

fabric sample Fig. 1, is shown outlined by letters of reference *a, b, c, d,* and *e,* in working design Fig. 2.

Having thus reproduced the given portion of the design, and studying the latter, it will be seen that the same shape of figure occurs at the positions lettered *A, B* and *C,* respectively.

Considering *A* as our starting point, we see that at *B* the same figure is turned over from side to side, and in the same way at *C* from top to bottom.

CALCULATING WIDTH OF COMPLETE DESIGN.

Drawing a vertical line at a certain part of the design, see vertical line in the white squares near *A,* *i. e.,* between warp-threads 24 and 25, and duplicating the same through corresponding part of design at *C,* *i. e.,* between warp-threads 128 and 129, see vertical line in the white squares near *C,* will indicate to us half of the repeat of the complete design.

Thus in our example, distance between vertical lines *A* and *B* is

$11 \text{ squares} \times 8 = 88 \times 2 = 176$ warp-threads, repeat of complete design, and what is proven by the point paper design. The latter calls for 176 needles of a 200 Jacquard machine, 352 needles of a 400 Jacquard machine, or 528 needles of a 600 Jacquard machine.

CALCULATING LENGTH OF COMPLETE DESIGN.

Draw a horizontal line at a certain part of the design, see horizontal line on the white squares near *A,* *i. e.,* between picks 8 and 9, and duplicate this line through corresponding part of the design at *B,* *i. e.,* between picks 88 and 89. The distance between these two horizontal lines is half the repeat of the complete design for the filling.

In our example we find distance between horizontal lines *A* and *B* to be

$10 \text{ squares} \times 8 = 80 \times 2 = 160$ picks in one repeat of complete design, *i. e.,* 160 cards are required to be cut on the Royle Piano Machine, and what corresponds with our complete design given.

ASCERTAINING SETTING OF FIGURES IN THE REPEAT.

Points thus far ascertained will now give us all details necessary for ascertaining the principle by which the figures are distributed, considering the complete repeat of the weave.

In our example the basis on which the design has been constructed is, distributing the figures after the 4-harness satin setting, otherwise also known as the 4-harness broken twill, or the small crow-foot twill setting.

In working out the figure on the point paper it is first necessary to mark out the *unit* of the design, which then is repeated three times, either by copying square by square with the brush, or more quickly and better, by the aid of tracing paper and then painting up the figure portions in the regular way.

The required positions are readily obtained by comparing with the pattern and by noting that corresponding parts are always half the repeat (of the complete design) distance from each other in width or in length.

TO INCREASE WEIGHT AND BULK OF FABRIC BY MEANS OF BACK FILLING.

This system of fabric structure is one of the standard methods of producing medium and heavy-weight woolens and worsteds. Two systems of filling (Face and Back Filling) are used in connection with one system of warp.

One of these two systems of filling (the Face Filling) forms with the warp the regular single cloth structure, the other filling (the Back Filling) being hitched, not visible on the face, to the back of this single cloth structure, in turn changing the latter into what is known as a heavy-weight fabric.

The weaves employed for the face of the fabrics, *i. e.,* the single cloth structure, refers to most any one of the various systems of single cloth weaves explained during the last five years in the columns of "Posselt's Textile Journal," those most frequently met with being Plain, Fancy and Figured Twills, Entwining Twills, Granite Weaves, Corkscrews, etc.

For the weave for interlacing the back filling, *i. e.,* the arrangement of hitching the latter (not visible) to the single cloth structure, wherever possible to do so, common twills, or satin weaves are used. The back of the fabric structure is produced by the back filling, the warp not being visible.

The warp-threads, on account of having to resist the strain of weaving, more particularly having to bend around the extra filling, must be composed of a better stock than the filling, and, in addition to this, receive more twist.

The backing must contain only a small amount of twist, so that the bulk of the thread (without considering its additional heavy count) will always be larger than the harder twisted face filling, or the warp. This soft twist of the backing will produce a soft handling fabric, one of the features required in the construction of these fabrics. As will be readily understood, besides using wool for the backing, by-products, like shoddy, mungo, extract, card waste, roving waste, cotton, etc., are extensively used.

