PLAIN TWILLS AND SATINS; THE FOUNDATION OF TEXTILE DESIGNING.

The purpose of this article is to give a thorough explanation of the foundation of textile designing, i.e., the construction of plain, twills and satins, which weaves in turn form the backbone of textile designing, since most every weave as used in the construction of any kind of textile fabric can be brought back to these three systems of foundation weaves, a feature which readily indicates their importance to any textile manufacturer.

THE PLAIN WEAVE.

This is the most simple weave and can be woven with two harness, of which one or the other alternately is either up or down. Fabrics constructed with this weave, or its derivative weaves, are characterized by means of the lines of interlacings of the threads running warp and filling ways.

Diagram Fig. 1 shows this weave in connection with a portion of a woven fabric. A, indicates the weave, executed on 16 × 12. B shows a corresponding portion of a fabric executed with this weave. Lines C, between A and B, are given to indicate the respective threads in the weave with reference to its corresponding warp threads (as well as picks) in the fabric, a feature which will at once explain the weave to the reader.

An examination of Diagram B will convince the student that this weave produces a very firm interlacing of warp and filling to the fabric, in fact, the most thorough interlacing of warp and filling threads possible; in turn resulting in what we might term the strongest possible fabric to be produced with a certain number of warp threads and picks per inch, as each thread, by reason of its interlacing, supports the others to the utmost. This frequent interlacing of warp and filling will at the same time impart to the fabric a more or less perforated character, said perforations to be regulated according to the counts of yarn used as well as the twist imparted to the yarn; for the reason that the heavier in counts the threads are, the larger the

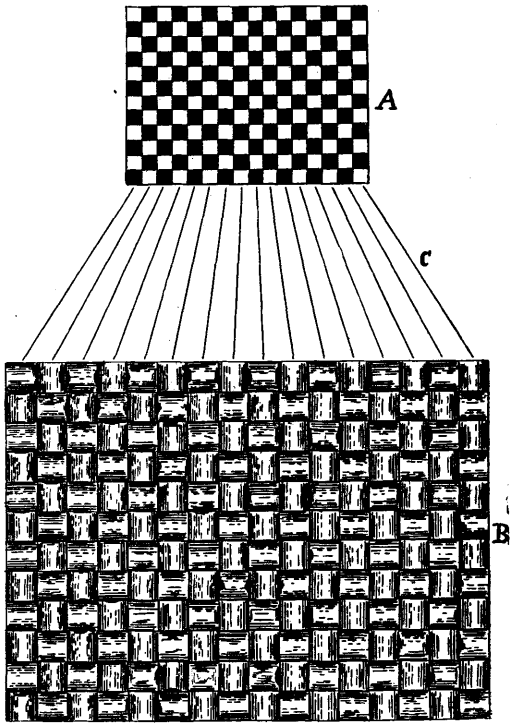


Fig. 1

perforations will be, that the softer the twist the less prominent the perforations; again, the perforations will be reduced by employing a twist for warp and filling which, when interlaced, runs in the same direction.

Fig 2

Fig. 2 shows a section of a fabric interlaced with the plain weave. One of the warp threads (a) is shown in shaded, the other (b) in outline and the filling (c) in full black circles. This description refers to a fabric cut in the direction

of its warp; in referring to fabric cut filling ways,

a = one pick,
b = the other pick of the repeat of the weave, and
c = the warp threads.

