COMBINING TWO SYSTEMS OF WARP WITH ONE SYSTEM OF FILLING.

Weaves of this class are designed for three purposes, *viz.:*

(1) Using two systems of warp to form with one filling double faced fabrics, such as ribbons, etc.

(2) To increase the bulk of single cloth by means of an extra warp; used in the manufacture of fancy worsteds for men's wear, etc.

(3) To figure by means of an extra warp upon single cloth, such as fancy cotton, worsted or silk dress goods, etc.

Weaves for Double Faced Fabrics.

As mentioned before, these weaves are extensively used in the manufacture of ribbons, etc., mostly in fabrics in which one side has to be of a different color, or stock, than the other.

Such fabrics require a high warp texture, since if combined 1 : 1, and which is most often the case, only one half the number of ends form the face, the other the back. Other combinations as for example 2 Face : 1 Back may be met with, but if so, only in few special instances.

Besides using a different color for either side of the fabric, the material itself may be changed, for instance silk for the face, cotton for the back, or a better quality of one material for the face used in connection with a similar material, but of a lower quality, for the back.

The weaves most frequently used in the construction of these fabrics are our satin weaves, and which we will use for illustrating this system of weave-formation, explaining at the same time its application to the combination of any two weaves we may come in contact with.

Although considering both sides of the fabric as face, technically, as well as practically in the mill, one side must be designated by face, the other by back; *i. e.,* the warp forming the face of the fabric in the loom we will call face warp, vice versa the other, the back warp. As mentioned before, only one system of filling is used in the formation of these weaves, *i. e.,* fabrics.

After having selected the proper weave for face and back, the rule for combining them is:

(*a*) Indicate face and back warp threads on point paper.

(*b*) Place face weave on the warp threads reserved for this purpose on the point paper.

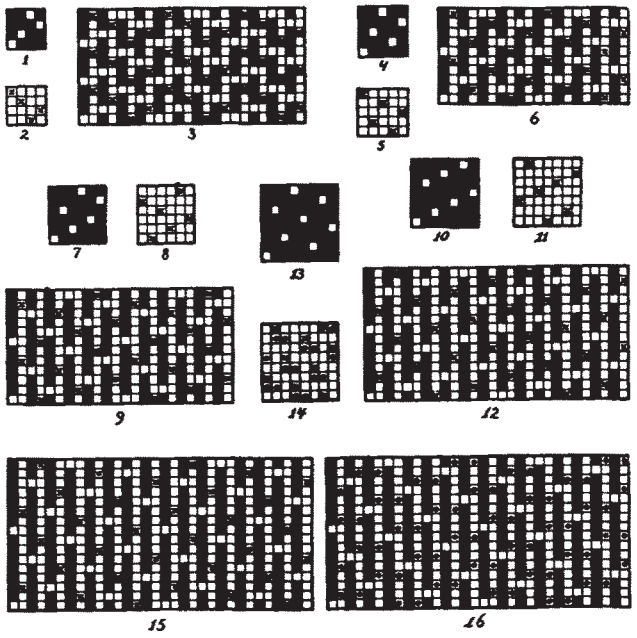
(*c*) Place back weave on the warp-threads reserved for this purpose on the point paper, being careful to place the risers of this back weave so that in every instance they will have a riser of the face warp on either side, in order to hide this place of interlacing of the back warp. Be also sure that every sinker of the face weave has a sinker of the back weave on either side, in order to hide the interlacing of the face warp on the back of the fabric.

Observing these rules will produce a clear face to either side of the fabric.

To illustrate the construction of these fabrics, weaves Figs. 1 to 16 are given, the same comprising what we might call a complete collection of the most frequently met with, double faced satins.

Fig. 1 is the 4-harness broken twill, warp effect, also known as the little crow-foot twill, or the 4-leaf satin, warp effect.

Fig. 2 is the same weave, filling effect.



Weave Fig. 1 is to form one side of the fabric (the face in this instance) and weave Fig. 2 the other side of the fabric (the back in this instance).

Fig. 3 shows the combination of weaves Figs. 1 and 2 into a double faced satin of the smallest repeat possible to be produced, viz: 8 warp-threads and 4 picks. *Full* type (as taken from weave Fig. 1) indicates the interlacing of the face warp and *cross* type (as taken from weave Fig. 2) that of the back warp. Repeat of weave: 8 warp-threads and 4 picks. Three repeats of the weave each way are given.

Fig. 4 is the 5-leaf satin, warp effect.

