for the gray; repeat 16 times and bunch them together at the ends to keep them separate from the rest.

Next take up the threads dropped and commence again. For the blue and black twist: take up 2, drop 2; take up 2, drop 1; take up 2, repeat 16 times. For the black: take up 2, drop 1, repeat 16 times. The threads left are for the black and white twist. These are tied in first to the spool at the bottom of the creel. The next color is the black, and so on in their regular order as the threads come to hand. The gray can be tied in on the same principle as was described for the plain warp, by taking 120 threads for the three spools on one side of the creel, and the balance, 136, for the four spools on the other side.

In dressing warps that are sized, care must be taken to have them well dried before being wound on the beam, since if damp, they are apt to mildew if allowed to lie on the beams any length of time.

CONSTRUCTION OF SKIP TWILLS.

(*Continued from page 61.*)

(*B*) Using Not Balanced Foundation Twills.

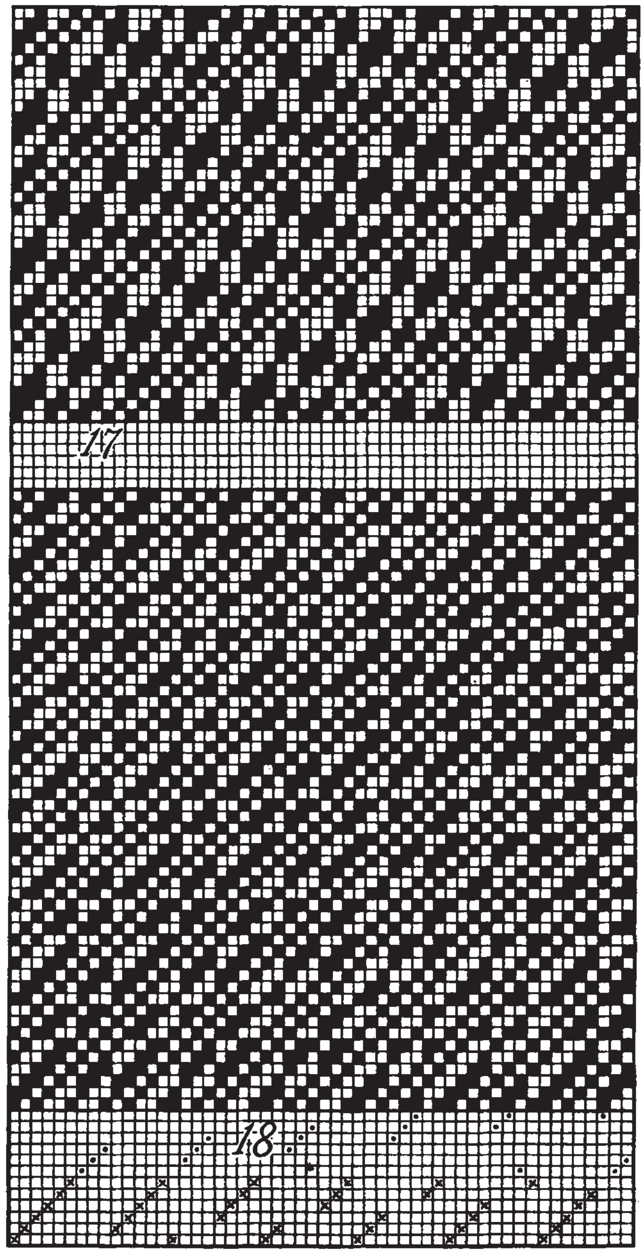
This class of even-sided twills, if used for foundation weaves in the construction of skip twills, as previously referred to, means the necessity of additional harnesses compared to skip twills having balanced even-sided twills for their foundation, for the fact that either arrangement of the even-sided twill requires its own set of harnesses, a feature readily explained in weaves Figs. 17 and 18.

