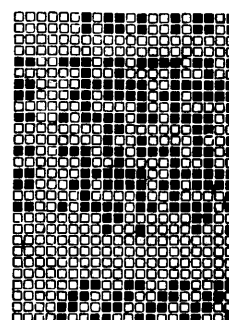


FIG. 1731.

If line effects are to be arranged to correspond with a given motif, the weave must be broken at the required points and arranged as shown at Fig. 1734. The color pattern in both warp and filling should begin 1 light 2 dark 1 light. The effect is shown at Fig. 1735.

The 3 up 3 down twill can also be used for color effects of this character. A difference of 1 thread between the color pattern and the weave pattern causes a gradual slant of the twill effect, as shown at Fig. 1736, in which there are 6 threads in the 3 up 3 down twill and 7 threads in the color pattern, the latter being 1 fancy 3 dark 3 light.

A peculiar effect is obtained by breaking and reversing the twill at regular intervals in warp and filling in

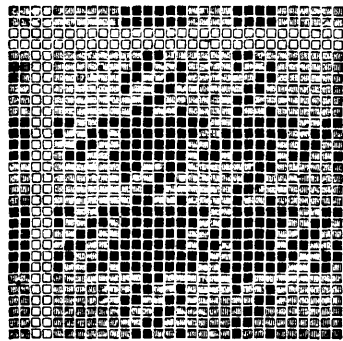


FIG. 1732.

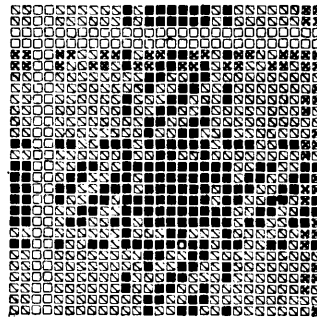


FIG. 1733.

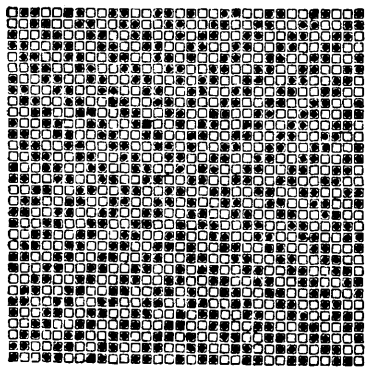


FIG. 1734.

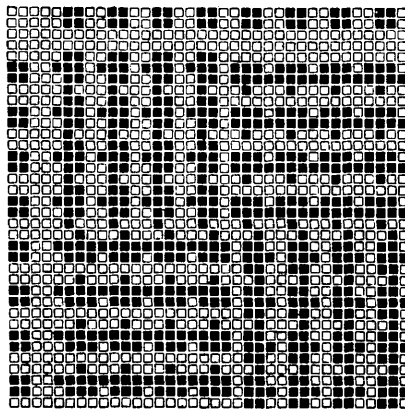


FIG. 1735.

connection with a color pattern having one thread more or less than the weave pattern. An example is shown at Fig. 1737 in which a 3 up 3 down twill is reversed at the end of each 30 threads. The pattern in warp and filling is 2 dark 3 light. A part of the weave is shown at the bottom and side, the color effect being shown in the center.

The effect becomes still more interesting and complex when the twill squares do not include an even number of the color patterns; for example, a reversal of the twill at intervals of 36 threads with a 5-thread pattern, 2 dark 3 light, in both warp and filling.

Squares are produced by breaking the twill in both warp and filling

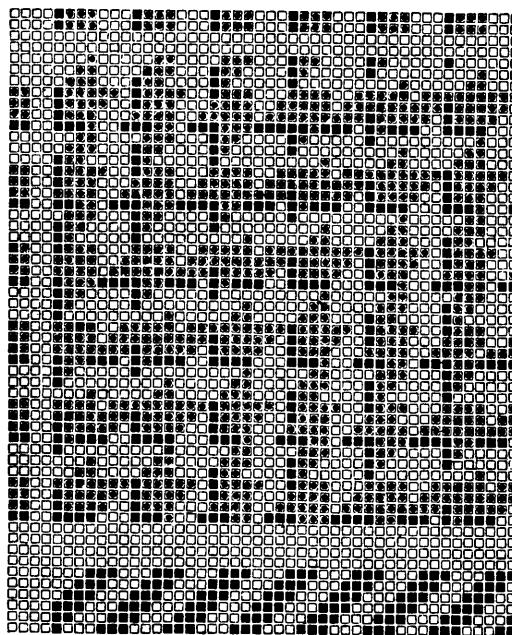


FIG. 1736.

and making the thread on each side of the break a different color from the body or ground. Fig. 1738 shows a 3 up 3 down twill reversed and broken every 4 threads; the color pattern is 1 dark 2 light 1 dark, a dark thread coming on each side of the break. Fig. 444 is often used for suiting patterns, the colors being arranged 1 dark twist 2 light twist 1 dark twist.

Similar effects can be obtained with the 4 up 4 down twill as with the 2 up 2 down or the 3 up 3 down twill, a coarser appearance resulting from the first-named

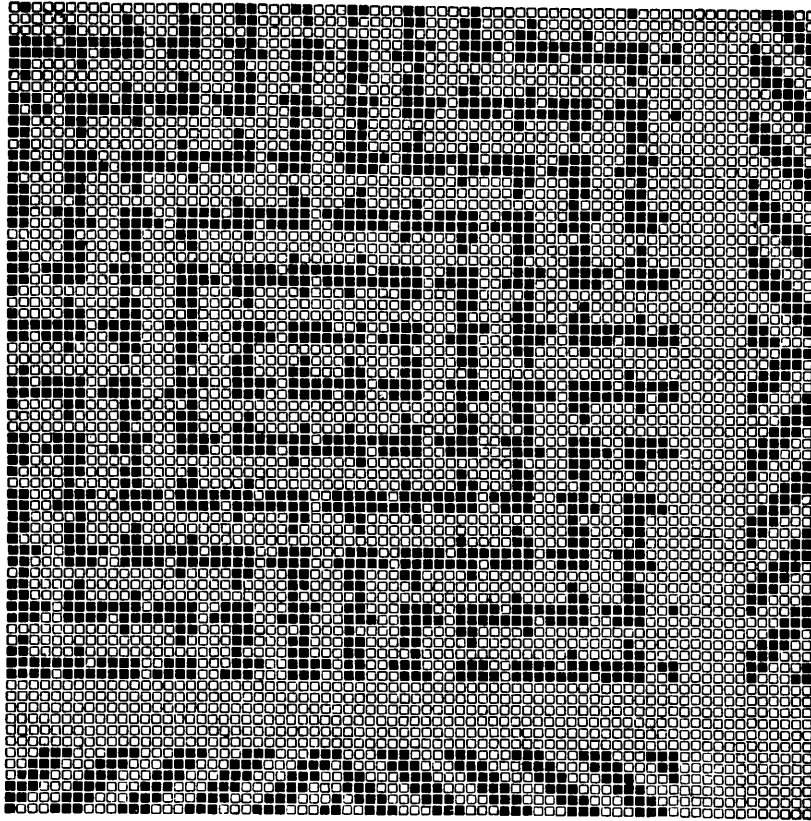


FIG. 1737.

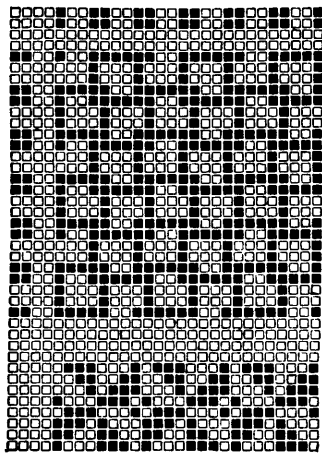


FIG. 1738.

arrangement. Fig. 1739 shows a stripe effect produced by a 4 light 4 dark pattern on a 4 up 4 down twill. Compare this with the stripe on a 2 up 2 down twill, Fig. 1719.

The stair patterns shown at Figs. 1740 and 1741 are obtained with a 1 and 1 color pattern on 8 and 9 shaft twills respectively. The stair effect runs in the opposite direction to that of the twill.

COLOR EFFECTS WITH THE BASKET WEAVE

All the color effects with a plain weave, Figs. 1688 to 1705, can be obtained with a basket or panama weave by substituting for each single thread as many threads of the same color as there are threads working together in the weave.

A variety of other color effects can be obtained by so arranging the color pattern that each color is brought into both squares of the basket. Several examples are shown at Figs. 1742 to 1749.

The basket weave gives many attractive color effects when the weave is so changed that the dark threads work together in certain places, while in other places they are divided, a part being raised when others are

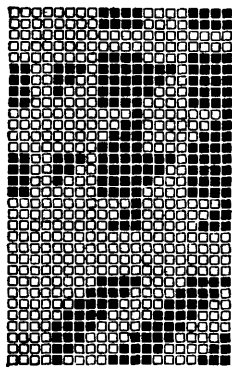


FIG. 1739.

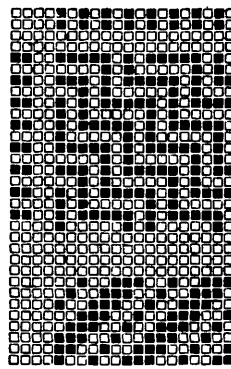


FIG. 1740.

