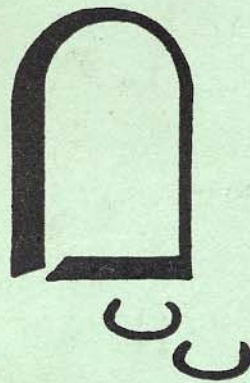


SPEED WARPING

For Handweavers

by

Dorothy and Curtis Payton



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Portland, Oregon

Handweaving Simplified

Three equally important divisions constitute weaving. Loom preparation, the weaving technique, and the choice and application of materials are present wherever weaving is found. Good craftsmanship is demanded by each, and none can be slighted. With such a perspective, you, as a weaver, want the methods and information that will enable you to independently achieve that ideal.

This book is the second of two books on the subject of loom preparation written for that specific purpose. The former, THE TERRASPOOL METHOD OF WARPING, fully presents a completely new, easy method of dressing the loom, from the initial warping through a simplified, economical threading and tying process ready for weaving. That method is especially suited to the small project, the short warp, and the beginning weaver.

This book contains another method of warping. It can be applied to projects of any width or length to 100 yards or more if practicable for the individual loom, and rounds out the information needed by the weaver about warping. While this method involves the well-known creel principle, it has been designated as "SPEED WARPING" because of the extraordinary efficiency in time and effort afforded by our special new adaptations and streamlined application of equipment. Creel warping has long been known as the best way of handling the longer warps. It contains a basic principle used universally in the weaving field of textile manufacture, and by many individual handweavers who appreciate its merits. Procedures may vary, but the principle of transferring thread from spool to spool remains its fundamental and inherent feature. We have retained this principle and at the same time brought the method down to practical use for the average handweaver. Special attention has been directed to the use of inexpensive equipment and step-by-step instructions that are simple, fast, and easy to do.

You want to know how to design and plan your warps. How to estimate materials needed, how to prepare them as a warp, and how to apply them will be among your first questions. You will want to make plaids, stripes, and mixed warps. This book has been written to explicitly answer these questions and tell you in clear descriptions, illustrations, and photographs just how to do each necessary step.

SPEED WARPING simplifies handweaving. The planning and application of warps to the loom is probably the most difficult problem of the weaver, and this is the method that most effectively meets any contingency of this phase of loom preparation. Not only does it meet this need, but does even more. Because it is so adaptable and easy to do that the executing of warps or making any necessary changes are brought within anyone's ability, SPEED WARPING contributes greatly toward new ideas and truly creative weaving. It has been personally taught for several years and is being used by hundreds of both experienced and inexperienced weavers.

Now it is yours to enjoy, and we are sure you will find new excitement in this part of weaving.

Sincerely yours,

DOROTHY AND CURTIS PAYTON.

Chapter I

THE PREPARATION OF YOUR LOOM

Subjects Explained in This Chapter:

- **The Importance of This Part of Weaving**
- **What You Should Know to Begin**
- **The Equipment You Need**

The Importance of This Part of Weaving

In any craft or business it is essential that the worker be master of his tools. This is a double necessity for you, as a weaver, to be in complete command at all times of both your loom and your materials from the initial planning to the completed project. Yet no weaver can admit that this is true unless his methods of procedure allow him:

- To Apply Any Kinds of Yarns to the Loom—
Whether they should be used as warp is another matter not dealt with in this writing.
- To Apply Any Materials Speedily and Efficiently of Time and Yarn.
- To Apply Any Quantity Practicable and Within the Loom's Capacity.
- To Apply Any Materials With Procedures That Are as Simple as Possible, Yet Allow for Any Adaptations Desired, with Dexterity in Handling.
- To Apply These Materials Accurately and as Designed Without Assistance.

This is a large order, but is perfectly possible with the proper equipment and the methods which the authors undertake to describe. All the information has been tested, and is being used and taught personally and also by others with splendid results for both the beginning weaver and those more experienced.

The setting up of the loom is a most important aspect of weaving for it constitutes one of the vital functions in the craft. Done over and over with each succeeding project, you soon realize that the very best loom preparation possible is an utmost necessity if your future in the craft is enjoyable and you are able to fully explore all the possibilities of beautiful and creative work.