Fig. 17 shows us a skip twill, in which the skipping is done only warp ways. The foundation twill used is the $\frac{3}{3}\frac{1}{1}\frac{2}{2}$ 12-harness even-sided twill and that of its mate, the $\frac{2}{3}\frac{3}{1}\frac{1}{2}$ 12-harness even-sided twill, the drafting observed being: take alternately 3 ends from the first mentioned arrangement and then 2 threads from the second (mate) arrangement, and continue to draft alternately in this way 3 threads from one and 2 threads from the other arrangement of said unbalanced even-sided twill, until the repeat of the skip twill is obtained, and which is 20 warp-threads and 12 picks. In our example we will use a 20-harness straight draw, for the fact that the repeat of the skip twill was obtained previously to using every one of the warp-threads of our two mate arrangements of the foundation twill.

Fig. 18 shows us the application of an unbalanced even-sided twill arranged for a skip twill, skipping warp and filling ways. The foundation twill used is the $\frac{2}{2}\frac{1}{1}$ 6-harness even-sided twill and its mate, the $_2\frac{2}{1}{}^1$ 6-harness even-sided twill. The drafting observed both warp and filling ways is: take 6 ends and arrange break, take 3 ends and arrange break, and continue to alternately take 6 ends of one arrangement and 3 ends from the other arrangement of the weave, arranging breaks when changing from one arrangement to the other, until repeat of the skip twill is obtained, and which in the present instance calls for 54 warp threads and 54 picks for its repeat. Below the weave we give the drawing-in draft necessary to produce this weave on 12-harnesses, shown in two kinds of type to simplify matters, using *cross* type for one arrangement and *dot* type for the mate arrangement, illustrating in this way how to construct a double draw easily understood by the weaver, by using 6 harnesses in sets together for each arrangement of the foundation twill.

How to Calculate the Repeat of a Skip Twill.

For this reason let us consider our last given weave, and where we will notice that the first warp-thread, considering the bottom of the weave, reads 2 up 2 down, etc. Considering the second group of 6 ends drafted, *i. e.*, more particularly warp-thread 10 of our weave, we then find that the 2 up 2 down, etc. inter-



lacing, has been raised one pick higher, *i. e.*, 2 up 2 down, considering warp-thread 1 starts with pick 1, whereas the same interlacing of 2 up 2 down in warp-thread 10 calls for pick 2 of the weave for its start. Since every other warp-threads of the foundation weave follows the same principle of being raised 1 pick every (6 + 3 =) 9 warp-threads, and since the repeat of the foundation twill is 6 warp-threads, we thus find that the complete skip twill has to repeat on 9 (repeat of arrangement of drafting the two groups) × 6 (repeat of the foundation twill) = 54 warp-threads. The same affair holds good also filling ways hence repeat in that direction is also 54 picks.

This calculating of the repeat for a skip twill, after ascertaining the change of interlacing of the first warp-thread in the first repeat of drafting, and the interlacing of the first warp-thread in the second repeat of drafting, as explained in connection with weave Fig. 18, holds good for any skip twill, and will simplify the work for the designer, since by locating the first warp-thread of the second repeat of drafting and comparing it to the first warp-thread of the weave, with reference to the starting of the foundation twill on a certain pick, and taking the repeat of the foundation twill at the same time into consideration, will give the repeat for the complete weave at once.

In connection with our example, we found that every repeat of drafting started one pick higher, and when by multiplying the number of ends in one repeat of arrangement of drafting with the repeat of the foundation twill, the repeat for the skip twill is obtained.

If, for example, the drafting of a skip twill would call for: 6 ends of arrangement one, to alternate with 4 ends taken from arrangement two, of our foundation twill, and when considering warp-thread 11, we would have found that the same has been raised 2 picks compared to the corresponding interlacing of the first warp-thread of the weave, and when then the repeat of the final skip twill will be 10 (repeat of drafting) × (6 repeat of foundation twill ÷ 2 on account of using only every other pick =) 3 = 30 warp-threads and 30 picks.

IMPROVEMENTS TO SHUTTLES AND PICKERS FOR LOOMS ABROAD.

Shuttles.

Figs. 1, 2 and 3 refer to an improvement to shuttles adapted to be threaded either automatically in a loom or by hand. From illustration we see the shuttle provided with a bent metal plate 3, Fig. 3, the inner limb of which is secured in a longitudinal slot 2, Fig. 1 while the outer limb has a gapped eye 5, Fig. 2, and extends below a ledge 1^c. In threading the shuttle, the filling is drawn past a beak 3^c and is then drawn into a slot 7, so that it passes beneath the plate 3 and assumes the shape indicated by the dotted line *a*. The thread finally slips down an inclined slot cut in the body of the shuttle and assumes the practically straight shape indicated by the dotted line *b*.