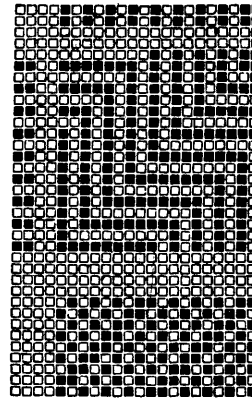


FIG. 1741.

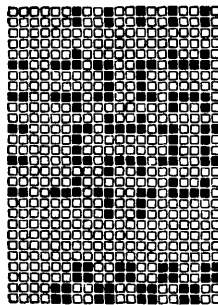


FIG. 1742.

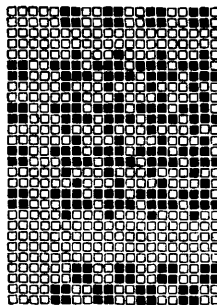


FIG. 1743.

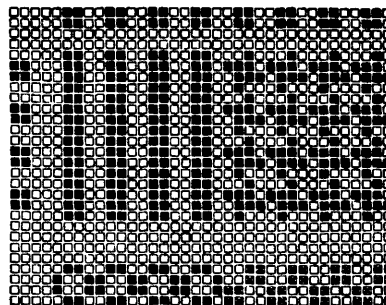


FIG. 1744.

lowered. Two patterns of this kind are shown at Figs. 1744 and 1745. Larger patterns can be obtained from a motif and with the corresponding arrangement of the weave.

Figs. 1746 and 1747 show the method of arranging the colors and weave to produce a combination of longitudinal and horizontal stripes.

Still another class of color effects with a 2 up 2 down basket is illustrated at Fig. 1748. The weave is rearranged in three different ways, producing longitudinal stripes, cross stripes and a mixed effect. The warp and filling pattern for Figs. 1743 to 1748 should be 1 light 2 dark 1 light.

Another kind of color effect on a basket weave is

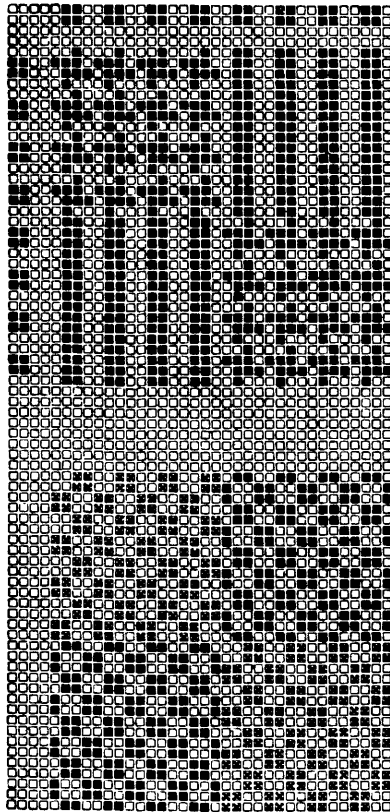


FIG. 1745.

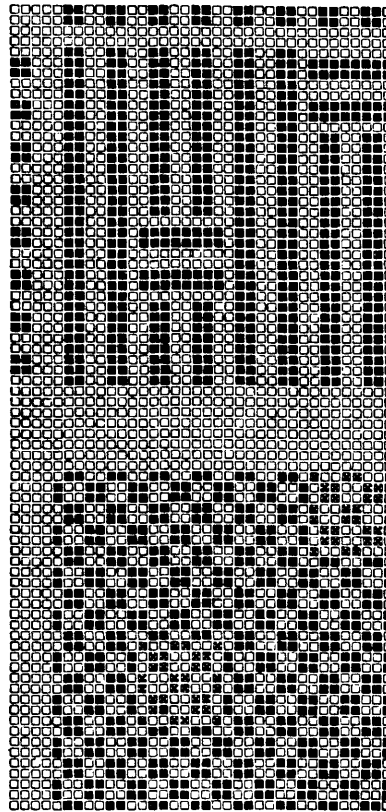


FIG. 1746.

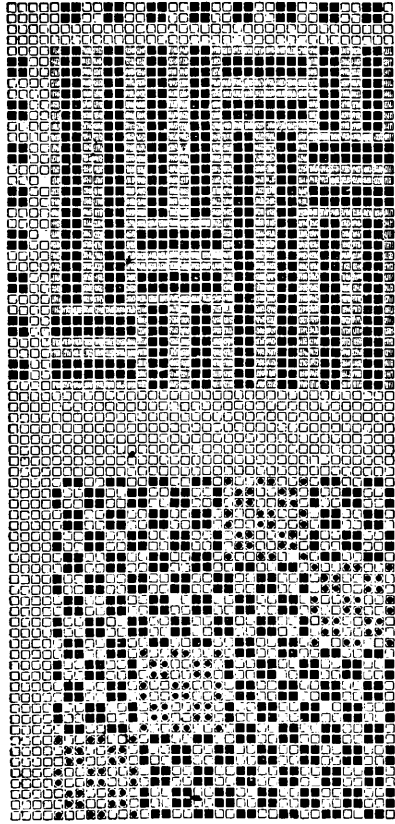


FIG. 1747.

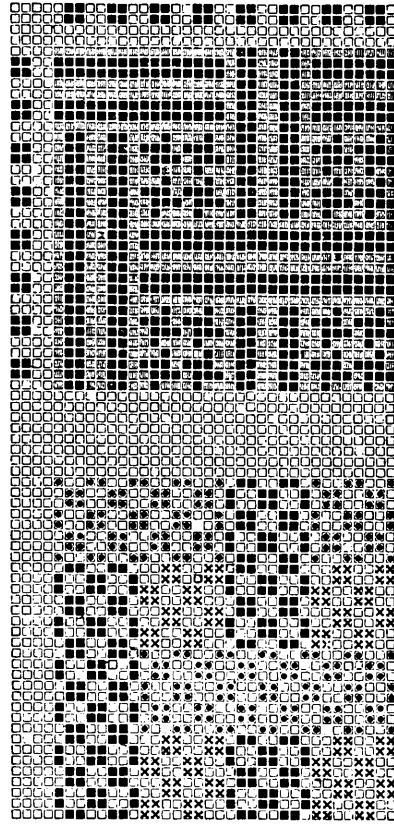


FIG. 1748.

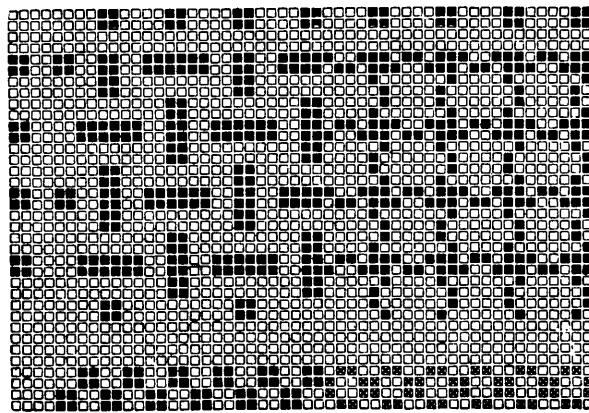


FIG. 1749.

FIG. 1750.



FIG. 1752.

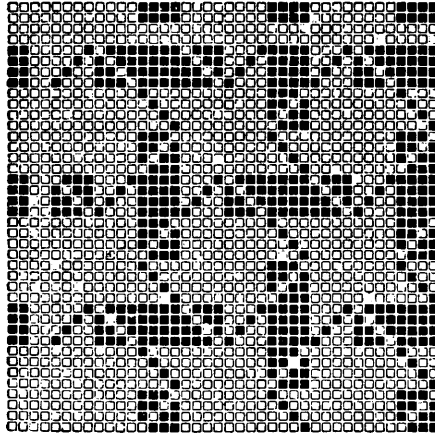


FIG. 1751.

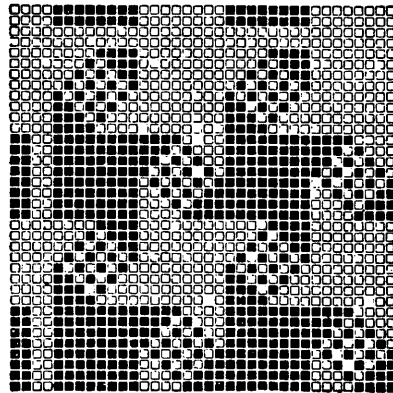


FIG. 1753.

FIG. 1755.

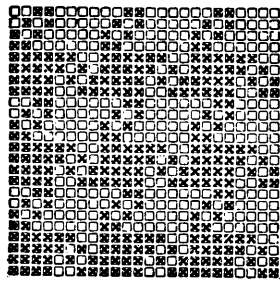


FIG. 1754.

FIG. 1757.

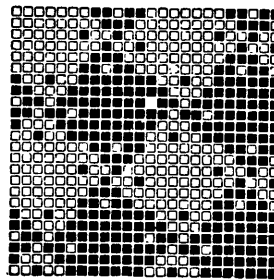
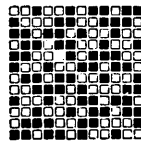


FIG. 1756.

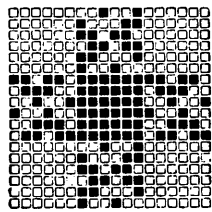


FIG. 1758.



FIG. 1759.

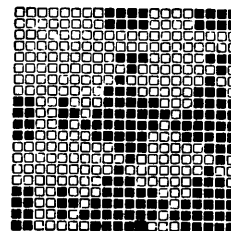


FIG. 1760.

shown at Fig. 1749, in which the warp and filling pattern is 4 light 2 dark, the weave being changed at intervals alternately to unite and separate the two dark threads in the shed.

