holder, the former is opened and removed, whereas the flax in its new holder is again passed into operation by being placed in another machine and the other end combed similar to the first explained.

Frequently a double-acting hackling machine is used. Such a machine (for illustration see Fig. 18) is really a combination of two machines in one; hence,

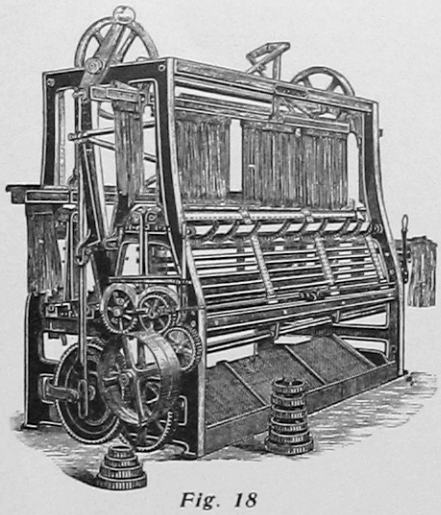


Fig. 18

after each holder has passed on one side, and the flax changed to a new holder, the latter is inserted and run through number two division (or the other side).

When this operation is completed, the flax is taken from the holders and placed in a box, the pieces being laid crosswise, to keep them separate for future processes. Underneath the hackles, boxes or baskets are placed to receive the combings, called tow, which as mentioned before are used for the manufacture of inferior yarns known as tow yarns. Each parcel of hackled flax is called a tipple, and after the box is filled with them, it is removed to another department to undergo the operation of

SORTING.—In the sorting room each box of hackled flax is separated into various qualities. At the same time, the fibre is pulled by the sorter through a coarse hackle called a *ten*, broken, and afterwards cleaned out over a finer hackle called a *switch*. This work, in addition to sorting, requires men who are good hacklers as well as experienced sorters. To supply roughed flax for a hackling machine, requires the work of four roughers, whereas seven sorters (on an average) are required to dress and sort the hackled flax obtained from one machine.

(*To be continued.*)

SHAWL WOOL.

This is the characteristic fine wool of Tibet. There are two varieties: One is a large animal with great horns, called *Rappoo;* the other, smaller with slender horns, is *Tsilloo*. The latter yields the finest wool but they are mixed for ordinary purposes. For shearing, the animals are caught by the tail, their legs tied, the long winter's hair pulled out and the remainder cut away with a broad, flat knife, sharpened with a scythe stone. The operation is carried on most clumsily by the natives, and the skin of the animal frequently much cut.

BROKEN STEEP TWILLS.

In the May, June and July, 1908, issues of POSSELT'S TEXTILE JOURNAL, the different methods observed in constructing 63° steep twills had been given. The object of the present lesson is to show their arrangement for broken effects, and which can be done either *broken warp ways*, or *broken warp and filling ways*.

Broken Warp Ways.

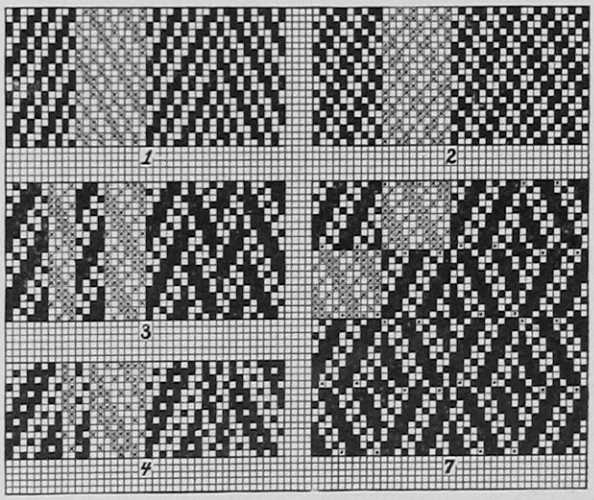
RULE:—Run your steep twill for a certain number of warp threads in one direction; arrange clear break if possible, otherwise as pronounced as possible, and reverse direction of twill for a certain number of warp threads. Continue to draft twill in this manner, alternately from left to right and from right to left until repeat of the broken steep twill is obtained.