Fig. 5 is the 5-leaf satin, filling effect.

Fig. 6 is the double faced satin, obtained by combining weaves Figs. 4 and 5; repeat 10 warp-threads and 5 picks.

Fig. 7 is the 6-leaf satin, frequently called the crow foot twill, warp effect.

Fig. 8 is its corresponding filling effect.

Fig. 9 is the double faced satin obtained by combining weaves Figs. 7 and 8; repeat 12 warp-threads and 6 picks.

Fig. 10 is the 7-leaf satin, warp effect.

Fig. 11 is the 7-leaf satin, filling effect.

Fig. 12 is the double faced satin, obtained by combining weaves Figs. 10 and 11; repeat 14 warp-threads and 7 picks.

Fig. 13 is the 8-leaf satin warp effect.

Fig. 14 shows two weaves; considering only *cross* type for risers = 8-leaf satin filling effect, considering only *dot* type for risers = 8-leaf double satin.

Fig. 15 is a double faced satin, obtained by combining weaves Figs. 13 and 14 (take *cross* type in Fig. 14); repeat 16 warp-threads and 8 picks.

Fig. 16 is a modification of Fig. 15, being the double faced satin, obtained by combining weaves Figs. 13 and 14 (take *dot* type in Fig. 14); repeat 16 warp-threads and 8 picks.

Weave Fig. 16, although presenting the same face as weave Fig. 15, will produce a slightly firmer fabric, on account of using a double satin for interlacing the back warp, *i. e.*, using twice the number of interlacings for the back warp in one repeat (8 picks) of the filling.

To Increase Bulk of Fabric by an Extra Warp.

In this instance the extra warp refers strictly speaking to a back warp, and the principle of weave formation more particular to that for men's wear worsteds.

The arrangements of Face and Back warp most frequently used are:

(*A*) 1 end Face : 1 end Back and

(*B*) 2 ends Face : 1 end Back.

(*C*) A combination of a and b, *i. e.*, 1 Face : 1 Back : 2 Face : 1 Back, giving us 3 ends Face in proportion to every 2 ends Back used.

Seldom we find the combination of 3 Face : 1 Back used.

In stitching the back warp to the face fabric it is necessary to observe the following points:

(*a*) Raise back warp over filling, in every instance, between two face threads raising at the same time, so that the latter will cover the stitch. Provided two joining face warp-threads, between which the stitching is to be done, float for more than 2 picks side by side, arrange the point of interlacing of the back warp as near the centre of the float (side by side) of these two face warp-threads. Again, should we deal with any face weave in which in certain places only one warp-thread raises at the time when stitching of the back warp has to be done, we then must raise the back warp-thread near this one end face, either to the right or left.

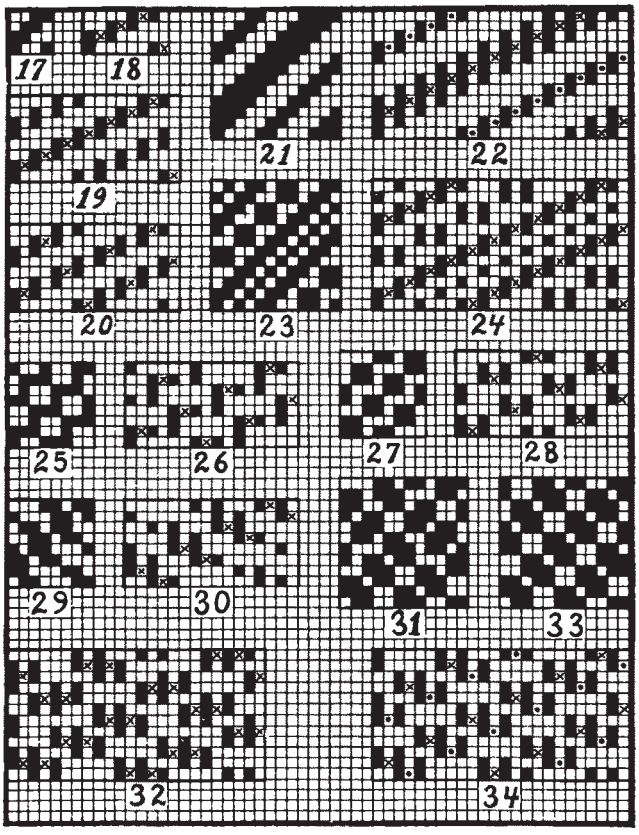
(*b*) Select for the back a weave as regular as possible, so that every warp-thread gets the same amount of binding and therefore tension.