COLOR EFFECTS ON CRÊPE AND SIMILAR WEAVES

Crêpe and fancy weaves offer a wide field for color effects. The most varied forms can be produced with

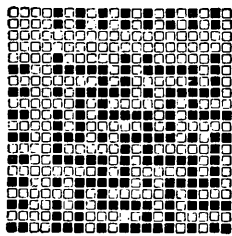


FIG. 1761.

FIG. 1762.

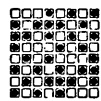
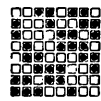


FIG. 1764.

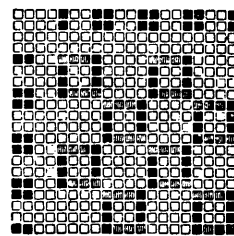


FIG. 1763.

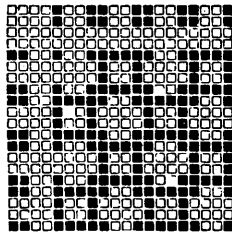


FIG. 1765.

FIG. 1766.

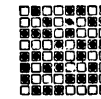
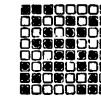


FIG. 1768.

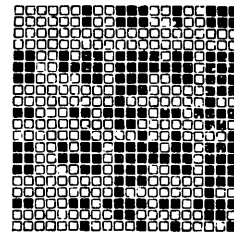


FIG. 1767.

FIG. 1770.

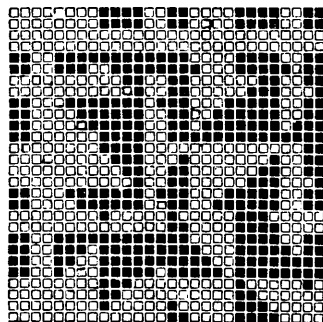
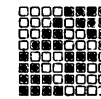


FIG. 1769.

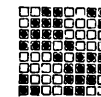


FIG. 1772.

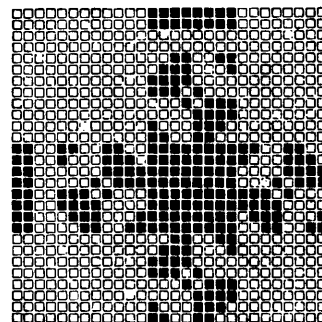


FIG. 1771.

these weaves by a suitable arrangement of the different colors. Examples are shown at Figs. 1750 to 1873.

Fig. 1754 shows a square effect obtained with a 4

FIG. 1774.

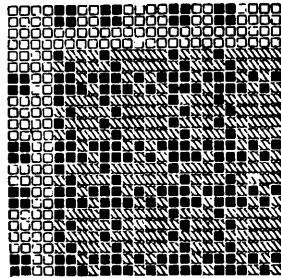


FIG. 1773.

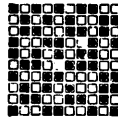


FIG. 1776.

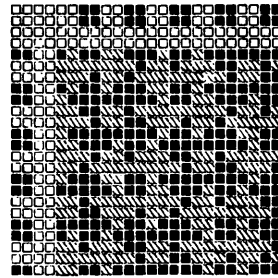
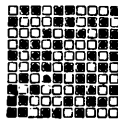


FIG. 1775.

FIG. 1778.

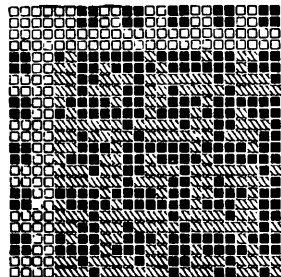


FIG. 1777.

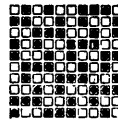


FIG. 1780.

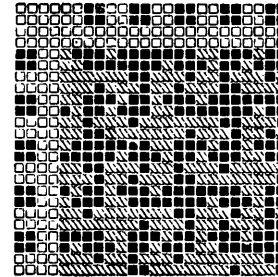
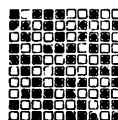


FIG. 1779.

FIG. 1782.

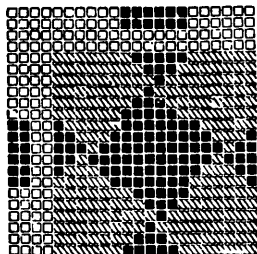


FIG. 1781.

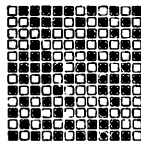


FIG. 1784.

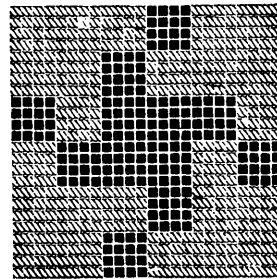
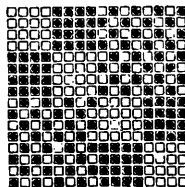


FIG. 1783.

dark 4 light pattern in warp and filling. The weave is shown at Fig. 1755.

The design shown at Fig. 1756 is made on the weave at Fig. 1757 with 6 light 6 dark in the warp, and 6 dark 6 light in the filling. If the pattern is begun in the same way in both warp and filling, 6 light 6 dark, the color effect shown at Fig. 1758 will be produced.

The patterns shown at Figs. 1787, 1789 and 1793 appear as if the threads had been woven in a diagonal direction. These weaves can also be used to advantage with 2 and 1, 6 and 6, 8 and 4 and similar patterns in the warp and filling.

The diagonal effect at Fig. 1795 results from a 3 light 3 dark pattern in warp and filling with the weave shown at Fig. 1796. Very attractive designs can be produced

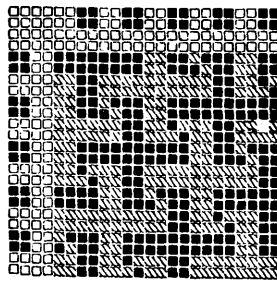


FIG. 1785.

FIG. 1786.

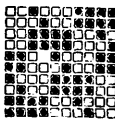


FIG. 1788.

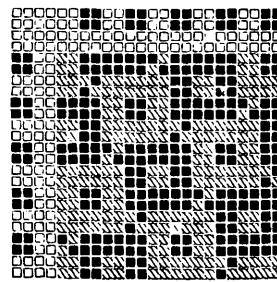
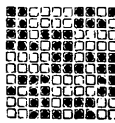


FIG. 1787.

FIG. 1790.

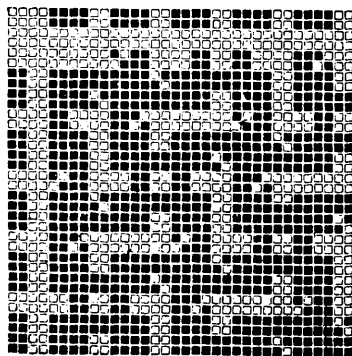
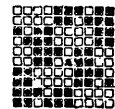


FIG. 1789.

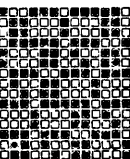


FIG. 1792.

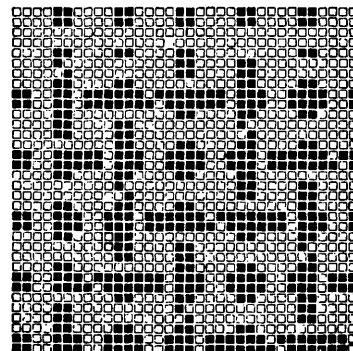


FIG. 1791.

by a regular transposition of this weave. Thus the color effect at Fig. 1798 results from a 3 light 3 dark pattern and the transposition of the weave, Fig. 1796,

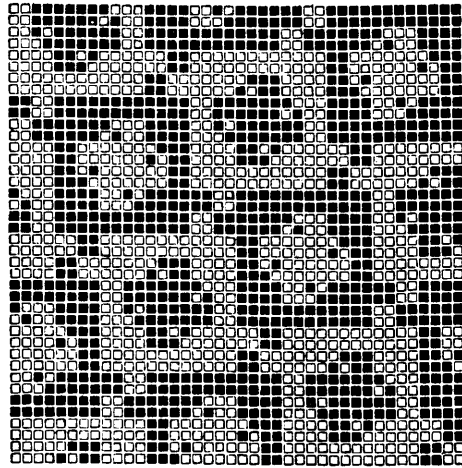


FIG. 1793.

in plain weave order, as shown at Fig. 1797.

Fig. 1799 shows the color effect resulting from a transposition of the same weave, Fig. 1796, according to the motif shown at Fig. 936.

Promiscuous effects are obtained by the use of single and isolated threads of one color in the pat-

tern. The color and weave patterns must not begin and end together, but must vary in size so as to bring the colors successively on all the shafts and picks of the weave draft.

FIG. 1794.

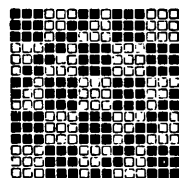
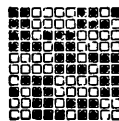


FIG. 1796.

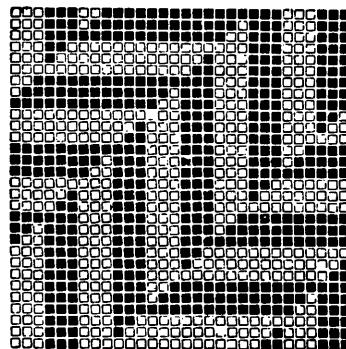


FIG. 1795.

Two color effects of this kind are shown at Figs. 1800 and 1805; each has a 2 light 1 dark pattern in warp and filling. The former is an 8-shaft crêpe

weave, Fig. 1800, the latter a 16-shaft crêpe weave, Fig. 1806.