The subject will be best explained with a few practical examples.

Weave Fig. 1 shows the $\frac{3}{3}\frac{2}{2}$ 5 by 10, steep twill, arranged thus:

Draft 10 warp threads from left to right
10 warp threads from right to left
20 warp threads repeat of broken steep twill.

The repeat filling ways does not change, it being identical for the broken steep twill with that of its foundation steep twill, as well as the foundation of the regular twill, as used originally in the construction of the steep twill, hence weave Fig. 1 has for its repeat 20 warp threads and 10 picks.



Weave Fig. 2 has for its foundation the $\frac{2}{1}\frac{2}{2}\frac{1}{2}$ 5 by 10, steep twill, arranged thus:—

Draft 10 warp threads from left to right
10 warp threads from right to left

Repeat of broken steep twill: 20 warp threads and 20 picks.

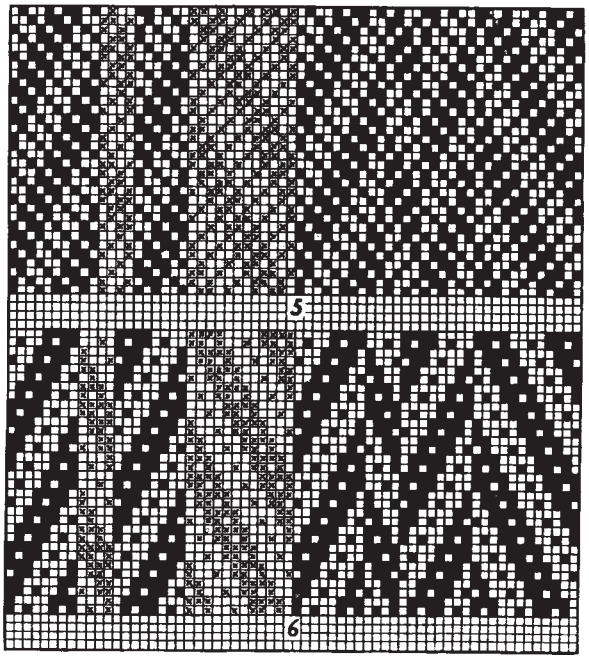
Weave Fig. 3 has for its foundation the $\frac{5}{2}\frac{1}{2}$ 5 by 10, steep twill, arranged thus:—

Draft 6 warp threads from left to right
4 warp threads from right to left
4 warp threads from left to right
6 warp threads from right to left
20 warp threads in repeat of draft.

Two new items present themselves in connection with this weave:

(1) No clear break, between the reversing of the twills, can be done; hence we arranged the break as prominently as possible.

(2) The number of threads drafted for the broken steep twill has been varied, *i. e.,* 6 one way, 4 the other way, 4 one way and 6 the other way. Notice that the number of threads drafted from left to right correspond to the number of threads drafted in the reverse direction, *i. e.,* 10 threads total number of threads drafted in either direction in the repeat of the weave. Drafting in this way an equal number of



threads in the total, for either direction, gives us a repeat for the new weave, when rotation of drafting is completed. When different totals are used, it will take some time before the repeat of the complete weave is obtained, the item depending on the difference as to a common multiple of the two totals, and how this common multiple repeats in the repeat of the foundation steep twill. This however, should not influence the designer, since it simply will refer to a larger fancy draft, no extra harness required.

Weave Fig. 4 has for its foundation the $\frac{3}{1}\frac{3}{3}\frac{1}{3}$ 7 by 14, steep twill, arranged thus:—

Draft 8 warp threads from left to right
2 warp threads from right to left
2 warp threads from left to right
8 warp threads from right to left.

The repeat of the weave is 20 warp threads and 14 picks.

