FORETHOUGHT IN FIGURING

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Forethought in figuring a fabric ahead of time, planning the warp and weft, knowing just how much of each you will need, how many yards of this particular thread is contained in a pound and therefore what part of a pound you will need to buy — is both a time saver and a money saver. To guess at amounts and either run short or have a surplus is not economy. Being ahead of the game and conscious of the adequacy of one's raw materials gives great satisfaction and enjoyment. Possibly you have our thread chart which contains the material for this information, but in addition it is wise for the weaver to make yarn calculations himself. After all, units of measure have been established as guides to go by.

A short history of our measurements, as adopted in the United States from England, may afford gratifying amusement to the weaver undergoing his first experience in figuring yardage, the points mentioned being taken from a folio on the subject published by Henry Ford.

In 1324 Edward II decreed that three barley corns taken from the center of the ear, placed end to end, equalled an Inch—a Foot ranged from 9¾ inches to 19 inches. A "Cubit" was the first known measurement, and this was about 20 inches, the length of the forearm from point of elbow to end of middle finger. The "Digit" was the breadth of a finger, from .72 to .75 inch. The "Palm" was the width across an open hand at base of fingers, about 3 inches. In the 16th century the lawful "Rod" was the length of

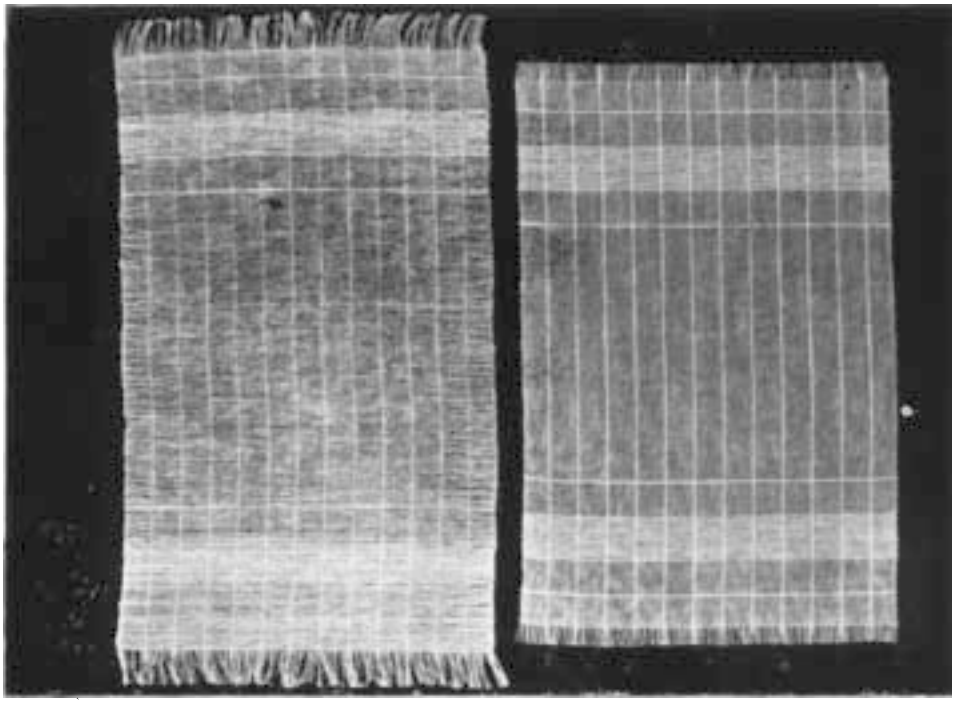
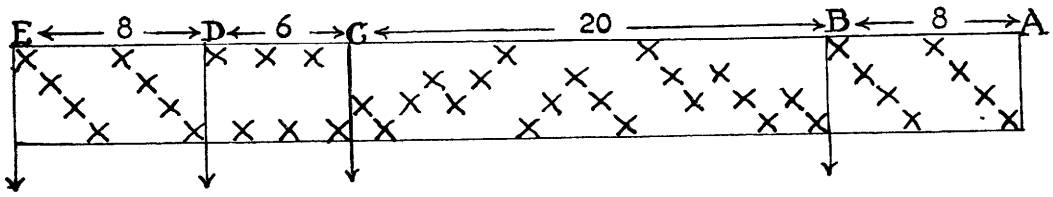