A very attractive line of patterns can be made by

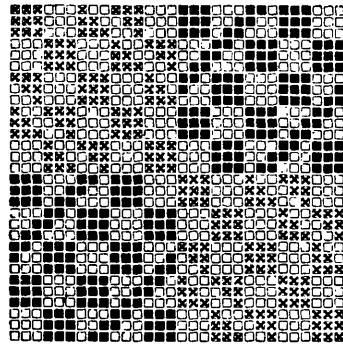


FIG. 1797.

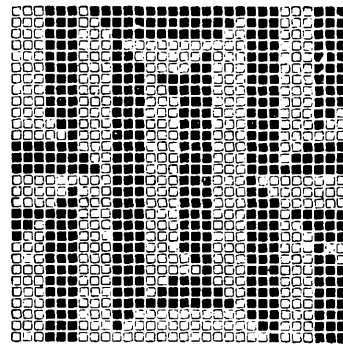


FIG. 1798.

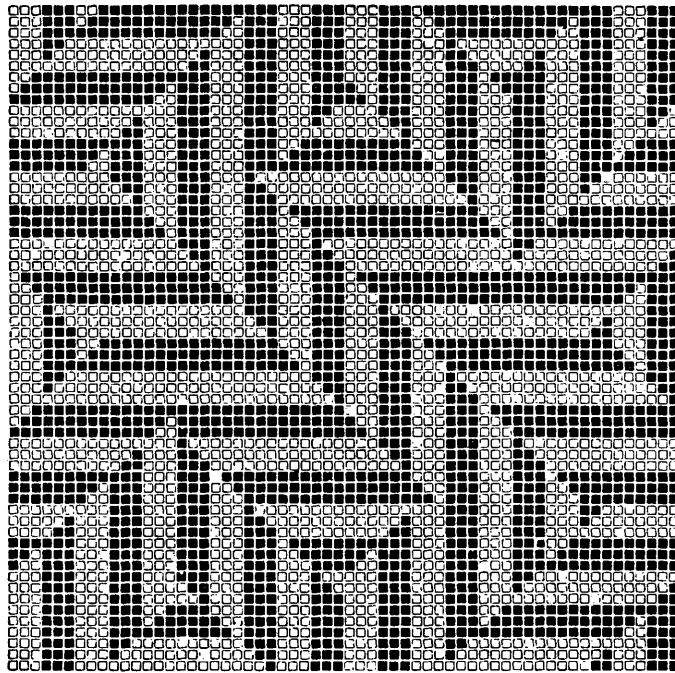


FIG. 1799.

combining a 2 up 2 down basket, Fig. 1801, with the weave shown at Fig. 1802. Fig. 1804 is the color effect

FIG. 1801. FIG. 1802.



FIG. 1803.

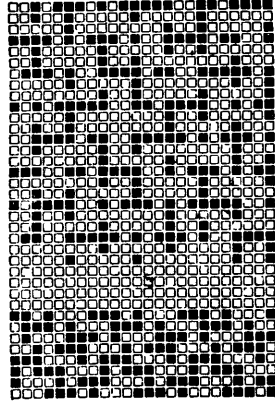
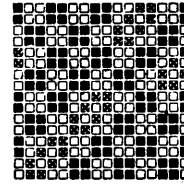


FIG. 1800.

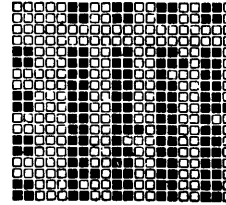


FIG. 1804.

FIG. 1806.

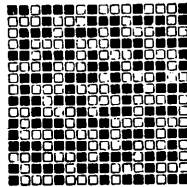


FIG. 1807.



FIG. 1808.

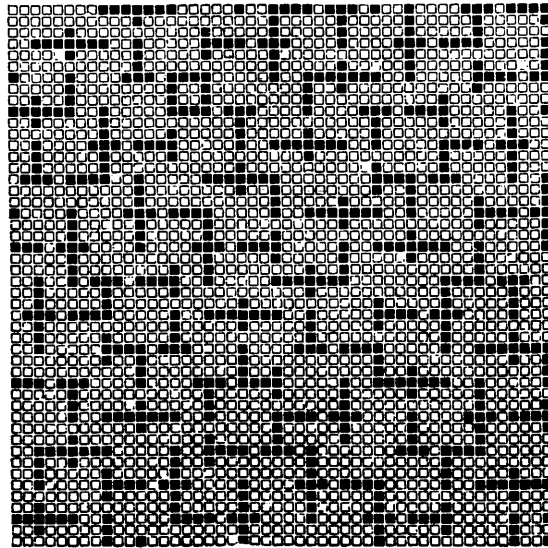
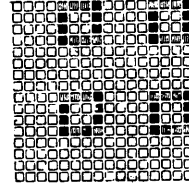


FIG. 1805.

resulting from a combination of these two weaves in broken 4-leaf twill order as shown at Fig. 1803.

In Figs. 1809 and 1810 the dark spots in the light

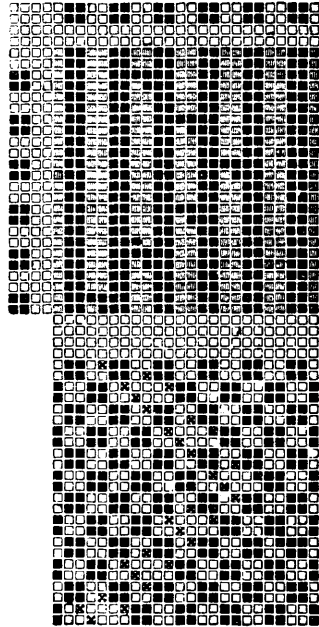


FIG. 1809.

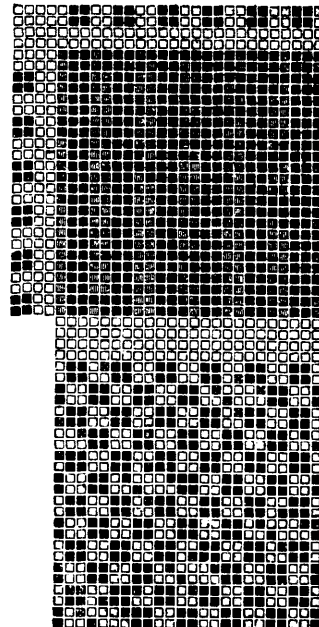


FIG. 1810.

FIG. 1811.



FIG. 1812.

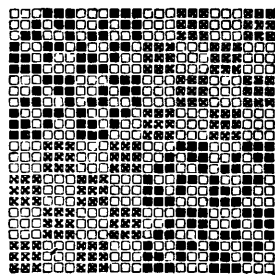


FIG. 1814.

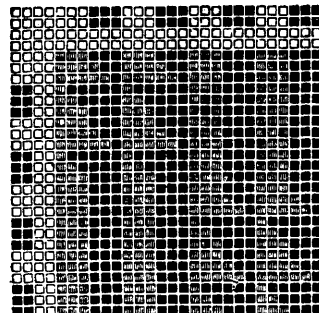


FIG. 1813.

stripes are larger than those in Fig. 1804. An examination of the weaves and corresponding color patterns will show the method of producing them. Fig. 1809

FIG. 1815.

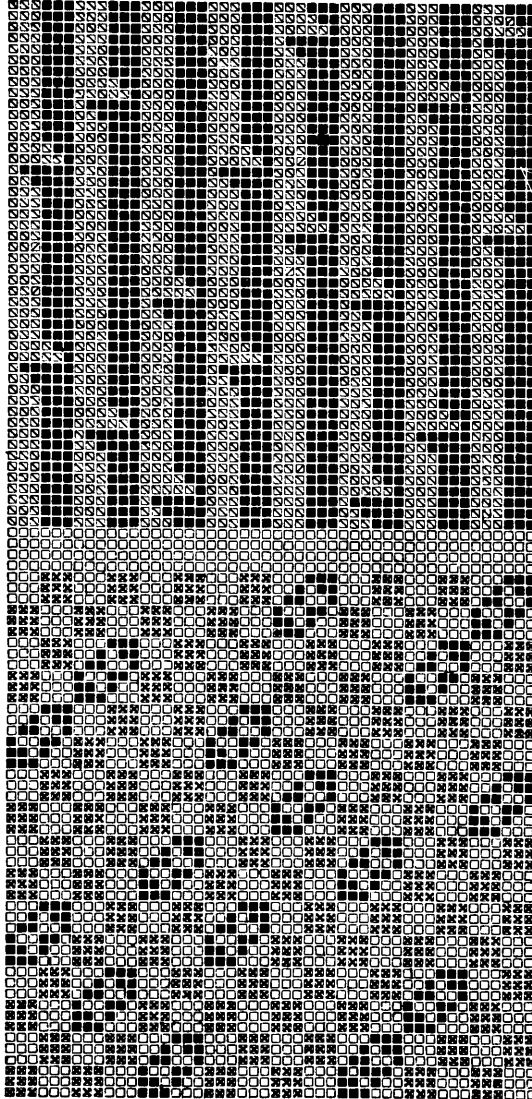


FIG. 1816.

shows the spots arranged in pointed form; Fig. 1810, in 6-leaf satin order.

With a 3 up 3 down basket weave, Fig. 1811, the

spots are produced by inserting the weave shown at Fig. 1812. Fig. 1813 shows the effect obtained by arranging the two weaves in checkerboard order, as

FIG. 1817.