The break between the change of reversing steep twills is perfect. The totals for the direction of draft correspond (10), hence repeat at once when draft, previously quoted, has been completed.

Weave Fig. 5 has for its foundation the $\frac{2}{1}\frac{2}{1}\frac{2}{2}\frac{1}{2}\frac{1}{2}$ 8 by 16, steep twill, arranged thus:—

Draft 10 warp threads from left to right
4 warp threads from right to left
6 warp threads from left to right
12 warp threads from right to left.

The repeat of weave is 32 warp threads and 1 picks.

Weave Fig. 6 has for its foundation weave th $\frac{4}{1}\frac{3}{4}\frac{1}{3}$ 8 by 16, steep twill, arranged thus:—

Draft 8 warp threads from left to right
4 warp threads from right to left
8 warp threads from left to right
12 warp threads from right to left.

The repeat of weave is 32 warp threads and 1 picks.

Broken Warp and Filling Ways.

In connection with these weaves, the characteristi break, as previously arranged warp ways, is duplicate filling ways, the resulting new broken steep twill presenting, in this instance, a somewhat embossed, *i. e.,* lined check effect.

Weave Figs. 7, 8 and 9 will explain the subject.

Weave Fig. 7 has for its foundation the same steep twill as was used in connection with weave Fig. 3, drafting in this instance 10 threads in one direction to alternate with drafting 10 threads in the revers direction, both warp and filling ways, the repeat of the broken steep twill being 20 warp threads and 20 picks.

In connection with these weaves, provided the *cut line* in the direction of the filling shows too pronounced, arrange overlapping of warp threads which otherwise should form a clear break, in this way modifying, *i. e.,* lessening the cut line effect filling ways. The subject has been explained in weave Fig. 7, in connection with *dot* type, and which consider as risers. Such a change will naturally call for a special harness for warp threads thus treated. Possibly four of the dots in the complete repeat of the weave will be sufficient for weakening the cut line effect running filling ways, again all eight may have to be used, again you may change their position, these being items regulated by the texture of the fabric under consideration.

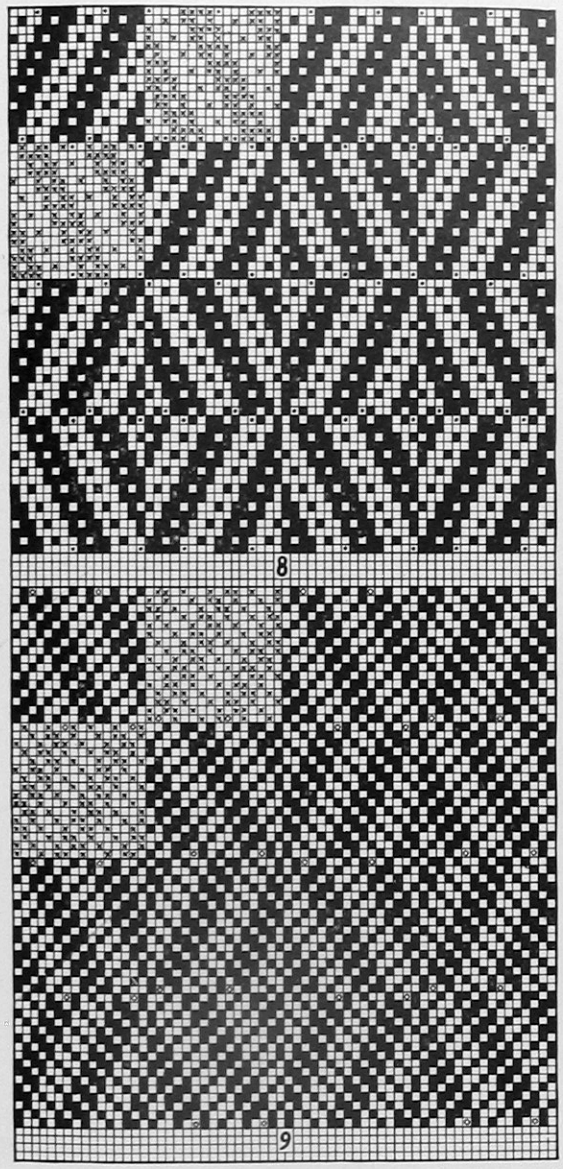
Weave Fig. 8 has for its foundation the same steep twill as was used and explained in connection with weave Fig. 6. The drafting observed is 16 ends in one direction to alternate with 16 ends in the reverse direction, both warp and filling ways. The repeat of the broken twill weave is 32 warp threads and 32 picks.