(*c*) If there are more intersections of the face-warp than that of the back warp (in the same number of picks) we must work each warp from a separate beam, on account of the difference in the take-up.

Two warp beams must also be used if the material for the face and back warp is of a different nature, such as wool and cotton or worsted and wool spun yarn, etc.; the number of intersections of face and back-warp in such a case can be equal.

(*d*) If using the arrangement one end face warp to alternate with one end back warp, never use a heavier size of warp yarn for the back warp than you use for the face yarn. This will prevent the back warp from showing upon the face. If using two ends face to alternate with one end back, a proportionally heavier yarn can be used for the back warp. Great care must be exercised in selecting the stock for the face warp and back warp for fabrics requiring fulling during the finishing process. The material in the back warp, which can be of a cheaper quality, must have, as nearly as possible, the same tendency for fulling as the stock which is used in the face warp.

In selecting the weave for the back warp we should be guided by the required appearance of the face in the fabric. For example, a twill weave can be used for the interlacing of the back warp if the face weave is a prominent twill. If the face warp is interlaced into a twill of short repeat, as $\frac{2}{1}$ 3-harness twill, $\frac{2}{2}$ 4-harness twill, etc., etc.; or if the face warp interlaces on the plain weave, or a rib, basket, or granite weave, etc., etc., thus showing small broken-up effects upon the face of the fabric, a satin weave should be used for the interlacing of the back warp. In woolen fabrics, requiring fulling, the back warp, by reason of its lesser amount of intersection as compared with the face warp, is apt to show by impressions the points of intersecting of the back warp on the face cloth. For this reason a twill weave, if used for interlacing the back warp, might possibly show its lines of impressions running over the face of the fabric,



whereas if a satin is used, such impressions, if visible on the face of the fabric, will be distributed.

(*A*) Combination of 1 Face : 1 Back.

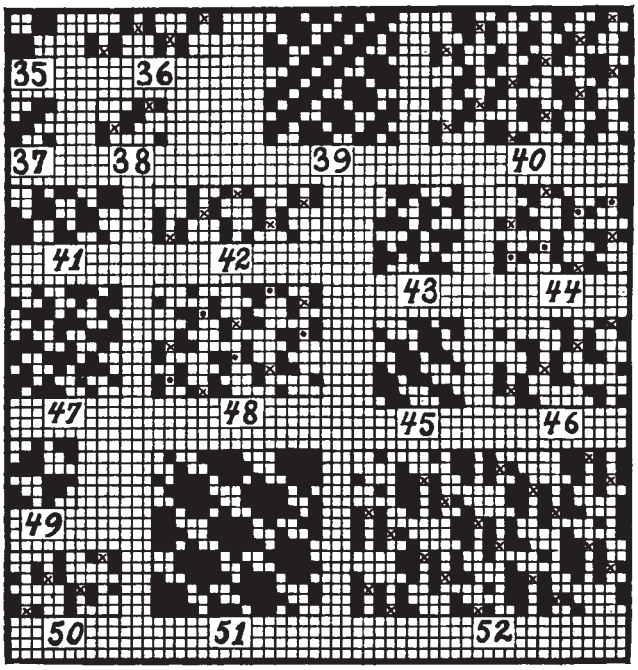
Weaves Figs. 17 to 34 are given to illustrate the subject. In every instance full type means face; the other types used refer to the back warp.

Fig. 17 is the 4-harness even sided, *i. e.*, cassimere twill.

Fig. 18 shows this weave backed with the $\frac{1}{3}$ 4-

harness uneven sided twill, forming what we can call a rather tight interlacing, *i. e.,* liable to produce a somewhat stiff, hard, fabric structure.

Fig. 19 shows the $\frac{1}{7}$ 8-harness twill used for interlacing the back warp in connection with our cassimere twill. In this instance we produce a considerable looser interlacing for the fabric. One repeat of this 8-harness twill calls for two repeats of the face weave, with the result that the stitching of the back warp is done only with one of these two twill lines, in turn showing the one used more prominent on the face in the fabric compared to the other twill line not stitched in. This effect may be desired; again in most cases not, and when weave Fig. 20 will overcome the



trouble. In this instance the 8-harness satin, filling effect, is used for the interlacing of the back warp, and which weave stitches uniformly once in one twill line, once in the other twill line of the two repeats of the cassimere twill required to balance said satin. A smooth face will be the result, one twill line on the face of the fabric showing as prominently as the other.

