The most common type of twill (2:2) is a development of Basket weave. We have pointed it out already, but we may as well repeat this statement. A 2:2 basket (fig.1 A) has all floats of two in warp and weft, and is a soft and weak weave. A 2:2 twill has also floats of 2 both in warp and weft but is much stronger. The only difference between the two is that every other pick of weft in basket has been shifted to the right (in our illustration) by one warp end. This made the fabric stronger and also the weaving much easier. Since we have no more parallel picks of weft, there is also no danger of two shots being twisted in the same shed; therefore the weaving can be done with one shuttle and with normal rhythm.

The common characteristic of all twills is that in their basic, pure form they always produce a diagonal. But they can be woven in a number of ways, so that the diagonal may form any angle with the weft, not necessarily 45° as in fig.1 B. It may be "slow" or "fast" that is with an angle of more or less than 45°. The diagonal may change direction from time to time, or it may do it so often that it will be invisible for all practical purposes.

The number of twills is unlimited, and therefore we could not possibly describe all of them. The best we can do is to classify twills according to their different properties.

The first factor which describes a twill is the length of floats in weft on both sides of the fabric. In industrial weaving the symbol which gives the length and relative position of floats consists of a solid line, which represents a pick of weft, with numbers above and below this line. The numbers indicate the length of floats. The numbers above the line are floats on the face, and the numbers below the line are floats on the back of the fabric. Thus \( \frac{2}{2} \) means: "over two and under two" (warp ends). There is one float of two on the face and one float of two on the back.
A twill $\frac{1}{3} \frac{2}{1}$ means: "over three under one over one under two". There will be a float of three and a tie (single) on the face, and a float of two and a tie on the back.

In handweaving we use simpler notation: 2:2, or 3:1:1:2, but it means the same. Incidentally the sum of all numbers gives the number of shafts on which this twill can be woven.

Twills may have one diagonal (2:2) or more; for instance 3:1:1:2 twill has two diagonals on each side of the fabric.

Twills may be "balanced", that is all floats on both sides of the fabric are of the same length: 2:2, 3:3, 4:4.

A special class of twills is of the 1:N, or N:1 type."N" stands for any number at all. For instance: 1:2, 2:1, 1:3, 3:1, 1:4, 4:1, 1:5, 5:1, 1:6, 6:1, 1:7, 7:1. Higher twills of this type (higher than 1:3) may be used to weave satins.

Twills which produce diagonals all across the fabric are called "biased". We may have right-hand or left-hand diagonals. Left-hand (LH) diagonal starts in the left upper corner of a drow-dawn, and right-hand (RH) diagonal in the right upper corner. A fabric which has a RH diagonal on the face, will have a LH diagonal on the back.

Reversible twills have both sides of the fabric identical except for the direction of the diagonal. All balanced twills are reversible, and all 1:N, or N:1 twill are not. A 3:1:1:2 twill is not reversible, but 3:1:1:3 twill is.

Warp-face twills have no floats in weft on the face. For instance: 1:N, 1:3:1:2, 1:4:1:2. If the twill is woven as 50:50 fabric (the same number of ends as picks per inch) then the back of a warp-face twill is a Weft-face twill. If the fabric has more ends than picks per inch then the face will be a warp-face twill, but the back should not be called "weft-face".

For true Weft-face twills the number of picks per inch should be even to, or higher than the number of ends per inch, and then the twills will be: N:1, 2:1:3:1, 2:1:4:1, etc.

Fig.2 shows several twills mentioned above. When comparing the sequence of floats in weft with the numerical notation of the twill we must realize that 3:1:1:2 twill is the same as 1:2:3:1;
3:1:1:3 - the same as 1:3:3:1, 1:4:1:2 - the same as 1:2:1:4 etc. It all depends on which particular float in weft we have selected as the beginning of the repeat, and whether we read from the left, or from the right.

A

B

C

D

E

F

G

Fig. 2

All twills in fig. 2 are biased. "A" is LH 2:2 (balanced); "B" - RH 2:2 (balanced); "C" - LH 3:1 (weft-face); "D" - LH 3:3 (balanced); "E" - RH 3:1:1:2 (not reversible); "F" - LH 3:1:1:3 (reversible); "G" - RH 1:4:1:2 (warp-face).

One may have doubts at this point whether all this terminology is really necessary. What does it matter whether the dia-
gonal is LH or RH, whether the twill is reversible or not. It matters in one case: when we make yardage for clothing. If we want to make a coat and have a fabric which is not reversible, then we shall find out that the tailoring is impossible, because the diagonal will run always in the same direction, regardless of how we turn the fabric. We cannot turn it by 90° because that would substitute warp for weft, and the two have different properties (like shrinkage etc), even if they are of the same yarn. Thus goods sold by the yard must be made in reversible twills only. When weaving just a length for one article in not reversible twill we must make half of it with LH and another half with RH diagonal. All in all it is better to avoid not reversible twills in this type of work.

Here is a list of twills up to 8 shafts:


When selecting twills for a higher number of shafts than 4, one should beware of "false" twills, even if they look all right in a numerical formula. Thus 1:2:1:2 is the same as 1:2 (3 shafts instead of 6); 1:3:1:3 = 1:3; 2:2:2:2 = 2:2. We may use these twills exceptionally to avoid overcrowding of shafts, particularly with warp-face fabrics woven in sticky wool. Twill 1:2:1:2 has one superiority over 1:2 - it can produce tabby, which may be of importance when we use tabby and twill in the same piece of weaving.

In the next article we shall take up twills which do not produce continuous diagonals, that is are not biased.

We shall discuss practical problems of weaving twills at the end of this series, and then we shall have to spend some time on projects for yardage in general whether in basket or twill.

It would help if the Reader took the above list of twills and made draw-downs of all of them. The threading and braiding are always straight, and the tie-up must be found from the draw-down.

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