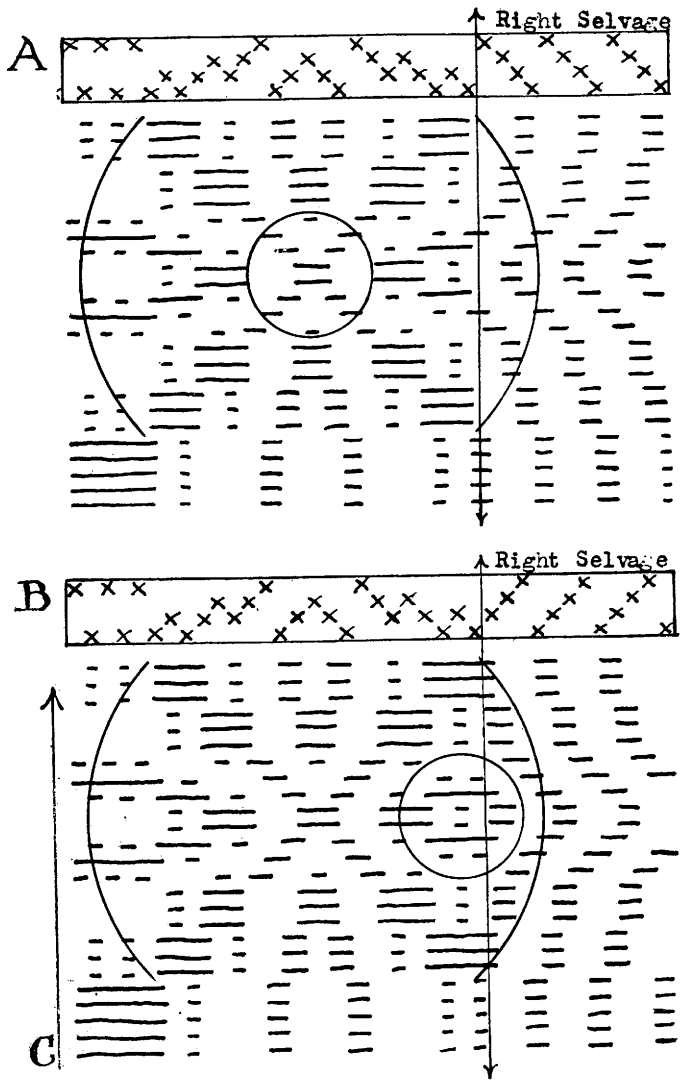
Figure III. This photo shows two doilies made with exactly the same kind of thread and the same design. In the lower one, the warp was set too far apart and resulted in a texture that slipped apart; in the upper one the warp is perfectly set and the texture resulting adds beauty and strength to the design.

FIGURE I. THREAD PLAN FOR HONEYSUCKLE PATTERN •



Right Selvage, A-B------ 8 threads
1st Motif: B-C ------- 20 "
2d Motif: C-D ------- 6 "
Left Selvage: D-E----- 8 "

FIGURE II. ILLUSTRATING SELVAGES RUNNING IN SAME DIRECTION AS PATTERN, A, AND IN OPPOSITE DIRECTION, B.



Planning Selvage

With selvage planned at the sides of a draft the woven edge will have the pleasing effect shown at A and B. The selvage at A travels in the same direction as the first figure of the pattern, and blends into it nicely, as shown. Here the center of the first motif is enclosed in small circle, and the edge of the motif in the large circle. The selvage serves to set it off.

At B, the direction of the selvage opposes that of the first motif and the result is rather confusing, for the opposition of the selvage with the first motif makes a little diamond, shown by small circle at B, which interferes with the first motif and rather destroys its effect. In planning selvages, therefore, make the selvage travel in the same direction as the first figure.