If you pause and consider that here in this initial process is the place where the first actual steps toward the finished project take place, it is not hard to realize how important it is. At first, one will want to simply duplicate conventional pattern or weaving recipes of individuals. Then you see that these patterns and recipes can be changed a little here and there, modernized, or adapted by materials or colors.

After the early experience of seeing how the loom function and yarns combine to reveal various pattern effects, you will go on to satisfy another inevitable curiosity—that about materials. You become more aware of their differences in size and texture, and note that these sizes can be mixed, and have definite and distinct effects in the very simplest of weaves,

that of tabby. The textures become important for they vary in practicability as warp. You soon look toward combining smooth with rough materials, shiny with dull, or mixing materials like cotton with wool or linen, and others. Eventually the blending of these in various colors will be a desirable achievement. Along the way some of your important observations will be:

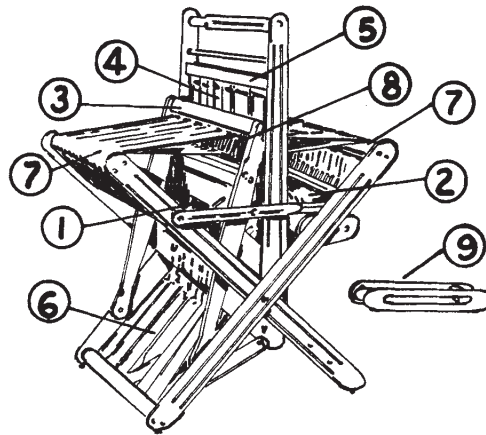
- Whether the yarns are strong enough or desirable as warp.
- Whether they cling to one another as yarns spun with hair-like fibers on them tend to do.
- Whether they are bumpy at regular intervals as the boucles, or have nubs at spaced or irregular intervals, as the ratines.
- Whether they are fluffy such as chenilles, or novel yarns with loops or twisted with metals.
- Whether they are elastic in their tensile propensities. This is most important, for incompatible materials placed together in a warp cause the weaver no end of trouble. For instance, a non-stretch type of yarn such as linen warped with an extremely elastic one, as some nylons, would be a most unhappy combination. The new weaver finds these considerations are necessary and preliminary to the actual warping process.

As to technique, the control and placing of color in the warp is assumed desirable and necessary from the outset. To be able to accurately place or distribute the colors as desired is a "must". As to the design aspect, everyone is increasingly aware of the growing importance of color and the intelligent use of it. Probably nothing is more so from a sales standpoint, and the challenge of combining and blending colors on the loom is as endless as it is fascinating. One of the fields of exploring color, practically uncharted, is that of "loaded" or "filled" color, the close arrangement and mixing of several related hues.

There is still another factor in the design possibilities that becomes apparent to the young weaver. Variations are found in threading the heddles of the loom with multiple numbers of threads or colors, or the reed sleyed in different ways. Here again freedom and ease of placing and executing these thread arrangements on the loom is imperative if you are to avoid monotony and bring variety and originality into your work.

What You Should Know to Prepare the Loom

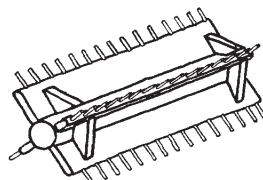
Know the Essential Loom Parts and How They Function



1. The Cloth Beam—The round at the front of the loom upon which the woven material is wound.
2. The Warp Beam—The round at the rear of the loom upon which the warp thread is first wound and from which it is drawn to the cloth beam for weaving.
3. The Beater—The swinging crosspiece containing the reed, used to bring the threads of the weft together to form the web of the cloth.
4. Heddles—Metal or cord lengths in the harnesses, containing “eyes”, for holding and guiding the warp threads in the loom.
5. Harnesses—Frames in which the heddles are hung or stretched. These are raised or lowered in the action of the loom.
6. Treadles—The pedals or means by which the harness frames are depressed or raised in weaving.
7. Front and Rear Breast Beams—Parts of the loom frame over and between which the warp threads must be strung and aligned with the heddle eyes in order to make a shed.
8. Shed—The opening in the yarn arrangement created by depressing or raising the harnesses. The shuttle is thrown through this opening.
9. Shuttle—A sled or boat shaped frame containing a spool or bobbin for holding the weft thread.