Fig. 21 is the $\frac{4}{3}\frac{2}{3}$ 12-harness twill, shown arranged with a back warp in Fig. 22. In the latter weave two kinds of interlacing for the back warp are shown, viz.: raise *cross* type only, representing the $\frac{1}{11}$ 12-harness twill; or raise *cross* and *dot* type, representing the $\frac{1}{5}$ 6-harness twill. The latter will produce a more solid interlacing to the fabric, compared to the 12-harness twill. Weave Fig. 22, with either back weave used, repeats on 24 warp-threads and 12 picks.

Fig. 23 shows a fancy twill, repeating on 12 x 12, and Fig. 24 the same weave arranged for a back warp, with two interlacings in every 12 picks, using for this purpose the two *2 up* twill effects in the face weave.

Figs. 25, 27 and 29 show us three examples of popular 8-harness granite weaves; Figs. 26, 28 and 30 illustrate a back warp applied to these three weaves respectively. In either case we stitched the back warp once in every eight picks, using in the first two examples our regular 8-harness satin, and in Fig. 30 an irregular 8-harness satin.

Fig. 31 is a fancy 12-harness granite, shown backed in Fig. 32, stitching every back warp-thread twice in the repeat of 12 picks.

Fig. 33 is a regular constructed 12-harness granite, shown backed in Fig. 34. In the latter weave, *cross* type, considered only, illustrates stitching the back warp with the 12-harness satin, filling effect. *Dot* type shows position for an additional stitching of each back warp-thread, provided a more tightly interlaced fabric is desired.

(*B*) Combination of 2 Face : 1 Back.

The arrangement of face and back warp 1 : 1 as previously explained, produces the most bulk to a fabric, but at the same time its disadvantages. For instance, there are many weaves met with which cannot be backed perfectly by this combination, but will permit the adding of a perfectly stitched back provided the arrangement of 2 : 1 is used. Another item to be taken into consideration is the price of the fabric. As a rule, the appearance of the face is the important item as to the salability of a fabric, and to produce this result a good quality of stock, spun to the proper high count and used with a proper texture must be used for the face warp. In the combination of 1 : 1, face and back warp call for the same, or at least similar yarn, as to quality and count spun, whereas in the combination of 2 Face 1 Back a somewhat heavier count of warp yarn can be used, which means at the same time that a somewhat cheaper grade of stock can be used in said back warp yarn.

A few examples of weaves backed this way will readily explain the subject:

Fig. 35 is the 4-harness basket.

Fig. 36 shows this weave arranged with a back warp; repeat 12 x 4.

Fig. 37 shows the 4-harness cassimere twill and

Fig. 38 the same backed; repeat 6 x 4.

Fig. 39 illustrates a 12-harness fancy twill, and Fig. 40 the same arranged for back warp; repeat 18 x 12. Two places of stitching the back are shown, one only, or both of which may be used, according to texture and counts of yarn used in the construction of the fabric, its finish, as well as the handle of the fabric desired.

Fig. 41 is a 10 x 5 granite, arranged for a back warp in Fig. 42; repeat: 15 warp-threads and 5 picks.

Fig. 43 is an 8 x 8 granite, arranged for a back warp in Fig. 44. Every back warp-thread in this instance is stitched twice (see *cross* and *dot* type) in the repeat of 8 picks of the weave, using every pick once for this purpose. If resulting fabric handles too hard, either the *dot* or the *cross* type may be omitted, *i. e.,* considered as *empty*. Repeat: 12 warp-threads and 8 picks.

Fig. 45 is another 8 x 8 granite, arranged for a back warp in Fig. 46. In this instance, each back

warp-thread is only stitched once in the repeat of the weave, using every other pick for this purpose. Repeat: 12 warp-threads and 8 picks.

Fig. 47 is a 10 x 10 granite; Fig. 48 shows its arrangement for a back warp. Two interlacings of the back warp-threads in each 10 picks are shown, one in *cross* type, the other in *dot* type. Either one, or both places of stitching may be used, in the latter instance using every pick for stitching, in the first instance using every other pick only. Repeat: 15 warp-threads and 10 picks.

(*C*) COMBINATION OF
2 FACE : 1 BACK : 1 FACE : 1 BACK.

Two examples are given to explain this combination of face and back warp.

Fig. 49 is a 6-harness granite, shown arranged for a back warp in Fig. 50. Repeat: 10 warp-threads and 6 picks.

Fig. 51 is a 15 x 15 granite, shown arranged for a back warp in Fig. 52. On account of the large float (over 15 picks) we stitched every back warp-thread twice in 15 picks. Repeat 25 warp-threads and 15 picks.

