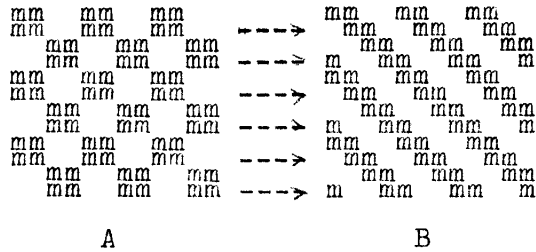# TWILLS - 1

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.

```
mm  mm  mm          mm  mm  mm
mm  mm  mm   ---->   mm  mm  mm
  mm  mm  mm         m  mm  mm  m
  mm  mm  mm   ---->
mm  mm  mm          mm  mm  mm
mm  mm  mm   ---->   mm  mm  mm
  mm  mm  mm         m  mm  mm  m
  mm  mm  mm   ---->
mm  mm  mm          mm  mm  mm
mm  mm  mm   ---->   mm  mm  mm
  mm  mm  mm         m  mm  mm  m
  mm  mm  mm   ---->

     A                   B
         Fig.1
```

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 $\dfrac{1\quad 2}{3\quad 1}$ 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 <u>the sum of all numbers gives
the number of shafts on which this twill can be woven.</u>

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 <u>"balanced"</u>, 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 <u>1:N, or N:1 type</u>. "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 <u>"biased"</u>. 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 dia-
gonal on the back.

<u>Reversible</u> 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.

<u>Warp-face</u> 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 <u>Weft-face</u> 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 realise 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,
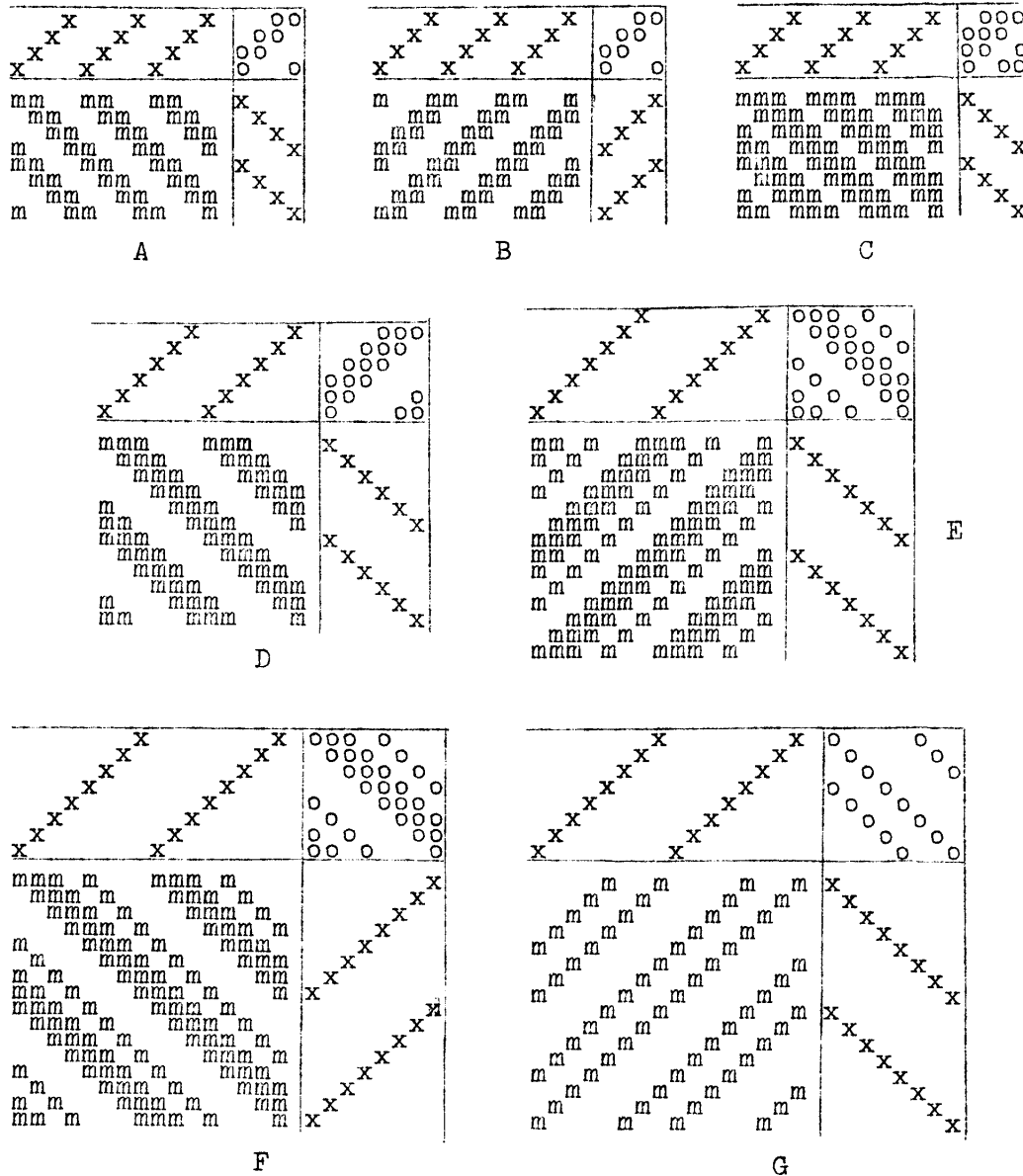or from the right.

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 termi-
nology 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 substitue 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 rever-
sible twills in this type of work.

Here is a list of twills up to 8 shafts:

Reversible: 2:2, 3:3, 1:2:2:1, 4:4, 1:3:3:1, 1:1:2:2:1:1,
1:1:2:1:1:2.

Not reversible: 1:2, 1:3, 1:4, 2:3, 1:1:2:1, 1:6, 2:5, 3:4,
1:1:4:1, 1:2:1:3, 1:2:3:1, 1:1:1:2:1:1, 1:7, 2:6,
3:5, 1:1:1:5, 1:1:2:4, 1:2:1:4, 1:2:2:3, 1:2:3:2,
1:1:1:3:1:1, 1:1:1:2:1:2.

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 in-
stead 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 super-
iority 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 treadling are
always straight, and the tie-up must be found from the draw-down.

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