Another improvement to threading shuttles is shown in Figs. 4 and 5. In this instance the shuttle is provided with a curved threading-slit *f*, a^1 which communicates with the thread-passage *c* and with a recess *g* leading to the shuttle eye *d*. When the thread is drawn into the recess *g*, by way of the slit *f*, a^1 and is broken off, the end of the thread either rebounds through the eye *d* or falls into such a position that it may be readily blown through the eye. The shuttle is provided with a drag-pin d^1 and is formed with an horizontal hole *i* to prevent ballooning.

Figs. 7 and 8 show another improvement lately patented in the construction of shuttles. In the same threading-slits *a*, *b*, are angularly disposed with respect to the thread-passages a^1, *i*, and the recess *e* is inclined to the top of the shuttle, thus producing three spurs *c*, e^1, *j* which prevent unthreading. The slit *b*, which may be undercut, communicates with an horizontal slot *h* leading to the thread-passage *i*. A plug *f* is inserted in the shuttle near the entrance of the slit *a*. A V-shaped staple *k* may be arranged near the base of the slit *b*, and a bent pin *l* may be inserted in the shuttle-eye to take the rub of the weft. The recess *e* may be partly closed by a filling-piece, or a pin c^2 may project from the rear wall of the recess.

In the construction of the shuttle shown in Figs. 9 and 10, the hand-threaded shuttle *b* is provided with a longitudinal bore in line with the point of shuttle peg, penetrated by a narrow vertical slit or groove *c*, a vertical slit or groove *d* inclined to the groove *c*, a vertical bore *f*, a lateral delivery passage *e* entering the longitudinal bore at right-angles and forming the shuttle eye, and a side groove *h* between the groove

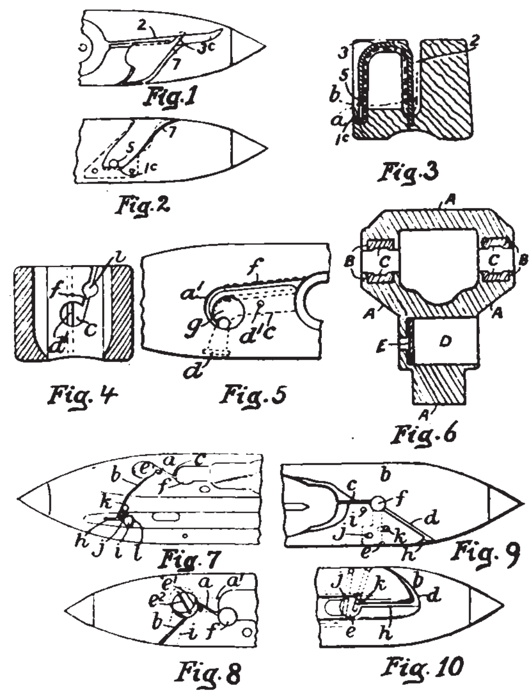


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9 Fig. 10

d and passage *e*. The usual wire curl is replaced by pins *j*, *k*, the latter of which prevents the weft from re-entering the groove *h* after the shuttle has been threaded. One or more drag-pins, such as the pin *i*, may be placed in the respective thread passages to tension the filling.

Loom Picker.

The same is shown in its section in Fig. 6. In its construction cast bronze bearings *B* for the spindle, preferably having grooves *C* for lubricant, are mounted on a rod or sand core and are placed in a mould. Molten aluminium to form the body *A* is then poured into the mould. A recess *D* is provided for resilient material, which is adapted to be removed by a plate *E*.

New Variety of Cotton in Egypt.

Consul General Olney Arnold, of Cairo, notes the development of a fine new variety of Egyptian cotton, which has been named *Pangalo*, having been produced by careful selection on Mr. Pangalo's estate at Mit Ghamr. Mr. Arnold adds that this new cotton, which is brown, and of a most silky texture, has a staple which is probably stronger than any of the other varieties of Egyptian cotton. One of the most characteristic features of the plant is its shortness and the fact that it is covered with bolls, over 100 having been found on a single plant.