One can readily see what would happen if the draft ended at the finish of a repeat, as shown at C. The woven edge would be rough and unattractive. One therefore plans one's draft to make a perfect balance at right and left, with a bit of selvage for smoothness at the edge.

the left foot of 16 men lined up as they left church on Sunday morning. In Britain the Roman Foot became merged with the Anglo-Saxon measures which also contained the Fathom or length across the two arms outstretched, equal to 4 cubits or 6 feet. Under the Norman kings, half-a-fathom or one arm outstretched from the middle of the body was found to be a more convenient length, particularly for measuring cloth, the most important trade. Thus, the "Yard" of 3 feet arose, and a bronze yard bar was kept as the standard of Reference in the King's Exchequer. Henry I decreed the distance from the point of his nose to the end of his thumb was the lawful yard.

Very few of these measures have survived in exactly the same amounts as they were at the start, but the new standards have been guided more or less by them. The interesting point is that practically all of our units of measure started by distances taken from parts of the human body, often of a royal personage. Our thread units go back to the same origin. The size of a "Skein" was 54 inches, a measure figured from the length of the forearm of one of the English kings, this probably being double the length, or twice around as we wind yarn about our forearms today.

How To Figure Yardage and Sizes of Threads

Cottons

Yarn Size. The sizes of cotton range from the lower numbers for the coarse yarns, such as Nos. 3, 5, 10, etc. to the higher numbers for the fine yarns, such as Nos. 20, 30, 40, etc. A "Unit" or "Hank" of cotton consists of 840 yards. This is purely an arbitrary ruling and originates from the ancient English system. The unit of measure was a "Knot" or 60 yards, and there were 14 knots in one skein or 840 yards. The size of the "Skein" was 54 inches. If this 840 yards is reduced to inches we find that there are 560 rounds in a 54″ skein to make 840 yards of thread.

The size of yarn, such as yarn size No. 20, was figured according to the number of hanks of it necessary to make a pound. For instance, in the case of Size No. 20, it takes 20 of the 840-yd. hanks to make a pound, or 16,800 yards. This particular number or size yarn has a certain diameter of thickness, and a variation to a less or greater thickness would produce more or less yardage per pound. So we grow accustomed to this size as representing a certain definite diameter, and can usually tell the size by sight or feeling between thumb and forefinger. In the mills they test size by taking from 8 to 12 strands of the yarn about 3 inches long, twisting them hard together between the thumb and finger, and comparing them to a bunch of threads of the next size yarn treated in the same way. They do this because they know that in some spun threads there is a variation in size and one cannot be sure by taking a single yard. The variation along the length is greater in silks, wools and linens than in cottons, however. Size, then, refers to the diameter or thickness of the strand of thread, and the number of yards of it necessary to make a pound.

The "PLY" of a Yarn. "Singles" yarn refers to thread which is composed of only a single continuous length of fibers, and constituting only one strand in cross section. There is very little twist to "singles", just enough to hold the fibers together. This type of yarn is generally best suited for use as weft, because the fibers tend to pull apart when subjected to any strain. However, when two of these strands are twisted together, we have what we call a two-strand or two-ply yarn. Likewise three strands may be twisted together to form a three-ply; four to form a four-ply yarn, etc. Yarns may have any number of strands and the thread companies go as high as 12 to 16 strands in making multiple

yarns such as candle-wicking. Our everyday sewing thread is a "6-cord", a strong tightly twisted sewing thread composed of six strands. The "ply" of a yarn, therefore, refers to the number of strands found in a cross-section of a piece of that yarn.

Yards per Pound. We are now ready to determine the number of yards per pound in any given size yarn. It was stated above that it took 16,800 yards of Size No. 20, "singles" to make a pound, or 20 units of 840 yards each. In the case of 20/2 ply yarn, where two No. 20 "singles" strands are twisted together, we find a yarn double the size of 20/1 or "singles". Obviously then, there would be half as many yards per pound to this yarn. We therefore divide 16,800 yards by 2, and find that 20/2 ply cotton has 8,400 yards per pound. In the same way, 20/3 ply yarn would be three times the size of 20/1, and we divide 16,800 by 3 to find that 20/3 ply cotton has 5,600 yards per pound. The rule we have discovered is this: to find the number of yards per pound for any size cotton yarn, multiply the number of yards in one unit, or 840 yards, by the count or size of the yarn in question, then divide by the ply. Here are a few examples:

For 20/2 ply: 840 times 20 equals 16,800; divided by 2 equals ..... 8,400 yards per lb.