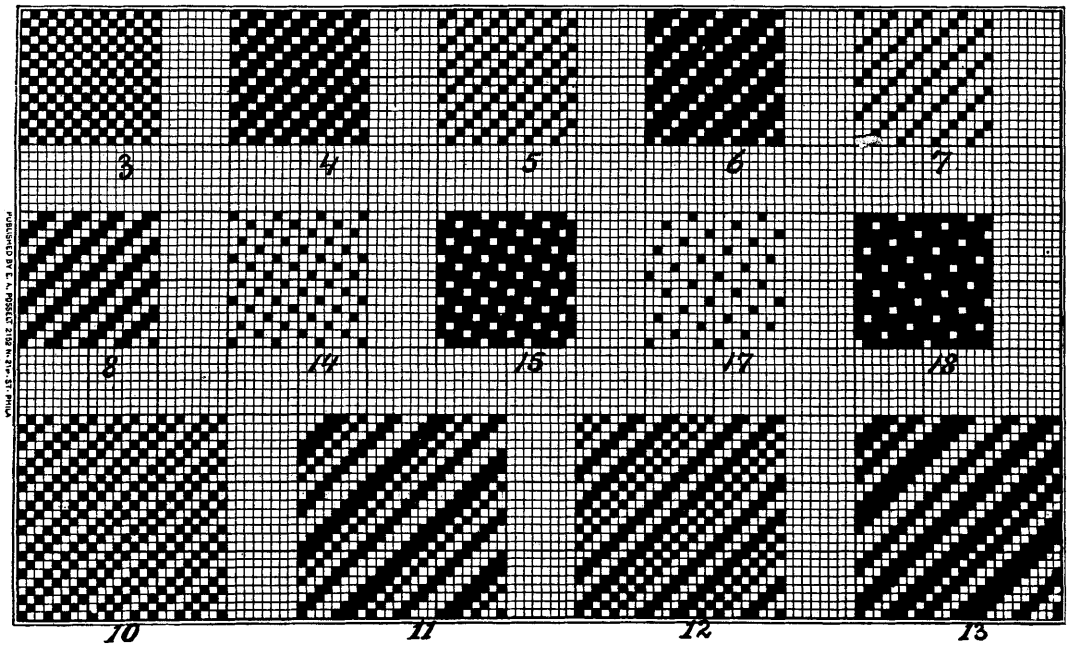
Fig. 3 shows the plain weave executed on point paper.

TWILLS.

In this system of weaves, warp and filling do not interlace alternately as in the system explained before, in single (or one) twill line of interlacing warp and filling gives the fabric a distinct "twill effect pattern," i.e., lines running in a diagonal direction across the face and back of the fabric.

Twills commence with three (3) harness and after this can be designed for any number of harnesses.

Comparing fabrics constructed with twill weaves to those interlaced with plain weave more in particular, we notice that twill weaves permit of the introduction of more material in the structure, in turn producing a closer fabric



effects only the third, fourth, etc., thread being used. Two or more twill line effects (in one repeat of the weave) hold to the same principle, however in some instances carrying plain weaving arranged as a twill with it (for example the $\frac{1}{3}\frac{1}{1}\frac{1}{1}$ 8 harness twill). The characteristic of twills, i.e., their rule of construction is: After indicating the interlacing of the first warp thread or pick throughout the repeat of the weave, every successive pick interlaces correspondingly with its successive warp thread or vice versa.

Thus, if for example, the first warp thread ties in the second pick, the second warp thread must interlace in the third pick, the third warp thread in the fourth pick, and so on until the repeat of the weave is obtained. This manner than would have been the case with the plain weave, for the reason that, as mentioned before, twills only interlace at intervals of two, three, or more threads, and consequently permit the warp and filling threads to lay closer together.

The direction of the twill effect can be either from left to right or vice versa, as required by the nature of the fabric; said twill effect being more prominent to the eye provided the same runs in the same direction as the twist in the warp. As mentioned before, twills can be made for any number of harnesses beginning with three.

THREE HARNESS.

Two twills can be constructed on it, i.e., the $\frac{2}{1}$ and $\frac{1}{2}$ 3 harness twill. The first-mentioned

weave (see Fig. 4) is what we technically term the warp effect three harness twill, i.e., the face of the fabric is by means of this weave produced more particularly by the warp, whereas the three harness twill filling effect (see Fig. 5) is exactly

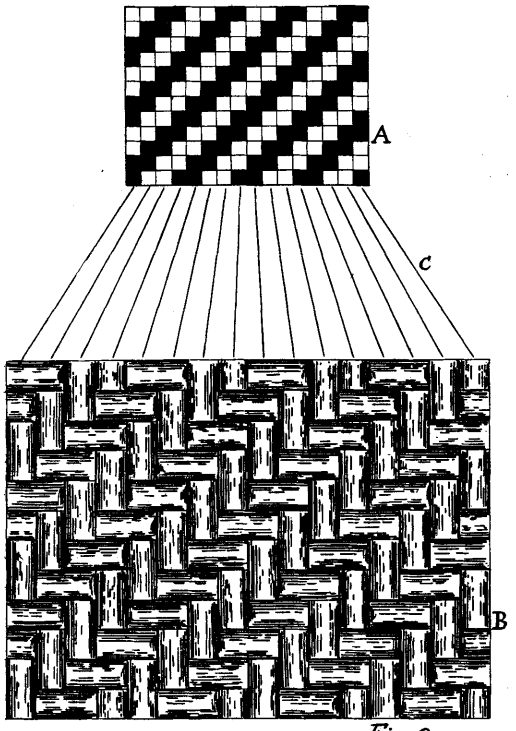


Fig. 9

the reverse of the former weave, i.e., the face of the fabric is more particularly produced by means of the filling. Both weaves are what we technically term uneven-sided twills, by what we mean if one of these two twills is used for the face of the fabric, the back of the structure is produced by the other and vice versa.