Know About Your Loom

Whatever make of loom you select, whether it operates on the “jack” principle with “rising shed” or the counterbalance type with a “sinking shed”, you naturally want to use it proficiently. For the best, most versatile, and fastest loom preparation of any kind you need on your loom



A Sectional Warp Beam

The sectional warp beam is to be preferred on *any* loom because it enables you to apply your yarn accurately and quickly, smoothly and without trouble or fuss, and put on any length your loom will hold without assistance. You can warp mixed textures and colors as easily as plain ones.

The sectional warp beam is a roller or drum divided usually by 4 rows of pegs into sections 1 or 2 inches wide. The 1-inch sectional beam is to be preferred for the following reasons:

In preparing warp for the beam of the loom by the Payton “Speed Warping” method to be described, *only half the number of spools are needed* to be wound than for the 2-inch sectional beam. Any 2-inch sectional beam can be subdivided by pegs set between the present ones.

In tensioning the warp on the beam by the easy unique method described, the narrower width can be handled more accurately and easily.

The inch sections are more convenient in calculating and gauging your work when designing or cartooning.

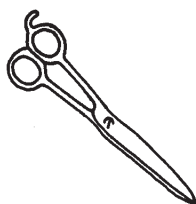
All weaving is measured by inches; i.e., a project is a certain number of inches wide, and variable numbers of ends or threads per inch are used.

Planning your project is simplified greatly by the smaller division.

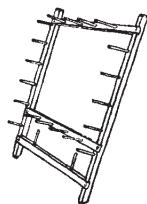
If your loom does not have the one-inch sectional beam it can be converted to one by building this arrangement over your present plain beam. See the Conversion Plan as pictured and detailed with the warp saving extenders in the Terraspool Method of Warping. The trouble and expense of any necessary conversion is more than offset by the many advantages of the Sectional Beam throughout your future weaving experience, and becomes apparent at once when you begin to warp your loom.

The Equipment You Need

Needed for Any Warping:



Scissors



Warp Frame



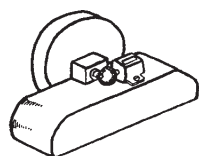
Thread Hook



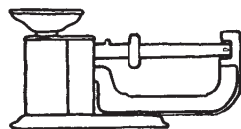
Pocket Comb
With Fine and Coarse
Teeth

The warp frame is a wood frame with large pegs protruding from it. It can be used in warping either as a measuring device or converted into a spool rack and used as a creel, eliminating the need of an extra piece of equipment. The 10-yard warp frame is adequate for *all warping needs*. A splendid type of warp frame is shown in the Terraspool Method of Warping. It is demountable, designed for strength and rigidity, and can be set anywhere or stored in a small space.

Needed for Payton "Speed Warping"

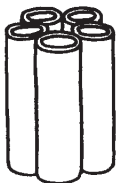


or an



Mechanical Warp Counter—Machine for measuring your warp thread as it is wound directly onto the spools for warping. Easy to use, it eliminates guesswork in mechanical winding, saves yarn, and is advantageous in planning warps. Can be run fast or slowly like a speedometer, registers yards wound on dial face. Available from the publisher, TERRACE YARN SHOP, Portland 19, Oregon.

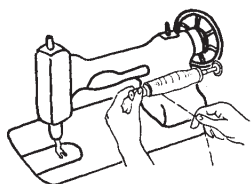
Air Mail Balance Scale—This can be used instead of the Mechanical Warp Counter. The warp yarn is measured by weight instead of by lineal measurement in using the scale. Use is to be described in detail. Available from most stationery supply houses.



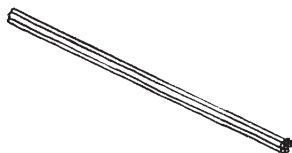
Paper Tubes—The type of cardboard tube that comes from the ½ lb. tubes of linen yarn. Dimensions are approximately 1½" x 4". You will need one for each "end per inch" of your material in the project. A set of at least 36 is advisable. If the weighing method is used, they should all be uniform in weight and thickness. Available from publisher.



