required for the warp. For this reason, fabrics which have two systems of weaves combined (for example, 1-inch plain weave to alternate with 2-inch 8-harness satin= 3 inches repeat, 10 repeats in width of fabric) require two beams; one beam to carry the warp for weaving the plain, and one beam for carrying the warp for weaving the satin. This also applies to worsted fabrics made with woolen back-warps, or such where the face-warp interlaces different from that of the back-warp, like for example, a 4-harness twill for the face, and an 8-harness satin for the back, in most instances will call for two beam work on account of the difference in the take-up of the two systems of warp threads. Double cloth, wool or worsted face warp used in connection with a cotton back warp will also call for two beam work.

The amount of shrinkage in warp pile fabrics, for its pile-warp is considerable. It is regulated by the height of pile required, the amount of wires or loops per inch, etc. Such fabrics may often require their pile-warp dressed four to eight times longer than the piece measures woven.

To ascertain the exact percentage of take-up for a fabric needs experience, and can only be mastered by a thorough study of the theory of constructing the different weaves, the nature of the various raw materials, their various methods of preparing the yarn for the loom, and the different processes of finishing.

(To be continued.)

DIAGONALS.

The same are one of the most important system of weaves used in the woolen, worsted, cotton and silk industry. The object aimed at in designing these weaves is to produce more prominent, besides steeper twill effects in the fabric than our regular twills will show.

On account of the steeper twill effect produced, compared with regular twills, Diagonals are also technically called Steep Twills.

As a rule, Diagonals are obtained by means of *warp drafting* from the regular twills; in some instances *filling drafting* is resorted to, but the first mentioned procedure will produce better and quicker results.

To more readily explain the construction of these Diagonal weaves, the accompanying collection of weaves is given; the first three weaves show one repeat, the last two weaves two repeats.

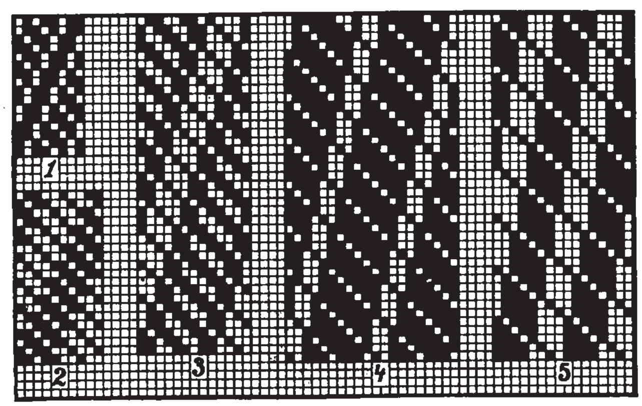
Diagonals are classified in such as showing a steep twill effect of what we technically term 63, 70, 75, and 80 degree grading respectively, by what is understood that the twill effect of the Diagonal considered on the point paper, runs at one or the other of the four degrees quoted. As will be readily understood, this degree of the steep twill effect changes in the fabric from that shown on the point paper. It may become more or less oblique, depending upon the warp and filling texture used in the construction of the fabric, whereas on our regular point paper used for the construction of these weaves, the same is considered as balanced. By this is meant that (considering the point paper design, *i. e.*, warp and filling texture in the fabric balanced) the higher the warp texture to that of the filling, the more oblique the steep twill effect will appear in the fabric, *vice versa*, the lower the filling texture to that of the warp, the less oblique the twill effect will be.

63° Grading Effects.

Two examples of this are given.

Fig. 1 shows us a Diagonal having the $\frac{4}{2}\frac{2}{1}\frac{2}{1}\frac{2}{2}$ 16-harness regular twill for its basis, using every alternate warp-thread only in the formation of the Diagonal, *i. e.*, every uneven number warp-thread of the twill is used, and every even number warp-thread of it is dropped, resulting in a Diagonal repeating on 8 warp-threads and 16 picks. No reduction in the picks takes place.

This Diagonal can also be obtained by filling drafting, *i. e.*, combining the $\frac{2}{1}\frac{2}{1}\frac{1}{1}$ 8-harness twill,



pick for pick, with itself, starting with a different pick in either foundation, thus:

1 6 **2** 7 **3** 8 **4** 1 **5** 2 **6** 3 **7** 4 **8** 5.

Fig. 2 shows us another 63 degree grading effect, the same having the $\frac{2}{1}\frac{2}{1}\frac{2}{1}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{1}$ 20-harness regular twill for its basis, using the same as before, only every other warp-thread in the construction of the Diagonal. Filling Drafting, as explained in the previous example, can be also used for obtaining Diagonal given in Fig. 2. In this instance the $\frac{2}{1}\frac{2}{2}\frac{1}{2}$ 10-harness regular twill is the foundation (double drafting) for Diagonal Fig. 2; repeat 10 warp-threads and 20 picks.

70° Grading Effects.

One example, Fig. 3 will suffice. Regular twills are again the foundation; in this instance it is the $\frac{3}{1}\frac{3}{2}\frac{2}{2}\frac{2}{2}\frac{2}{2}\frac{3}{1}\frac{3}{3}\frac{1}{3}\frac{1}{3}$ 39-harness twill. Every third warp-thread of this regular twill only is used (successively combined) in the formation of the Diagonal, resulting in a repeat for the latter of (39 divided by 3, equals) 13-harness and 39 picks.

75° Grading Effects.

Diagonal Fig. 4 is given to illustrate subject. In this instance only every fourth warp-thread of the foundation (regular) twill only is used in the formation of the Diagonal.

Said foundation twill in this example (see first warp-thread in Diagonal) is a 40-harness regular twill; hence (40 divided by 4, equals) a Diagonal repeating on 10 warp-threads and 40 picks the result.