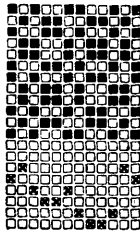


FIG. 1818.

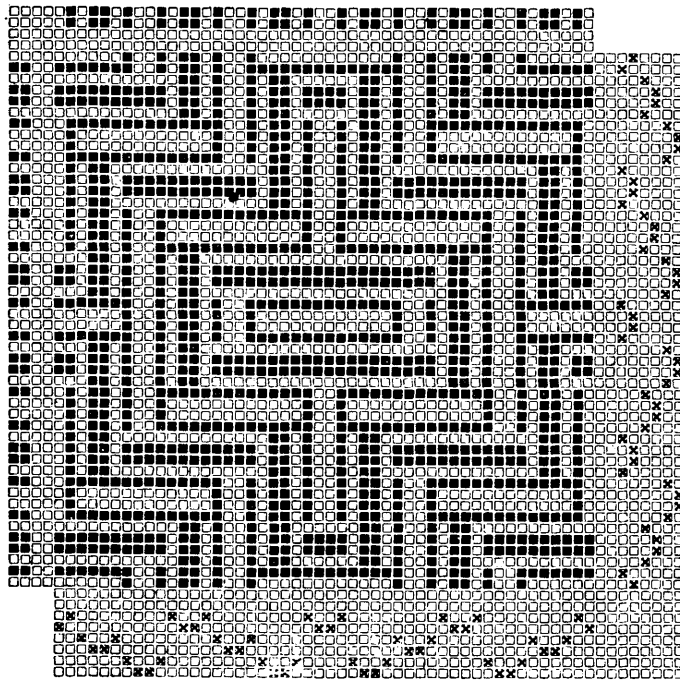
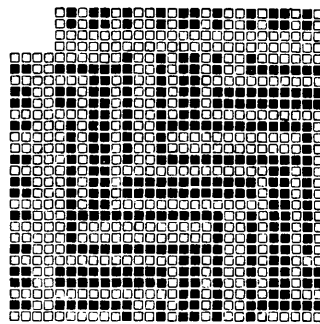


FIG. 1819.

shown at Fig. 1814. Fig. 1816 shows them arranged according to the accompanying motif, Fig. 1815.

Another class of designs is illustrated at Fig. 1818,

in which the warp and filling pattern is 1 light 1 dark, 1 light 2 dark, 1 light 1 dark, 1 light, total 8. The weave is shown at Fig. 1817.

This design can be indefinitely varied by rearranging the drawing-in draft and picks. An example is

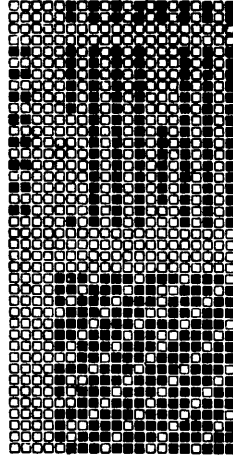


FIG. 1820.

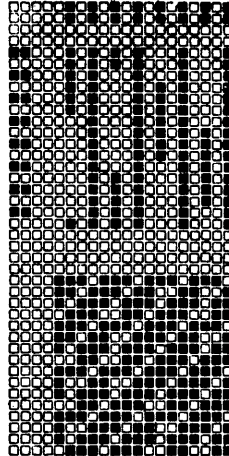


FIG. 1821.

FIG. 1823.

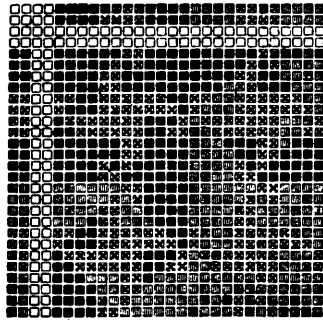


FIG. 1822.

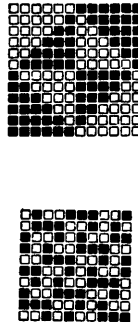


FIG. 1825.

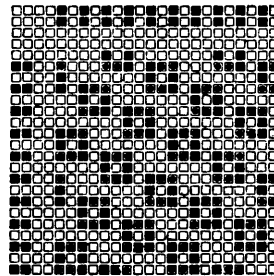


FIG. 1824.

shown at Fig. 1819, in which the color effect results from the weave at Fig. 1817 with the color pattern and drawing-in draft shown at Fig. 1819. The method of rearranging the picks of Fig. 1817 is shown at the right of Fig. 1819.

Streaked or spotted effects with a 1 dark 1 light

pattern in warp and filling are produced in the following manner :

A 4-leaf warp twill is first drafted over the pattern area. The risers are removed for certain distances from a dark warp thread, throwing the thread on the

FIG. 1827.

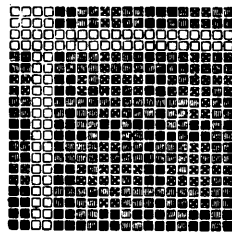
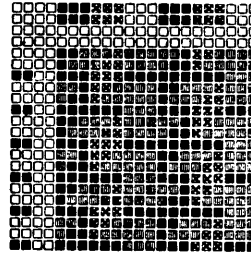
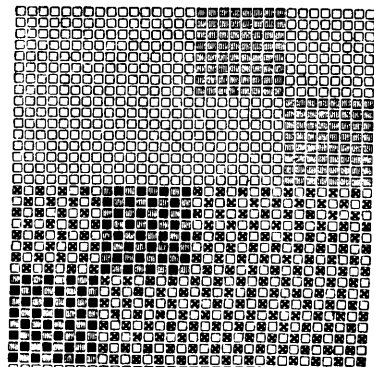
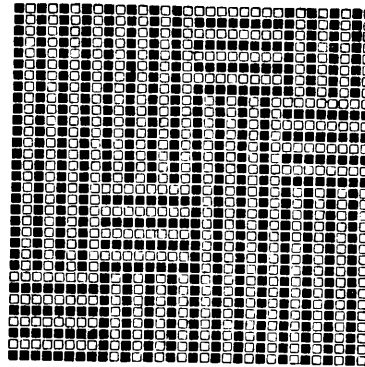


FIG. 1826.

FIG. 1829.

FIG. 1828.

FIG. 1831.



82

1

FIG. 1830.

back in a 1 up 3 down order. This causes the light threads on either side to approach each other and make a more pronounced streak of the light shade in the cloth. Figs. 1820 and 1821 illustrate the method and the effect produced.

Other designs of this character are shown at Figs. 1822 to 1840.

Longitudinal and cross stripes on a plain weave can

FIG. 1832.

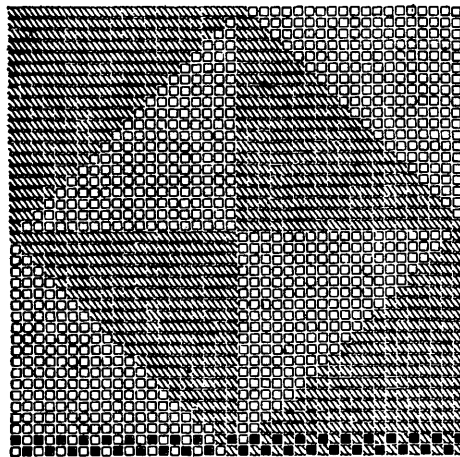
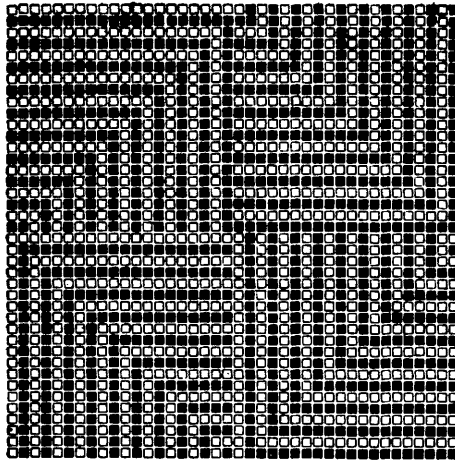


FIG. 1833.

be obtained with a continuous 1 and 1 color pattern in warp and filling. It has already been explained that longitudinal stripes are produced with this combination of weave and color pattern by laying the light pick when the light warp thread is down; also that cross stripes result from laying the light pick when the light warp thread is up. The stripe can be run in either direction by rearranging the plain weave to raise or lower the light and dark warp threads in the required order. The method of drafting is as follows:

1. The positions of the vertical and cross lines are determined and marked on the draft.
2. The cross lines are painted yellow.
3. A plain weave is drafted on the yellow lines to raise the light warp when the light filling is laid.
4. A plain weave is drafted on the remaining portion

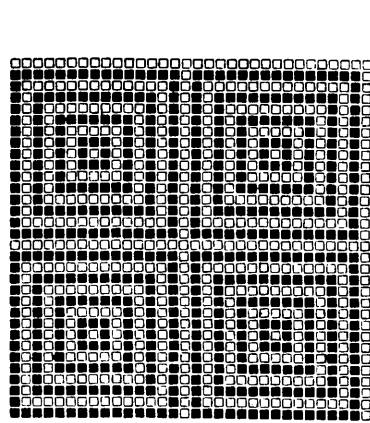


FIG. 1834.

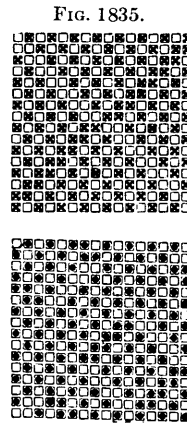


FIG. 1837.