In constructing these weaves, we must first deal with the face-weave (interlacing warp and face filling) and this independent of any additional backing, *i. e.,* in the same way as it applies to any weaves for single cloth.

The backing must only form an addition to this single, cloth structure, separately introduced into the face fabric, and for purpose originally intended, unless a special effect, such as *tricot,* etc., is required.

The most frequently used proportions for backing to face filling are: 1 pick face to alternate with 1 pick back, or 2 picks face to alternate with 1 pick back. Seldom do we find 3 picks face to alternate with 1 pick back, or an irregular arrangement as 2 picks face, 1 pick back, 1 pick face, 1 pick back, *i. e.,* 5 picks in repeat of combination, etc., used.

In using the arrangement of 1 pick face to alternate with 1 pick back, be careful to use a count of yarn for the backing not much (if at all) heavier than the count of yarn used for the face pick, since

if using too heavy a count of yarn for the back, compared to that used for the face filling, it will influence the cover of the face of the fabric, *i. e.*, an open, thread bare face appearance in the fabric would be the result, the individual face picks showing distinct, separated, from each other, a feature not desired if dealing with a face finished fabric like worsteds, neither in connection with woolens, where an even, full, smooth, face is desired.

The back filling should not be taken into consideration in the construction of the face fabric, both with reference to weave as well as texture, that is, provided a single cloth structure has to be duplicated in heavy-weights. The same number of picks per inch, as required in the single cloth structure, must be retained for the face picks (per inch) used in the heavy-weight structure. For instance, a single cloth fabric requiring 40 picks per inch, if arranged for a heavy-weight: 1 pick face to alternate with 1 pick back, will then require 80 picks per inch. If the arrangement used is 2 picks face to alternate with 1 pick back, 60 picks per inch have then to be used in the heavy-weight fabric. In either example we supposed that the counts of warp and that of the face filling remain identical in the single cloth to that of the heavy-weight structure.

RULES FOR DESIGNING THESE WEAVES.

The weave for the back filling must be selected without disturbing the face. The back filling in its method of interlacing must pass readily underneath the face pick previously interwoven; also, allow the succeeding face pick to cover any part of the back pick not covered by the previously interwoven face pick.

To produce this result, the warp-threads, used for binding the back filling, must be in the lower shed in the face pick preceding and following the back pick.

Another point which comes under consideration is how, and where, to arrange the stitching of the back pick to the single cloth structure.

If the face-weave contains a far floating filling, the binding of the back picks into the warp-threads should be arranged as nearly as possible below the centre of this float.

To produce good work on the loom, and perfect cloth, every warp-thread in the repeat of the weave should be used for binding the back filling, since if some of the warp-threads should not be used for interlacing the back filling, they will get slack at weaving, and in turn be the cause of poor work on the loom; slack ends will be the cause for shuttles flying out, shuttle-smashes, ends breaking, etc. If compelled to omit some of the warp-threads in the repeat of the weave from interlacing with the back filling, we must be careful to arrange those used and those omitted, in a regular, well distributed manner.

If the weave (or system) for interlacing the backing to the warp is of a short repeat, that is, no large floats of the backing, we must use a soft-twisted back filling. Should we use a very hard-twisted yarn, the possibilities are that the backing will show through on the face.

To use a backing with the least possible twist (yet sufficiently so to avoid tender goods) will also be of advantage during the finishing process, since most fabrics to which the present system of weaves applies, require a soft, well-covered back.

Care must also be exercised in selecting the material for the backing with due consideration of the proportional amount of binding.

The heavier in size the backing is, the earlier will imperfections appear.