FOUR HARNESS.

With this number of harnesses three twills can be designed, viz.: $\frac{3}{1}$ (see Fig. 6) its warp effect, $\frac{1}{3}$ (see Fig. 7) its filling effect, and $\frac{2}{2}$ (see Fig. 8) which weave is as much a warp as filling effect, i.e., warp and filling being balanced on the point paper. $\frac{3}{1}$ and $\frac{1}{3}$ are uneven-sided twills, and $\frac{2}{2}$ is the first even-sided twill, being also frequently (in practical work) designated as the "fancy cassimere twill."

In order to give the reader a thorough understanding of the construction of fabrics interlaced with twill weaves, Diagram Fig. 9 is given, and of which A indicates the weave (to correspond with Fig. 8) and B a corresponding portion of the fabric constructed with this weave. Lines C between Diagram A and B indicate or will guide the eye to the respective warp threads between both diagrams, i.e., the respective warp thread in the weave A and in the fabric B.

In the same manner as we thus constructed weaves on four harness, we find that we can construct on five harness the following weaves: $\frac{4}{1}$, $\frac{1}{4}$, $\frac{3}{2}$, $\frac{2}{3}$, $\frac{1}{1}\frac{1}{2}$ (see Fig. 10, two twill effects in one repeat of weave) and $\frac{1}{1}\frac{1}{1}\frac{2}{}$.

On six harness the following twills can be constructed: $\frac{5}{1}$, $\frac{1}{1}\frac{5}{}$, $\frac{2}{4}$, $\frac{2}{2}\frac{4}{}$, $\frac{3}{3}$, $\frac{1}{1}\frac{1}{1}\frac{3}{}$, $\frac{1}{1}\frac{1}{1}\frac{3}{}$ and $\frac{1}{1}\frac{2}{2}$.

On our plate of weaves we have given three more different twills, viz.: weave Fig. 11 being the $\frac{2}{2}\frac{1}{1}\frac{3}{3}$ 12 harness twill (three twill effects n one repeat of the weave), weave Fig. 12

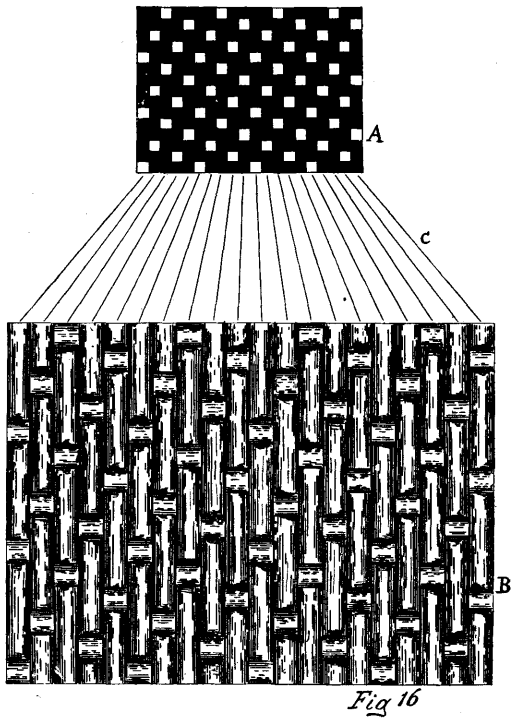


Fig 16

being the $\frac{2}{2}\frac{2}{2}\frac{1}{1}\frac{1}{1}$ 12 harness twill (four twill effects in one repeat of the weave) and weave Fig. 13 being the $\frac{3}{2}\frac{2}{3}\frac{4}{2}\frac{2}{1}\frac{3}{2}$ 24 harness twill (five twill effects in one repeat of the weave).

Having thus given a thorough explanation of

he construction of twills we next come to the construction of

SATIN WEAVES.

Fabrics constructed with these weaves are without the prominent lines identical to twills, i.e., fabrics interlaced with satin weaves are characterized by a more or less smooth face, and are either warp or filling effects.