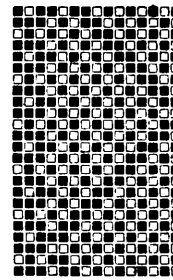


FIG. 1836.

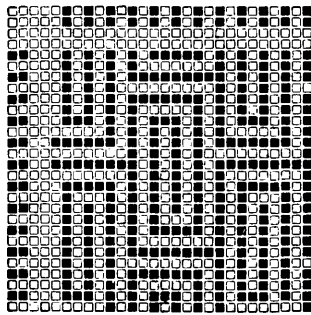


FIG. 1838.

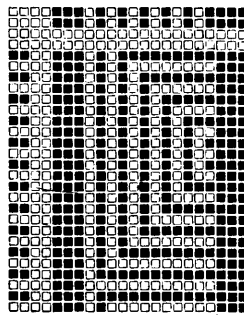


FIG. 1839.

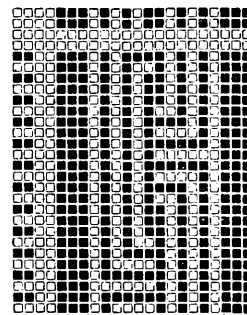


FIG. 1840.

of the area, where longitudinal lines are wanted, so as to raise the dark warp when the light filling is laid.

These operations are illustrated by the two examples shown at Figs. 1830, 1831, 1832 and 1833.

At the dividing line between the two divisions of the weave two

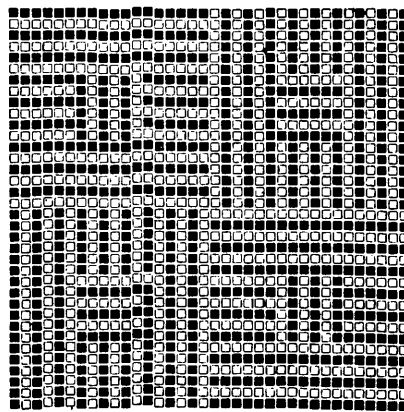


FIG. 1841.

risers or two sinkers come together, but this does not injure the pattern.

Several examples of this class of effects are shown at Figs. 1830 to 1844. Fig. 1836 is the weave for the color effects shown at Figs. 1839 and 1840.

FIG. 1842.

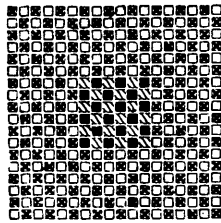


FIG. 1843.

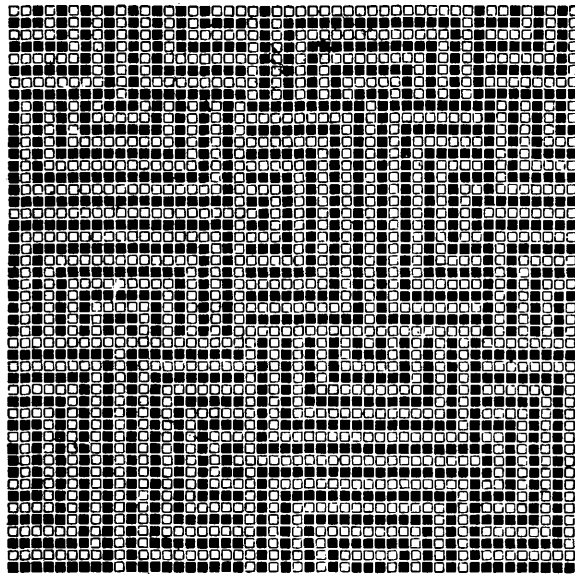
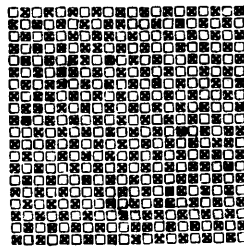


FIG. 1844.

When two threads of one color in patterns of this kind are placed together in warp and filling at the end of the weave pattern or at any other place, the light threads are changed to the position in the weave previously occupied by the dark threads, the dark threads taking the place previously occupied by the light

threads. The result is that longitudinal stripes displace cross stripes, while cross stripes appear where longitudinal stripes were previously formed. This causes a complete transposition of the color effect, as may be seen by comparing the part, *b*, in Fig. 1840 with the part, *a*, in Fig. 1839.

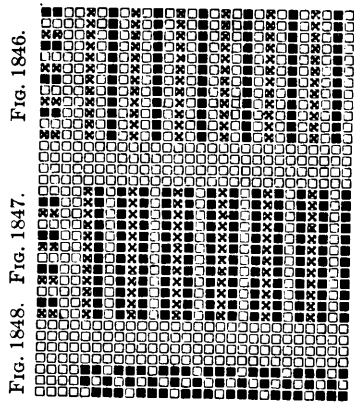
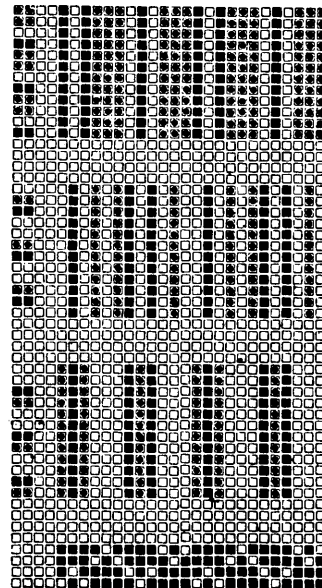
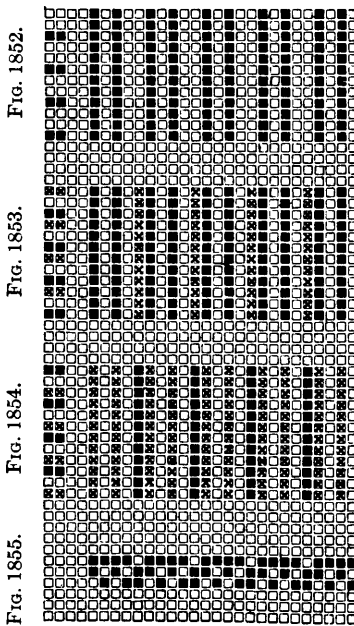
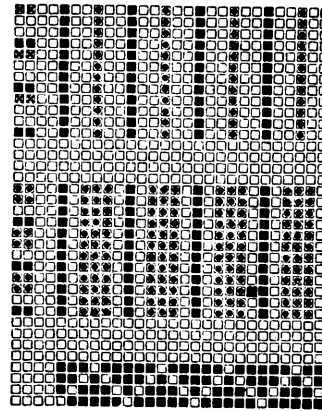


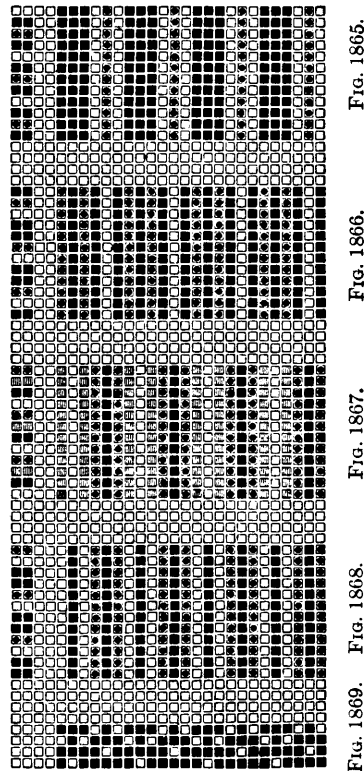
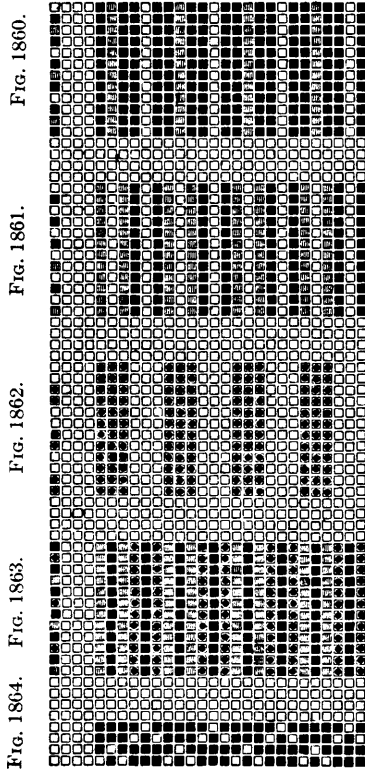
FIG. 1845.



For the color effect shown at Fig. 1841 the color patterns are as follows:

WARP	FILLING
$9 \times \left\{ \begin{array}{l} 1 \text{ dark} \\ 1 \text{ light} \end{array} \right.$	$10 \times \left\{ \begin{array}{l} 1 \text{ dark} \\ 1 \text{ light} \end{array} \right.$
$9 \times \left\{ \begin{array}{l} 1 \text{ light} \\ 1 \text{ dark} \end{array} \right.$	$10 \times \left\{ \begin{array}{l} 1 \text{ light} \\ 1 \text{ dark} \end{array} \right.$
$\frac{36}{}$	$\frac{40}{}$

The line effects become still more interesting when, in place of the plain weave, that shown at Fig. 1845 is used, which has two threads working in reverse order, followed by two working together.



Figs. 1846 to 1873 show a number of additional examples of hair line effects. The weave is shown at

FIG. 1870.