For 30/2 ply: 840 times 30 equals 25,200; divided by 2 equals .....12,600 yards per lb.

For 30/3 ply: 840 times 30 equals 25,200; divided by 3 equals ..... 8,400 yards per lb.

For 24/3 ply: 840 times 24 equals 20,160; divided by 3 equals ..... 6,720 yards per lb.

Although we figure on the count of 840 yards per unit, they say at the mills that this yardage is lessened when it comes to the actual yardage count in pounds of thread purchased. The exact amount of 840 yards does apply to 20 "singles", but when any twisted yarn whatever is figured, the twist takes up some of the yardage. About 40 of the 840 yards in a skein are taken up by the twisting of the strands of the yarns as 20/2, 30/2, etc. Therefore in figuring yardage always allow a margin.

Wools

For wools and worsteds the length of skein and count of yarn is the same as for cotton, but the count is very seldom used in retailing the yarns in small lots. The diameter of the skein varies but should be 54 inches. European worsteds are generally put up on a 72 inch reel. But wool of any kind is so subject to shrinkage in treatment, that it is almost impossible to rely upon the length of a set skein and the consequent standard count of the yarn.

Linens

A "unit" or hank of linen consists of 300 yards. Again this is an arbitrary ruling but we must accept it, and figure on quite a different basis from that used for cotton. However, the rule is the same. For obtaining the number of yards per pound, multiply the number of yards in one unit or 300 yards, by the count or size of the yarn in question, then divide by the ply. For instance:

For 40/2 ply linen: 300 times 40 equals 12,000; divided by 2 equals .....6,000 yds. per lb.

For 20/3 ply linen: 300 times 20 equals 6,000; divided by 3 equals .....2,000 yds. per lb.

How to Figure a Warp

Planning the Warp. The following questions are important to decide upon when purchasing your warp.

1. What size and ply thread is needed? (No. 20/2 cotton, means size No. 20, 2-ply)
2. How many threads per inch, and what dent reed will you use?
3. How wide do you plan to set your warp? (Always allow at least 1 inch per foot for shrinkage)
4. What length warp do you wish?

Estimating Amount of Warp to Buy. With the above information we can easily find out how much warp in pounds to buy. For instance; taking a sample warp,—

1. Size thread: 12/3 toweling warp.
2. Threads per inch: 20.
3. Width in reed: 20 inches.
4. Length of warp: 25 yds.

To get the total number of threads across the warp, multiply the number per inch, or 20, by the total width, 20 inches, giving 400 threads across warp. If these threads of the warp are to be 25 yds. long, multiply 400 by 25, to get total number of yards in warp, or 10,000 yards. Now since there are 6,720 yds. in a pound of 12/3 ply, find out how many pounds it will take to furnish 10,000 yds. of warp by dividing 10,000 by 6,720. The result is 1.48 times, or nearly 1½ lbs. necessary. The cost of the warp will therefore be 1½ lbs. at $.75 or $1.13. To get the cost of the warp per yard, divide $1.13 by 25 which gives $.04½ per yd. To figure the cost of the weft per yard, if the weft is the same material as the warp, the amount used will be about the same if an even tabby is to be woven, so double $.04½ to get total cost of warp and weft, i.e., $.09 per yard, or about $.03 per running foot. If you plan to use a weft of another material, or if you have more threads of weft per inch than of warp, figure as follows:

1. How many threads of weft do you weave with the material along 1 inch of warp?—For instance, 22.
2. How far is it across the warp, i.e., once across with one strand of weft?—20 inches.
3. To get the amount of thread used for 1 inch of weaving, multiply 20 inches for each time across by 22 threads in 1 inch of weft, i.e., 440 inches, or 12 2/9 yards.
4. To get the amount of thread used for 1 yard of weaving along warp, multiply this amount, 12 2/9 yds. in 1 inch, by 36 inches, which gives 440 yards.