Two Adapter Ends—Each adapter is a graduated step wood plug with ¼-inch metal stem for winding. These are used to convert the paper tubes into simple practical spools. The steps in the plug allow for using tubes of other diameters, handy for winding your left over weft from your bobbins after weaving. Available from publisher.

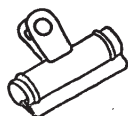


Winder—The converted “spools” can be wound on either a sewing machine or any $\frac{1}{4}$ -inch motor shaft by means of a small 1-inch piece of rubber coupling. Coupling available from publisher.



Wood Dowel Rods—You will need about 6 or 7 wood dowel rods, $\frac{1}{2}$ inch in diameter by 4 feet long. These come in this standard size, and are available from most lumber companies.

Incidental Equipment



Yardstick—The regular thin, standard yardstick is best.

Roll of Scotch Tape or Masking Tape.

Rubber Bands—Small and large ones.

Spring Paper Clamp—Available from stationery supply house, your local variety store, or from the publisher.

The Steps Involved in Preparing the Loom

Loom preparation must necessarily precede the fun of actually throwing the shuttle and the weaving technique itself. There are four major steps in the process, designated as

- A. **Warping**—The placing of the yarn on the warp beam of the loom.
- B. **Threading**—Drawing the individual threads through the heddles of the loom.
- C. **Sleying**—Drawing the threads through the reed in the beater of the loom.
- D. **Tying Up**—Tying the warp ends to the cloth beam at the front of the loom.

The time required for these various steps depends, of course, on the project, the individual weaver, and the circumstance, but generally you should expect to set your loom up for weaving in 5 to 6 hours or less with the methods and equipment described in these pages. This preliminary loom preparation as given is interesting and not difficult, but it is most important that you have the proper equipment.

Methods of Warping

Two methods of applying warp to the sectional warp beam are:

- (1) **Payton “SPEED WARPING” Method**—A streamlined, simplified method using me-

chanically wound spools, which you wind yourself. Spools with winding instructions and practical inexpensive equipment are all completely described. Especially good for all yardage projects or long warps, and mixed textures or colors.

- (2) **Payton “TERRASPOOL” Method**—A unique easy method of applying warp to the sectional beam without winding spools by the use of a Terraspool warping attachment. For beginners, and for small projects to 10 yards in length. Contains full threading and sleying, and apron tying instructions applicable to both methods.

Both methods of warping are easy. Both have distinct advantages. You will find yourself employing either at some time or another, and it is even possible to use the advantages of both and combine them to warp some projects. In these two methods you can be assured that you will have the answers to any possible warping problems you will encounter on the handweaving loom. The information given can be adapted to any loom, including table looms, for the principle of handling warp by rolling it from one spool to another will ever remain the one efficient way of handling it.

Chapter II

PROCEDURE OF WARPING

by the

PAYTON "SPEED WARPING" METHOD

Subjects Explained in This Chapter:

- Calculating the Amount of Warp
- Requirements and Technique of Winding Tube Spools
- Two Ways of Measuring Warp in Winding Spools
- How to Set Up the Creel
- Winding and Tensioning the Warp on the Beam

Estimating and Calculating the Amount of Warp

Factors Affecting Your Warp Requirements

Certain elements affect the warp requirements for weaving. In planning any project these must be taken into consideration or the finished work may not be the size desired:

Width

Draw In—Weaving tends to "draw in" from the edges for a few threads, and the finished weaving is slightly narrower than the warp width set on the loom. This "draw in" varies with the type of material used, and also with the weaver's technique. Wool, for instance, draws in more than less elastic materials, as linen and rayon.

Take Up—The web or interlacing of the threads, has a tendency to "take up" or shorten due to the over and under path the yarn travels. This take up affects both the length and the width of your weaving. Small sized yarns result in little take up, whereas very large yarns take up in width and length appreciably. Special allowance must be made in such cases.

Shrinkage—The shrinking of materials in washing should be given thought when planning warp requirements. Wool and cottons tend to shrink more than linen and rayon. As nearly all projects from the loom should be washed, this is a factor that must be noted. Because these amounts vary with the individual materials no definite allowance can be stated. See the TERRACE TEXTURE studies of materials, available from the publisher, for more detailed information on yarns.