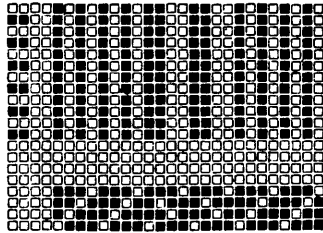


FIG. 1872.

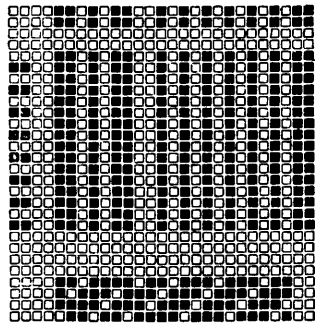
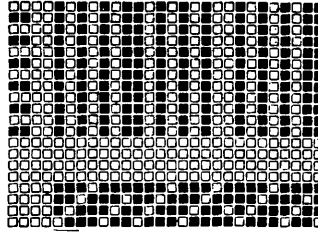


FIG. 1871.

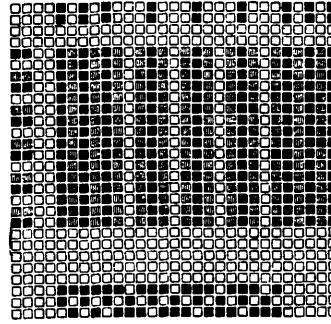


FIG. 1873.

the bottom of each group of color effects. Above the weaves are the color effects obtained with various color patterns. The

continuous lines of the width of one thread in these patterns are produced by inserting a pick of a given color when the warp thread of the same color is down. Thus when a black warp thread is down a black filling thread is inserted in the fabric.

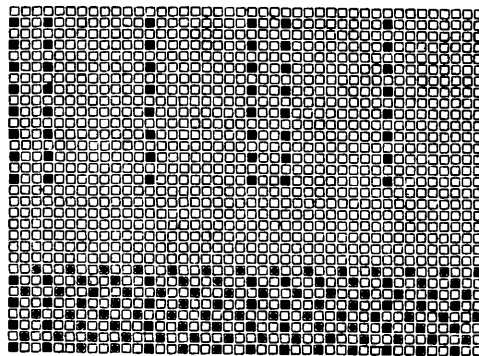


FIG. 1874.

Fabrics in which color effects are to be produced

should not be set excessively close in the warp, as it is desirable to have the filling colors fairly prominent.

The weave shown at Fig. 1874 is well adapted for clearly defined, but subdued, stripe effects. Each individual stripe, as well as the whole pattern, must comprise a number of threads which is divisible by 3. The warp pattern for the color shown at Fig. 1874 is as follows :

1 dark
2 light
1 dark
8 light
1 dark
8 light
<hr/>
21

“STRAIGHT LINE” ANALYSIS OF WEAVES, PATTERNS AND FABRICS

By SAMUEL S. DALE

It seems peculiarly fitting that a treatise on weave construction such as the “Handbook of Weaves” should be supplemented by an explanation of the best method of analyzing weaves and fabrics. The “Handbook” explains and illustrates the construction of weaves; that is, the manner in which warp and filling threads are interlaced to produce the effect desired. This supplement to that work will explain how the weave and the fabric construction of a woven cloth are determined, enabling a manufacturer to obtain the details of the layout for any sample of woven goods that may be submitted to him.

WEAVE AND COLOR PATTERN ANALYSIS

The method by which the weave is determined from a given sample is very simple, but the process itself is frequently difficult because of the felted condition of wool cloth, which prevents the separation of the threads in the fabric. Cloths composed of cotton, linen, silk, lightly felted wool, or other textile material ordinarily offer no serious difficulty in determining the weave construction.

A needle, scissors, pencil and cross section paper are the only appliances required. A slender awl, such as is used by machinists, answers well as a needle for this work.

A square or oblong sample of the cloth to be analyzed or, to use a common expression, "picked out" is cut with the edges running as nearly straight with warp or filling threads as possible. Three or four square inches of the fabric is a convenient size to handle and usually large enough to give several complete color and weave patterns.

The threads, usually the filling, are then withdrawn from one side of the sample for one half or three quarters of an inch, leaving the other set of threads (the warp, if the filling is withdrawn) projecting from the edge of the cloth. These projecting threads are clipped close to the filling for about half an inch at the left.

The sample with the face to the operator is then drawn firmly over the index finger of the left hand and held at the right between the first and second fingers. At the left, where the projecting warp has been clipped, it is held between the thumb and first finger, with the projecting warp threads pointing up.

One filling thread is loosened along the clipped edge of the sample and for a short distance beyond, care being taken not to withdraw it completely from the projecting warp threads.

Holding the cloth firmly over the first finger, the operator, beginning with the first projecting warp thread, notes carefully whether these warp threads are above or below the filling thread that has been loosened from the cloth. After the color of the filling thread has been marked at the left of the draft, the position and color of each warp thread are marked on the cross section paper, the color being indicated by a letter at the top of the draft. A cross in a square indicates that the warp is above the filling at that point of intersection, and a blank square indicates that it is below. This operation is continued until a record of the warp threads in one or more complete color and weave patterns for the filling thread has been obtained. This filling thread is then withdrawn

and the same operation is repeated with the next filling thread, the work being continued until a record of the filling threads in one or more complete color and weave patterns has been obtained.

When it is impossible by the ordinary method to determine beyond question the order in which the warp threads lie in the cloth, the object can sometimes be attained by clipping some of the projecting threads and marking the short threads on the draft for identification. In this way a correct record for each warp thread is obtained. If in such a case the warp threads should be marked on the draft in the wrong order, it is often possible to correct these errors when the draft of an entire filling pattern has been obtained. It frequently happens, however, that this difficulty can be obviated by turning the sample quarter way around and raveling the warp instead of the filling thread by thread.

When the weave and color patterns in warp and filling have been determined, the weave draft, drawing-in draft, and color pattern are arranged in the form already explained in the "Handbook of Weaves."

Fig. 1875 shows the weave and thread drafts obtained by "picking out" a cross rib cloaking fabric. The 2-ply worsted warp threads are marked "W". The 2-ply cotton warp threads are marked "C". The marks at the left of the draft indicate the three kinds of filling: "5-p", 5-ply cotton; "2-p", 2-ply cotton; and "B", carded woolen backing.

The warp pattern is:

2 worsted, 2 ply

$\frac{1}{3}$ cotton, 2-ply

3

The filling pattern is:

1 cotton, 5-ply

1 cotton, 2-ply

$\frac{1}{3}$ carded woolen, single

3

The face weave of this cloth is the full rib weave shown at Fig. 212 and described in the "Handbook of Weaves" under "Cross Ribs". The carded woolen back filling is stitched by the cotton warp in a 3 up 1 down broken twill order in an area of 12 threads square.

THE "STRAIGHT LINE" ANALYSIS OF WOVEN FABRICS

The best method of analyzing woven fabrics is that known as the "straight line," which is based on the convenient relations existing between ounces per yard, square yards per pound, width of cloth in inches, number of threads per inch, and the English basis for numbering yarn. Developed in the mill by the writer, it was first made public in October, 1902, and has since then been extensively adopted in American and foreign mills, always with complete success. The attention of the textile trade and the public in this and other countries was directed to this method of cloth analysis in 1913 when the United States tariff on cotton cloth was revised, with the ad valorem rates adjusted to a sliding scale based on the average yarn number, determined by the "straight line" method.

The essential feature of this method consists in cutting a rectangular sample of the cloth to be analyzed so that it will have an area of $\frac{1}{300}$ th square yard (4.32 square inches). This is called the standard sample.

Every warp and filling thread in 1 square inch of cloth represents 1 inch of yarn, and also represents 4.32 inches of yarn in 4.32 square inches ($\frac{1}{300}$ th square yard) of cloth.

If, for example, a woven fabric has 50 warp threads and 40 filling threads per inch, there will be 90 lengths of warp and filling yarn, each 4.32 inches long, in the standard sample of $\frac{1}{300}$ th square yard (4.32 square inches). If this standard sample weighs, say 5 grains, it follows that the warp and filling yarn in the sample will have an average of 18 of these lengths (4.32 inches) per grain.

This number, 18, is the cotton yarn number because cotton yarn is numbered in all parts of the world to indicate the number of 840-yard lengths per pound, which is equivalent to the number of 4.32-inch lengths per grain.

It follows that the average number (by the cotton system) of the yarn in a woven fabric is equal to the number of warp and filling threads per inch divided by the number of grains in the weight of $\frac{1}{30}$ th square yard (4.32 square inches).

The size or count of any particular kind of yarn in a fabric, for example, warp, filling, back warp, back filling, face warp, face filling, is found by the same method; that is, dividing the number of threads of the yarn in question per inch by the number of grains in its weight.

The result thus obtained indicates the size or count of the yarn (by the cotton system) as it lies in the cloth. To determine the count of the yarn when spun it is necessary to estimate and make allowance for the changes in length and weight in weaving and finishing by reason of the take-up in twisting and weaving, shrinkage of length in finishing, and loss or gain in weight during these processes.

The weight per yard and number of yards per pound are found with equal facility by the "straight line" method. The standard sample ($\frac{1}{30}$ th square yard) is equal to a sample .12 yard (4.32 inches) long and 1 inch wide. It follows that multiplying the grain weight of the standard sample by the width of the given fabric in inches will give the grain weight of .12 running yard of the goods.

The number of running yards of cloth per pound is equal to a pound (7000 grains) divided by the weight of one yard or to .12 pound (840 grains) divided by the weight of .12 yard.