In planning the weave for these fabrics indicate first on your point paper which of the picks are face picks and which are back picks, taking their arrangement, whether 1 face: 1 back, or 2 face: 1 back, etc., under consideration. Next place the weave for the face, *i. e.*, the single cloth structure on those picks designated as fancy picks on the weave-plan on the point paper in the usual manner, the same as you would proceed with single cloth, *i. e.*, omitting any of the picks previously indicated as back picks. After that, introduce the weave or the interlacing for the back picks on its respective horizontal rows of squares indicated on point paper for the back filling, being careful to have a sinker previous and following the sinker in the back pick, arranging these sinkers for the back pick after a standard weave, or system of interlacing provided a regular weave cannot be used, *i. e.*, will not stitch perfectly to the single cloth structure. As mentioned before, twills, but more satisfactorily satins will be the weaves to rely on for stitching the back filling to the single cloth structure.

To clearly illustrate the subject, the accompanying plate of 28 weaves in connection with 3 diagrams of fabric sections are given. In every one of the weaves, we indicated the face picks, *i. e.*, the single cloth weave by means of *full* type, the back picks being indicated in every instance by means of *cross* type.

Weave Fig. 1 shows us the 4-harness uneven sided twill, filling effect, used for the single cloth structure. The back filling is interlaced with the warp effect of the same 4-harness twill.

It will be well here to call attention to the fact that although we use a warp-effect weave in every instance for the weave for the back filling, it means filling effect for the back filling, since if considering the back structure of the fabric the bulk of the warp is raised on said back picks, giving in turn the back filling a chance to float on the back of the fabric structure.

Diagram 2 will illustrate the subject, being a section of a fabric interlaced with weave Fig. 1, cut in



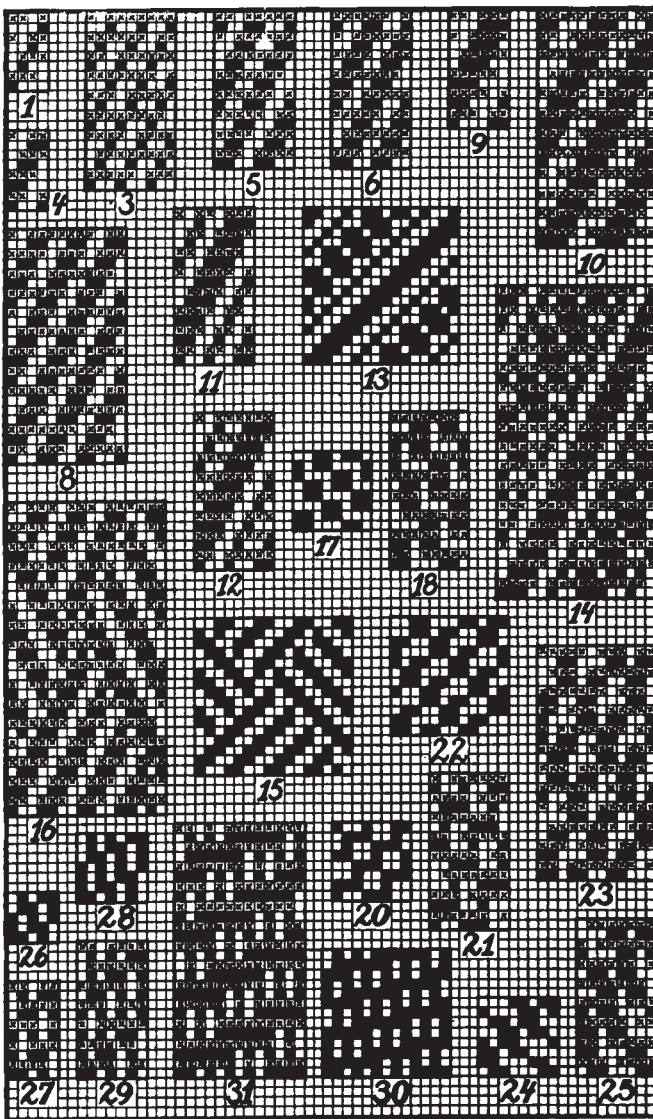
Fig. 2

the direction of the filling. The circles indicated by numerals 1, 2, 3, 4 refer to one repeat of warp-threads in the weave.

a indicates a face pick, floating over warp-threads

1, 2 and 3, and interlacing with warp-thread 4 in the repeat of the weave.

b indicates one of the back picks, being interlaced by warp-thread 2, and floating under warp-threads 1, 3 and 4 in the repeat of the weave.