The principle of constructing these weaves is to arrange the interlacing of warp and filling as much as possible distributed and at the same time as regular as possible, for the fact that the more scattered we can arrange the interlacing of warp and filling, the less visible such places will be to the eye in the fabric. The lowest number of harness for constructing a satin weave is five, after which (with the exception of six) satins can be constructed for any number of harnesses.

Rule for Constructing Satin Weaves. — Divide the number of harness for which you want to design your satin in two prime numbers (technically known as "counters"), adding one of these numbers (counters) to 1 until the repeat of the weave is obtained. This affair will be better explained by means of an example thus: —

Ascertain the five leaf satin. $5 - 2 = 3$ and using 2 as a counter we find: $1 + 2 = 3 + 2 = 5 + 2 = 7$ (or 2, since $7 = 2$ in the second repeat of the weave) $+ 2 = 4 + 2 = 6$ (or 1, since $6 = 1$ in the second repeat of the weave) giving the points for interlacing warp and filling in the weave thus: 1, 3, 5, 2, 4, which means that: —

the 1st warp thread interlaces with the 1st pick,
the 2nd warp thread interlaces with the 3rd pick,
the 3rd warp thread interlaces with the 5th pick,
the 4th warp thread interlaces with the 2nd pick and
the 5th warp thread interlaces with the 4th pick.

Or vice versa: —

the 1st pick interlaces with the 1st warp thread,
the 2nd pick interlaces with the 3rd warp thread,
the 3rd pick interlaces with the 5th warp thread,
the 4th pick interlaces with the 2nd warp thread and
the 5th pick interlaces with the 4th warp thread.

The difference between using either way of counting, will result in a different twill effect for the satin; which to use depending on the fabric under consideration and consequently has nothing to do with the construction of the weave In place of using 2 as a counter, we can use 3, the result being that the same five leaf satin is obtained as before, hence no use to go into detail on the subject.

Fig. 14 on our plate of weaves shows us the regular five leaf satin as thus constructed — filling effect; weave Fig. 15 shows its mate, i.e., the warp effect of the five leaf satin. In order to make the construction of satins, with reference to fabric, more clear, Diagram Fig. 16 is given, showing by means of A, the five leaf satin (warp effect) and by means of B, a portion of a corresponding fabric; lines C between weave and diagram indicating the respective warp threads in weave and fabric. Diagram 16 B also corresponds with the five leaf satin warp effect shown on point paper by means of weave Fig. 15.

On six harness no regular satin can be constructed since 6 cannot be divided into prime numbers, and for which reason an irregular satin must be used which we herewith quote, since this satin is very extensively used by the cotton trade: 1, 3, 5, 2, 6, 4.

On seven harness we again find a regular satin by using either 2, 3, 4 or 5 as counter.

Weave Fig. 17 shows the eight harness satin, filling effect, and weave Fig. 18 its warp effect, both effects being given since the eight harness satin (as well as the five harness satin) are satins extensively used in single as well as double cloth.

By means of diagrams, weaves and their construction given, the reader will readily be able to construct a satin for any number of harnesses required.

LESSON.

In order to compel the student to study the construction of these foundation weaves, the following lesson, to be answered by him, will prove of the greatest value: —

Question 1. Quote rule for constructing twills.
Question 2. What is the lowest number of harness for weaving a twill?
Question 3. Give all twills possible to be made on nine harness, remembering that 42 different nine harness twills can be constructed.

Produce no duplicates, construct each weave with two repeats, warp and filling ways, in order to convince yourself that you have produced a proper weave.

Question 4. Give all the four line effect twills possible for 12 harness.

Question 5. What is the difference between an even-sided and an uneven-sided twill?

Question 6. Produce three even-sided twills for seven (7) harness.

Question 7. What feature is the difference between a twill weave and a satin weave?

Question 8. Quote rule for constructing the seven (7) leaf satin.

Question 9 Construct on point paper, two repeats each way, the seven leaf satin, filling effect, and the six leaf satin, filling effect.

Besides studying the present article for answering these questions as well as mastering the construction of the foundation weaves, the student will find it of the greatest value to procure for this purpose a copy of "Technology of Textile Design," by E. A. Posselt, a feature which will greatly simplify his studies. The book, or circulars of it giving Abstract of Contents and specimen pages, can be obtained from this office.