It follows that the number of running yards of cloth per pound is found by dividing 840 by the product of

the grain weight of the standard sample and the number of inches in the width of the cloth.

$$840 \div (\text{grain weight of sample} \times \text{width in inches}) \\ = \text{running yards per pound.}$$

As there are $437\frac{1}{2}$ grains in an ounce, each grain in the weight of the standard sample is equivalent to 1 ounce per $(437\frac{1}{2} \times 4.32)$ 1890 square inches. This is the area $(52\frac{1}{2} \times 36)$ of a running yard $52\frac{1}{2}$ inches wide.

It follows that the number of grains in the weight of the standard sample (4.32 square inches) is equal to the number of ounces per running yard, $52\frac{1}{2}$ inches wide.

The number of ounces per running yard for any other width is found by proportion :

$$(\text{grains} \times \text{width in inches}) \div 52\frac{1}{2} = \text{ounces per running yard.}$$

No special apparatus is required for the "straight line" system of cloth analysis. The cloth and yarn are weighed on an ordinary balance, such as is found in nearly every textile mill, with grain weights down to $\frac{1}{10}$ th grain or smaller.

The standard sample (4.32 square inches) can be cut by a die, or with scissors or knife around a template of the required size. The sample may be of any convenient form so long as it is of the required area. 1.8 inches by 2.4 inches are convenient dimensions. If a smaller or larger sample is used, it can be made a fraction or multiple of 4.32 square inches.

Following are several sizes and corresponding dimensions :

Standard size ($\frac{1}{100}$ square yard) 4.32 sq. in.	(1.6 inches \times 2.7 inches) (1.8 inches \times 2.4 inches)
Multiples :	
Two (2) sizes ($\frac{1}{50}$ square yard) 8.64 sq. in.	(1.8 inches \times 4.8 inches) (2.4 inches \times 3.6 inches) (2.7 inches \times 3.2 inches)
Three (3) sizes ($\frac{1}{33}$ square yard) 12.96 sq. in.	(1.8 inches \times 7.2 inches) (2.4 inches \times 5.4 inches) (2.7 inches \times 4.8 inches) (3.6 inches \times 3.6 inches)

Fractions:

Three quarters ($\frac{3}{4}$) size ($\frac{1}{4}$ square yard)	3.24 square inches	(1.8 × 1.8 inches)
Two thirds ($\frac{2}{3}$) size ($\frac{1}{3}$ square yard)	2.88 square inches	(1.2 × 2.4 inches)
One half ($\frac{1}{2}$) size ($\frac{1}{2}$ square yard)	2.16 square inches	(1.8 × 1.2 inches)
One third ($\frac{1}{3}$) size ($\frac{1}{3}$ square yard)	1.44 square inches	(1.2 × 1.2 inches)
One fourth ($\frac{1}{4}$) size ($\frac{1}{4}$ square yard)	1.08 square inches	(.9 × 1.2 inches)

A convenient method for determining the threads per inch consists in dividing the number of threads on each side of the sample analyzed by the respective dimension. If, for example, a standard sample has 120 warp threads on the 2.4 inch side and 72 filling threads on the 1.8 inch side, the number of threads per inch in the warp and filling is found as follows:

$$120 \div 2.4 = 50 \text{ warp threads per inch.}$$

$$72 \div 1.8 = 40 \text{ filling threads per inch.}$$

The cotton count found by the "straight line" method may be reduced to any other system of numbering desired. Following are a number of formulas for such reductions:

Cotton No. × .52 $\frac{1}{2}$	= Woolen Runs.
Cotton No. × 1 $\frac{1}{2}$	= Worsted No.
Cotton No. × 2 $\frac{2}{3}$	= West of England No.
Cotton No. × 2.8	= Linen No. (woolen cuts)
Cotton No. × 3.28	= Yorkshire skeins
Cotton No. × 840	= Yards per pound
Cotton No. × 1.693	= Metric No.
Cotton No. × .846	= French Cotton No.
5315 ÷ Cotton No.	= Deniers (for silk)
305 ÷ Cotton No.	= Drams (for silk)
1000 ÷ Cotton No.	= Grains per 120 yards
417 ÷ Cotton No.	= Grains per 50 yards
167 ÷ Cotton No.	= Grains per 20 yards
17.1 ÷ Cotton No.	= Dundee No. (for jute)

The "straight line" method of cloth analysis is illustrated by the following analysis of a heavy cross rib cloaking fabric composed of cotton, worsted and carded woolen yarn and the weave draft of which is shown at Fig. 1875.

ANALYSIS OF A RIB FACE CLOAKING

Made of cotton, worsted and carded woolen yarn

Counting the threads and weighing the different kinds of yarn in a standard sample of the cloth give the following results :

Warp, 2-ply worsted 61.2 ends per inch, 4.8 grains
 2-ply cotton 30.6 ends per inch, 2. grains
 Filling, 2-ply cotton 18.3 picks per inch, 1. grain
 5-ply cotton 18.3 picks per inch, 5.2 grains
 Single woolen 18.3 picks per inch, 13.6 grains
 Total weight of standard sample, 26.6 grains

The loss of weight after the yarn is spun is estimated as follows: Worsted, 10 per cent; cotton, nothing; carded woolen back filling, 28 per cent.

The warp take-up is estimated at 12 per cent. No change in length of cloth in finishing. Slack of filling in loom, 5 per cent. Loom width, $66\frac{1}{2}$ inches for 55 inches finished. The shrinkage of filling yarn in length is, therefore, 21.4 per cent.

From the foregoing data the weight of the cloth and sizes of the yarn are calculated by the "straight line" method as follows :

Weight of Cloth

$(26.6 \times 55) \div 52.5 = 27.8$ ounces per yard, 55 inches wide
 $840 \div (26.6 \times 55) = .574$ yard, 55 inches wide, to the pound
 These results are verified as follows :
 $27.8 \times .574 = 16$, ounces per pound

Sizes of Warp Yarn

$61.2 \div 4.8 = \text{No. } 12.7$ cotton = $2/38.1$ worsted
 $38.1 \div .88 = 43.3$
 $43.3 \times .90 = 2/39$ worsted, spun yarn
 $30.6 \div 2 = \text{No. } 15.3$ cotton = $2/30.6$ cotton
 $30.6 \div .88 = 2/35$ cotton, spun yarn

Sizes of Filling Yarn

$18.3 \div 1. = \text{No. } 18.3$ cotton = $2/36.6$ cotton
 $36.6 \div .786 = 2/46.5$ cotton filling, spun yarn
 $18.3 \div 5.2 = \text{No. } 3.52$ cotton = $5/17.6$ cotton
 $17.6 \div .786 = 5/22.4$ cotton, spun yarn
 $18.3 \div 13.6 = \text{No. } 1.34$ cotton = $.7$ run woolen
 $.7 \div .786 = .89$
 $.89 \times .72 = .64$ run woolen, spun yarn

Summary of Results

Weight of Cloth : 27.8 ounces per yard, 55 inches wide
.574 yard, 55 inches wide, to the pound

Warp : 61.2 ends per inch 2/39 worsted, spun size
30.6 ends per inch 2/35 cotton, spun size

Filling : 18.3 picks per inch 2/46.5 cotton, spun size
18.3 picks per inch 5/22.4 cotton, spun size
18.3 picks per inch single .64 run carded woolen
yarn, spun size

Set of Finished Cloth : 91.8 ends per inch ; 54.9 picks per inch

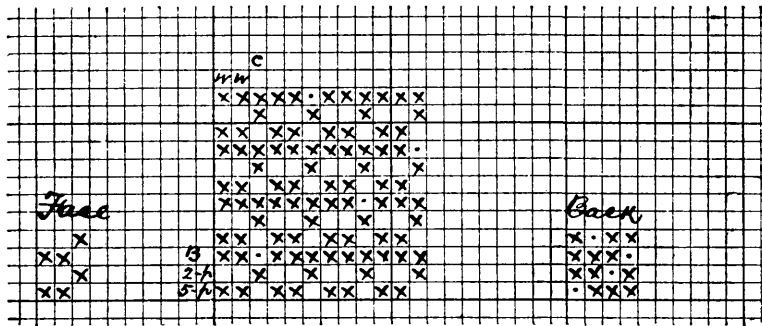


FIG. 1875.

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By MARY SCHENCK WOOLMAN, B.S.

President of the Women's Educational and Industrial Union, Boston, acting head
of the Department of Household Economics, Simmons College, recently
Professor of Domestic Art in Teachers College

AND

ELLEN BEERS MCGOWAN, B.S.

Instructor in Household Arts in Teachers College, Columbia University

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The growing emphasis upon textile study in college departments of home economics or household arts, and the increasing use of the textile industry as teaching material in other departments and other grades of schools, shows a recognition of the part that the textiles are playing in the development of civilization and in our everyday life. Interest in the subject is still further accentuated by the movements now on foot to regulate the social-economic conditions in the textile and clothing industries and to secure standardization and honest labeling of textile products, as is being done for food products by the "pure food laws."

To meet the existing need the authors have attempted to prepare a text suitable for use in college classes or by the public, shorter and more readable than the technical handbooks, yet sufficiently thorough and comprehensive to give a sound grasp of the subject as a whole with so much of the technology as is directly helpful to the consumer and as should be included in general courses in colleges and technical or vocational schools.

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Illustrated, Cloth, 8vo, \$12.00

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By F. W. ATACK, M.Sc.TECH., B.Sc., A.I.C.

Demonstrator in the Chemical Laboratories of the School of Technology,
University of Manchester

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