The diagram clearly shows the 4-harness uneven sided twill, filling effect, used for either side of the fabric structure, producing what we might call a reversible fabric, since the face may be of one color the back of a totally different color.

twill used for interlacing the back. One repeat of the back will call for 2 repeats of the face weave, showing that in this instance we arrange the stitching of the back filling to interlace into every other filling effect line of the face structure, and which will show up every other twill line of the face so much more prominent, since the stitching of the back, although not visible on the face, has a tendency to show on the face of the fabric the effect of the stitching, provided the latter is arranged, as in the present example, to touch every other twill line of the face weave only.

Fig. 6 shows the same face weave as used in the previous example, showing in this instance the 8-leaf satin used for interlacing the back filling.

This will prevent the stitching effect of the backing to affect the face, since in this instance both twill effects in the repeat of the weave are used alternately for stitching, *i. e.*, the stitching is balanced. Repeat of weaves Figs. 5 and 6 is 8 by 16.

Diagram 7 shows a section of the fabric, cut in the direction of the filling, interlaced with weave Fig. 5 or 6; numerals in circles in diagram indicate one repeat of the weave.

a shows a face pick interlacing twice in the repeat of the weave.

b shows a backing pick interlacing once in the repeat of the weave, the diagram clearly demonstrating how the face filling covers the back filling in the formation of the fabric.

Provided weave Fig. 4 produces a fabric of not sufficient bulk, and weave Fig. 5 or 6 too heavy a fabric structure, then a combination of both, as shown in weave Fig. 8, will produce the desired result. The same 4-harness even sided twill is then used for the face, the interlacing of the back filling however being arranged to interlace twice in the repeat of 12 threads in the weave, *i. e.*, float alternately under 3 and 7 warp-threads. The weave used for interlacing the back filling is what we call a 12-harness double satin.

Fig. 9 shows us for the face weave the 6-harness even sided twill used; for interlacing the back filling we used the 6-harness uneven sided twill. Repeat of weave 6 by 12.

Fig. 10 shows us the same face weave as used in connection with the previously given example, used this time in connection with the 12-harness satin for interlacing the back filling; repeat of weave 12 by 24.



Fig. 7

Weave Fig. 3 shows us the 3-harness uneven sided twill, filling effect, used for the face weave. For the back we use the 9-leaf satin; repeat of weave 9 by 18.

Fig. 4 shows us the 4-harness even sided twill for face weave, using the 4-harness uneven sided twill for interlacing the back filling.

Fig. 5 shows us the 4-harness even sided twill used for interlacing the face structure, with the 8-harness

FANCY TWILLS.

Weave Figs. 11 and 12 are given to illustrate the subject, showing in both instances the $\frac{3}{2} \frac{1}{1}$ 8-harness fancy twill used for face weave. In connection with weave Fig. 11 we stitch the back filling twice in the repeat of the weave, using the $\frac{4}{1} \frac{2}{1}$ 8-harness twill for this purpose. Fig. 12 shows the same face weave as used before arranged for a looser fabric structure,

showing in this instance the $\frac{1}{1}$ 8-harness twill used for interlacing the back filling; repeat of weave 8 by 16.



Fig. 19

FIGURED TWILLS.

Fig. 13 shows us an example of a 16-harness figured twill, single cloth structure, the same being shown arranged for interlacing with a back filling (1:1) in Fig. 14. Every backing pick is stitched twice in the repeat of the weave, floating in one instance under 4 warp-threads, in the other instance under 10 warp-threads, *i. e.*, using the $\frac{4}{1}-\frac{10}{1}$ 16-harness twill for interlacing the back filling; repeat of weave 16 by 32.

ENTWINING TWILLS.

Weaves Figs. 15 and 16 are given to illustrate the subject of arranging this system of weaves for backing by an extra filling. The face weave Fig. 15 repeating on 16 by 16 is shown arranged, 1 pick face to alternate with 1 pick back, in weave Fig. 16 and which repeats on 16 by 32.

GRANITE WEAVES.