Dot type means risers, if cut line filling ways shows up prominently; again in place of using 16 of these dots in one repeat of the weave, you may use a less number, or change position.

Weave Fig. 9 has for its foundation the same steep twill as was used in connection with weave Fig. 5. The drafting observed is 16 ends in one direction to alternate with 16 ends drafted in the other direction, both warp and filling ways; the broken twill weave repeating on 32 warp threads and 32 picks.

Circle type indicates sinkers, to be used as such, provided the cut line effect filling ways in the fabric

is too pronounced, it will take warp threads (and which would form a clear break between picks 16, 17 and 32 and 1) in the lower shed.



In this manner, an endless variety of broken steep twills may be designed, although not every 63° steep twill will be suitable for the subject.

THE INFLUENCE OF THE TWIST OF THE YARN UPON THE FABRIC.

(Continued from page 88.)

According to whether a thread is right or left hand twist, the same shows to the observer a different effect, with reference to light and shade. This difference is so much more pronounced as soon as two threads or two series of threads, each of a different direction of twist, are used alternately side by side in the construction of a fabric. At the same time, the twist in a thread influences its joining to the next thread in the fabric, *i. e.*, whether these two threads have the same direction of twist or reverse directions. This explains that the direction of the twist in the yarn, not only influences the appearance of the face of a fabric, but at the same time its construction, features, which we will now take more in detail under consideration.

Fig. 1 shows us two threads of the same count and quality of yarn, side by side, the difference being that one is right hand, the other left hand twist. Placing two such threads parallel, near each other, will show that the direction of the twill in the two threads, if extended, will meet each other at a right angle (see arrows in the illustration, drawn for the purpose of simplifying matter). This explains another subject.

The influence of the twist of the yarn upon a fabric, can be readily demonstrated. For instance, let

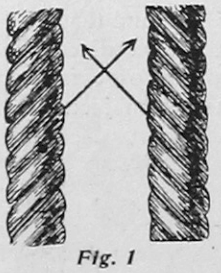


Fig. 1

us take the common plain weave, and use, for example, 10, 20 or more ends of right hand twist to alternate with a corresponding number of ends of left hand twist, of a yarn spun from the same roving, with the same number of turns per inch, and when clear, defined stripes will be seen in the finished fabric, the same as if two different kinds of yarns had been used. This characteristic feature is sometimes made use of by the designer in producing fancy effects in fabrics, more particularly, in the worsted industry. In that instance, provided we deal with piece-dyes, the yarn for one of the twists has then to be slightly stained, in order to guide the dresser, the drawer-in, but more particularly the weaver, so as not to mix threads of one twist with that of the other. The same as with the plain weave, thus referred to, matters hold good with twills, since in this case, one twist produces a more open, and its mate a more closed twill effect. This will explain, that in this way we may produce certain effects in a fabric, stripes or checks, not possible to be obtained in any other way.

The appearance of a fabric is always influenced by the twist of the yarn used in its construction, *i. e.*, whether we use the same twist for warp and filling, or a different twist for either system. Figs. 2^a and 2^b are given to explain the subject. Fig. 2^a shows us a filling used which has the opposite direction of twist from that of the warp, whereas Fig. 2^b shows us a fabric structure where warp and filling have the same direction of twist. Previously we mentioned, that if two threads with opposite twists, are placed parallel near each other, that the direction of the twists run vertically against each other. This then explains, that if threads cross each other at a right angle, *i. e.*, bring