LAPPET WEAVING.

(*Continued from page 89.*)

Figs. 6 and 7 are reproductions of two *presser* wheel types of ornament. The former repeats on 68 threads and 80 picks, and is produced by two frames working continuously—two colors of whip-thread being used. The pattern of the cloth illustrated in Fig. 7 is complete on 32 threads and 30 picks, and is also

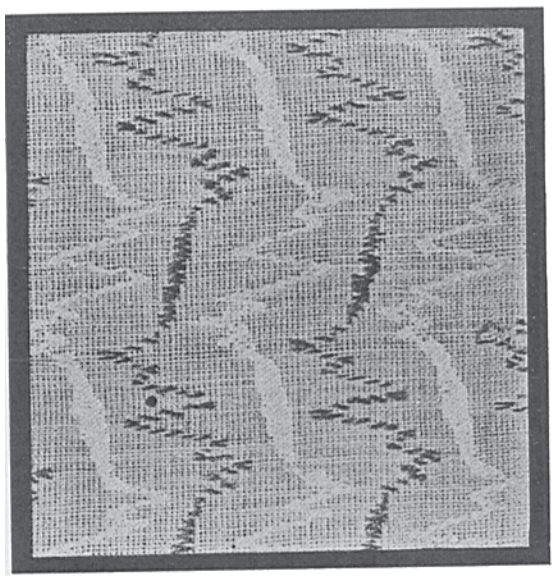


Fig. 6

produced by two frames which work continuously; at intervals, however, the needles of both frames overlap for a short distance in order to produce the heavy or thick portion of the net work.

Figs. 8 and 9 show special types of lappet ornament. The original of Fig. 8 is a 3-frame presser wheel production, one frame being used for the central zigzag stripe, which is of the usual character of lappet ornament. For the open-work side stripes, however, two frames are necessary, both of which rise for 6 picks in succession without moving to right or to left, and thus place the whip-threads on the face

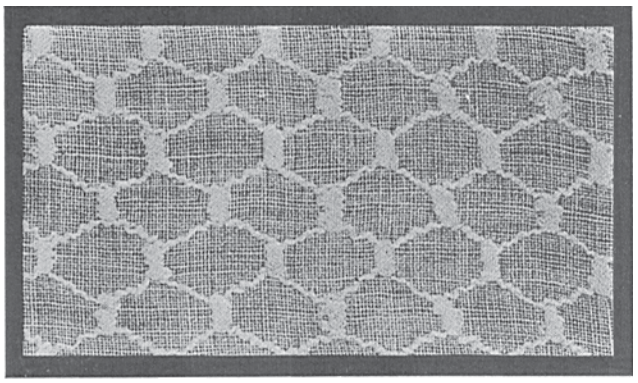


Fig. 7

side over the filling; but between the 6th and 7th picks they change positions, crossing their respective whip-threads to right and to left, under the same 8 threads, and then rise again for 6 successive picks in the new position. Between the 12th and 13th picks they again rise, or rather return, to the original lateral position. The general effect is enhanced, and a leno-like effect obtained by the omission of warp-threads from several splits of the reed at the proper points. The complete pattern repeats on 48 picks, and the open-work part on 12 picks. Although two frames are necessary for the latter effect, it will be seen that only one whip roll will be required for both, since the movement of both whip-threads is exactly alike in extent, although different in direction.

Fig. 9 illustrates a corded stripe effect, complete on 54 picks, and produced with difficulty, but perhaps most readily, by a common wheel arranged for two frames. One frame with shortened teeth, or else a plate with holes, carries the cord threads—3 strands of 2-fold cotton—close up to the under side of the cloth; the other frame carries the real lappet or stitching thread, which is lifted over the filling every pick as usual, but which also passes underneath the cord thread in the interval, and thus binds the latter to the fabric. Two successive stitches are made in the same split of the reed—one on each side of the cord thread—and to enable this to be done, the frame or plate, which controls these threads, is moved alternately to right and to left of this position by the usual common wheel movement, as well as being moved gradually from position to position in order to form the wave-like line. It will be apparent that very accurate spacing of the needles, and careful adjusting of the positions of the respective frames, are necessary in a case like this if satisfactory work is to be obtained. Indeed, in all cases care is essential for it will be seen from the photographical reproduction of the cloth in Fig. 1 that the outline of the whip figure is not nearly so accurate as that in Fig. 2.

Presser wheels are constructed on the same gen-