5. To get the fraction of a pound that this will be, see how many yards per pound come in this material. Suppose we are weaving with 10/1 linen weft, 3,000 yards per pound. This amount divided by 440 yards, the amount of weft needed for 1 yard of material, gives 6.8, or 1/6.8 of a pound. Since 10/1 linen costs $1.10 per lb. we will multiply $1.10 by 1/6.8 to get this portion of a lb. or $.16. Add this amount to the cost of the warp to get the total cost of material used in 1 yard:

Cost of Warp per yard:	$.09
Cost of Weft per yard:	$.16
Total cost of 1 yard:	$.25

The rule to follow for obtaining amount of weft necessary for 1 yard is: Multiply distance in inches across warp, (such as 20") by number of rows necessary for one woven inch such as 22 rows; then multiply this result by 36 to get total number of yards of weft in 36 inches of woven material.

Making a Threading Plan

The warp plan is now complete as follows:

1. Size thread: 12/3 ply.
2. No. of threads per inch: 20.
3. Width in reed: 20.
4. Total No. of thds. 400, (Item 2 multiplied by item 3).
5. Length of Warp: 25 yds.
6. Amt. of warp to buy for 25 yards: 1½ lbs.
7. Amt. of weft to buy to weave up this amount: about the same.
8. Cost of material per woven yard, including warp and weft, if weft is the same: $.09.

Our next step is to choose a threading pattern and make a plan by which the pattern will be placed at the center of the warp, with an even number of selvage threads at each side. To figure the number of times a given pattern will go into a certain number of warp threads, divide the total number of warp threads by the number of threads in one repeat of pattern, and if any threads remain use these for selvage, or plan to add more warp threads for selvage if needed. For instance, in the Honeysuckle pattern given in draft of Figure 1, there are 26 threads in one repeat of the pattern without the selvage, i.e., from B to D. If the warp has 400 threads, we divide 400 by 26, and find that it will go 15 times with 10 threads left over. In other words we can thread 15 repeats of the honeysuckle across this warp, and have 10 threads left over for 5 selvage threads at each side.

We find, however, that we often need to plan more carefully than this in order to make our pattern the same at both right and left sides. For instance, in a regular threading plan like the above, the lay-out consists of a selvage, A-B; the first motif of the pattern, B-C; the second motif, C-D; and the left selvage, D-E. If we thread our warp with 15 complete pattern repeats, we will begin with motif B-C, but end up with motif C-D. In weaving the pattern this shows up as an unsymmetrical arrangement. Therefore we plan to add motif B-C after the total number of repeats to make the left side of our threaded warp similar to the right, and if there are not enough threads left to cover this added motif, we must take out one repeat to give enough. Figuring this out step by step:

1. To get the number of repeats, divide total number of warp threads, 400, by number of threads in one repeat of pattern, or 26. The result is 15, with 10 threads left for selvage.
2. This 10 threads will not cover motif B-C. If we wish to add this motif to make pattern symmetrical, we must take out one repeat to provide enough threads. This gives 14 complete repeats of pattern, with the added motif B-C of 20 threads to finish left side; as follows:

14 repeats of 26 threads	364 threads
Added motif, B-C only	20 threads
Total	384 threads

Subtracting 384 from total number of threads, 400, leaves 16 threads for selvage, 8 at right and 8 at left. The complete threading plan therefore becomes:

Right Selvage, A-B	8 threads
Pattern, B-D, 26 threads, repeated 14 times	364 threads
Added motif, B-C only, to make pattern even	20 threads
Left Selvage, D-E	8 threads
Total	400 threads

Direction of the Selvage. In general the selvage should be written in the same direction as the pattern. Note in the above draft, that the threading of the pattern proper starts at the lower right, on 1, 2, 1, 2, and ascends left from 2, 3, to 3, 4; and note that the selvage rises in the same direction, 1, 2, 3, 4. This makes a softer line between selvage and pattern-proper in the weaving of the fabric than if it were written in the opposite direction. For instance, if the selvage were written, 4, 3, 2, 1, a sharp angle would be formed between selvage and pattern. Some folks may prefer this, but in general the selvage should blend off to the edge and not be emphasized. In Figure II, both types of selvage have been developed, and one can see at a glance the interposed triangle made by writing selvage in opposite direction from draft, shown at Figure 2, B, small circle.