Four examples of weaves of this kind, arranged for an extra back filling, are given.

Weave Fig. 17, repeating on 8 by 8, is the face weave for weave Fig. 18. The arrangement used is 1 face: 1 back. The interlacing of the back filling is done by means of the 8-leaf satin, which as mentioned before produces a perfect back, and is the weave most extensively used in connection with adding a back to single cloth structures, on account of the well distributed points of stitching; repeat of weave 8 by 16.

Diagram 19 is a section of a fabric interlaced with weave Fig. 18, cut in the direction of the filling, the affair referring with reference to filling *a* to face pick 7 of weave Fig. 18; pick *b* in diagram shows the interlacing of back pick 6 in weave Fig. 18, considering in both instances numerals 1 to 8 in the diagram to refer respectively to warp-threads 1 to 8 in weave Fig. 18.

Weave Figs. 20 and 21 show another 8-harness granite weave arranged with a back filling 1:1; repeat of weave 8 by 16.

Weave Fig. 22 is a 12 by 12 granite, single cloth, and weave Fig. 23 the same weave arranged 1:1 with a back pick; the latter is made to float respectively under 3 and under 7 warp-threads, *i. e.*, the 12-harness double satin is used for stitching the backing to the single cloth structure; repeat of weave 12 by 24.

Weave Fig. 24 shows again an 8 by 8 granite, and Fig. 25 the same arranged 1:1 for a back filling; repeat of weave 8 by 16.

CORKSCREWS.

Fig. 26 shows the common 5-harness corkscrew, and weave Fig. 27 the same arranged 1:1 with back picks; repeat 5 by 10.

Fig. 28 shows the common 7-harness corkscrew, and weave Fig. 29 the same arranged 1:1 for back

picks. The weave for stitching the back to the face structure is the 7-harness satin; repeat of weave 7 by 14.

Weave Fig. 30 shows us our standard 13-harness corkscrew, and weave Fig. 31 the same arranged 1:1 for back filling; repeat of weave 13 by 26.

(To be continued.)

Dyeing of Woolens With Artificial Silk Effect-Threads.

When dyeing woolen fabrics ornamented with threads of artificial silk, a number of methods of working come into consideration, the one chosen depending upon the particular result desired.

As a rule, light shades are dyed from a single bath, whereas medium and dark shades require two baths, *i. e.*, one of an acid character for the dyeing of the wool and the other neutral for the dyeing of the artificial silk.

As to coloring matters to use, this depends upon the results arrived at.

When it is required that the artificial silk should remain white throughout the dyeing of the wool, an acid dyestuff must be used that does not color cellulose, and then the treatment is carried out in one bath.

On the other hand, if it is desired to dye the artificial silk as well as the wool, a dyestuff must be used that colors cotton.

In all cases select a dyestuff to allow of the artificial silk effect-threads showing up in good contrast to the wool, otherwise the object of the designer would not be attained.

For mixed fabrics of wool and artificial silk, dyed in one bath, the latter should be made up of 5 to 10 per cent of sulphate of soda and one per cent of acetic acid. The material is entered into the liquor at a temperature of 30 to 40 deg. C., and while working it is raised gradually to 80 deg. C. The dyeing should occupy in this way about 40 minutes.

For the purpose of shading the wool portion of the fabric, dyes suitable for wool alone may be added to the same bath during the dyeing.

When it is desired to shade the artificial silk present, the bath should be cooled down to about 30 deg. C., when a substantive cotton dyestuff may be added for the purpose, and the manipulation continued for the requisite time at that heat.

When the two-bath method is used, acid dyestuffs applied at the boil give the best results. At first the bath is made up with 15 per cent of sulphate of soda and 4 per cent of sulphuric acid. After dyeing, the material is washed well, and then the artificial silk is dyed in a fresh cold bath made up with a direct cotton dyestuff under the addition of $1\frac{1}{2}$ to 2 per cent of sulphate of soda and 0.05 per cent of GRAN-CARB-SODA. At the end of 40 to 60 minutes the dyeing should be at an end, when the material should be washed and soured with acetic acid.