80° Grading Effects.

Fig. 5 explains this sub-division of Diagonals, having for its basis again a 40-harness (see first warp-thread) regular twill. In this instance we use only every fifth warp-thread of the regular twill in the formation of the Diagonal, what results, in our example, in a repeat of (40 divided by 5, equals) 8 warp-threads and 40 picks for the latter.

The few specimens of Diagonals given will readily explain the great variety of new weaves thus possible to be obtained, in fact the combination of new Diagonals is unlimited.

LAPPET WEAVING.

(Continued from page 61.)

Wheels are marked off or scored concentrically by means of a comb of the same pitch as the loom reed in the case of coarse sets, and of half the pitch in fine

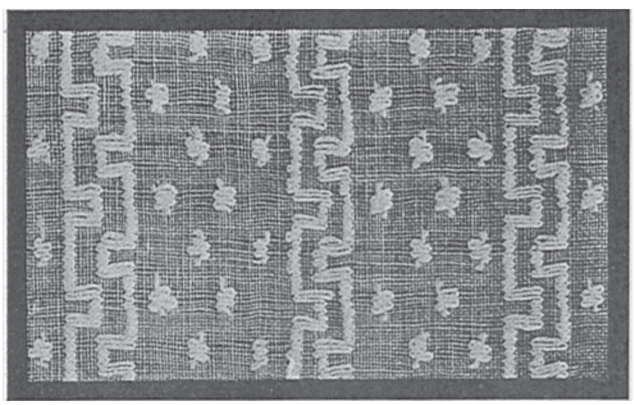


Fig. 1

sets. In the former case, the actual spacing of the splits of the reed is marked directly upon the wheel; in the fine sets every second split only is marked, and a single split is judged by the eye. As a concrete example of lappet wheel dimensions and construction let us consider the *common wheel* specimen illustrated in Fig. 1. It is a 3-frame example—two frames produce the key stripe by working continuously, while the third frame produces the intermittent spot effect.

The pattern repeats on 33 splits and 26 picks, and there are 28 splits per inch in the reed. Since it is a common wheel type there would be only 13 teeth in a repeat, but this would be doubled at 26 teeth in order to get a wheel of workable size; there would be, therefore, two repeats of the pattern cut round the wheel. If we assume a peck of $\frac{1}{4}$" diameter, the arc between two adjacent radial lines must not be less than $\frac{1}{4}$" in length (a shade longer), at a distance equal to the radius of the peck from the innermost circle of the groove:

$$\text{radius} = \frac{\text{circumference}}{2 \times 3.1416} = \frac{26 \text{ teeth} \times 0.25'' \text{ pitch}}{2 \times 3.1416} = 1.035''$$

and 1.035" — 0.125", radius of peck = 0.91" as the distance of the innermost circle of the first groove from the centre of the wheel.

To this distance must be added the space occupied by 6 splits, or $\frac{6}{28}$" for the extreme movements of each

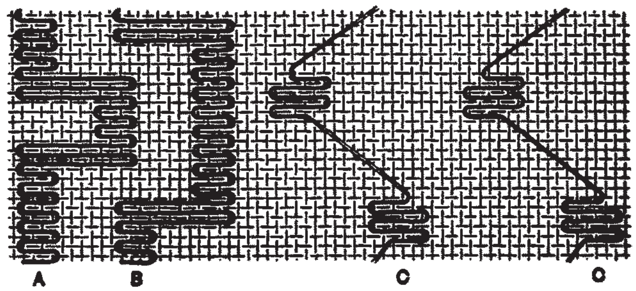


Fig. 2

of the frames 1 and 2; and 9 splits, or $\frac{9}{28}$" for the movement of the third frame—in all, $\frac{6}{28} + \frac{6}{28} + \frac{9}{28} = \frac{21}{28}$ or $\frac{3}{4}$ inch. Further, to each distance of movement should be added the diameter of the peck, and about half an inch of wood should separate the grooves. The total distance from the centre of the wheel to the outer circle of the last groove will therefore be:

$$0.91'' + (\tfrac{6}{28}'' + \tfrac{6}{28}'' + \tfrac{6}{28}'') + (3 \times \tfrac{1}{4}'') + (2 \times \tfrac{1}{2}'') = 3.3 \text{ inches}$$

Another inch would be necessary on the extreme edge of the wheel for strength, and to permit of sufficient wood for cutting the teeth. The minimum radius for such a wheel would therefore be, 3.3 + 1.00 = 4.3".

It is sometimes possible, on account of the configuration of the grooves, as in the case of the key stripe in Fig. 1, to arrange the grooves closer together than is indicated in the above general statement, but such cases can only be considered as they arise.

Fig. 2 shows in a graphic manner the interlacing of one complete repeat of 66 ground-threads and 26 picks of the specimen illustrated in Fig. 1, in addition to the ornament shown in heavy zigzag lines, and developed by the whip-threads or the lappet needle frames. *A*, *B*, and *C*, Fig. 2, indicate respectively the effects obtained by the three different needle frames. When the pattern is detached as demonstrated by effect *C*, the part of the whip-thread which joins the

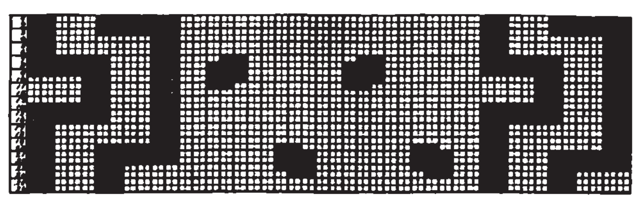


Fig. 3

figures, and shown in outline only, must be removed after the piece leaves the loom.

A more concise and simpler method of indicating the same pattern would be that of placing on design paper the figuring whip-thread only; indeed, there is