It is usually advisable to plan and warp a project at least *one inch wider than* the finished article. This

is an average, and a variation will depend on these factors. Example: a finished linen place mat to be 13 inches wide finished would be warped 14 inches wide on the loom.

The adjacent warp threads threaded through the loom are called "ends". The number of these per inch of the project width determines the density or lightness of your material. The sum of these ends is called "Total Warp Ends". Observing and noting the number of ends per inch and the size of the yarns in materials that you are able to examine is an aid to help you judge proper use and size of threads in handweaving.

Length of the Warp

Besides the number of ends in the width of your project which must be considered in estimating your warp, the following affect the amount of it:

Take Up and Shrinkage—As in the width, the matter of take up and shrinkage also affect the length of the warp, and any necessary allowance for these should be also included in the warp length. Elastic yarns, such as wool or nylon, should be handled with as little stretching as possible in order to retain the loft, suppleness, or spring that characterizes their finished projects. One can be shorted, too, on the finished quantity of woven material by stretching a yarn in measuring the length, because it springs back in the weaving process.

Loom Waste Allowance—You must allow warp for the length of the project, *plus* the amount needed for threading across through the heddles and the reed of your loom to the place where

it is tied to the "apron" of the cloth beam at the front. This added amount of warp is called "Loom Waste Allowance". It varies in amount on different looms. The economical warp saving equipment and suggestions given in the Terraspool Method of Warping call for 15 to 18 inches of warp waste, compared to others that may require 27 inches to a full yard for floor looms. Table looms, being smaller in depth, require proportionately smaller amounts of loom waste allowance.

Total Project Length—This will include the actual length of all the individual items to be woven of the same warp added together. Any allowance for finishing, such as hems or fringes, are included in the total amount.

Hems: The total amount turned under. This will include the turn in for finishing.

Before you begin, it is assumed that you have selected your project, the materials to be woven, and determined the number of warp threads or "ends" per inch of that particular material. The TERRACE TEXTURES SAMPLE SERIES, simplified lessons on yarns and their uses, available from the publisher, is designed to help you in this.

To the new weaver, giving all these factors attention may seem laborious. But it is far better to think it out and then act, than plunge into a situation and then regret too little planning. Your time and your money are involved, and neither should be wasted. At first one will have to deliberately and studiously plan his projects out, but it soon becomes an easy procedure that pays off handsomely. No serious craftsman overlooks this important preliminary, so

Always Know—Your Warp Width.

The Take Up and Shrinkage Allowance.

The Loom Waste Allowance for Your Loom.

Your Total Project Length.

The Ends Per Inch of Your Material to Be Woven.

You are now ready to estimate your warp requirement for weaving.

Step-by-Step Procedure for Calculating Warp

Formula For Estimating

1. Add:

$$\text{Total Project Length} + \text{Loom Waste Allowance} + \text{Take Up and Shrinkage} = \text{Total Warp Length.}$$
2. Multiply:

$$\text{Warp Width} \times \text{Ends Per Inch} = \text{Total Warp Ends.}$$
3. Multiply:

$$\text{Total Warp Ends} \times \text{Total Warp Length} = \text{Total Warp Needed for Your Project.}$$

Tying-Off Length—see next page.
Note: Always have on hand at least 5 to 10 yards of extra warp for any project.

EXAMPLE

Project:

8 Place Mats, 12"x20" finished with hems, each hem to have 1¼" turn under.

Yarn: Linen, 15 ends per inch.

Loom Waste Allowance: 18 inches.

Take Up and Shrinkage: 1 inch in width per mat, and 1 inch in length per mat.

Total Project Length:

$$\begin{array}{r} 20'' \text{ Finished size of mat} \\ + 2\frac{1}{2}'' \text{ Allowance for hems} \\ \hline 22\frac{1}{2}'' \text{ Actual mat length} \\ \times 8 \text{ Number of mats to be woven} \\ \hline 180'' \text{ Total Project Length} \end{array}$$

Calculation:

1.
$$\begin{array}{r} 180'' \text{ Total Project Length} \\ + 18'' \text{ Loom Waste Allowance} \\ + 8'' \text{ Take Up and Shrinkage for 8 Mats} \\ \hline 206'' \text{ Total Warp Length} \end{array}$$
2.
$$\begin{array}{r} 15 \text{ Ends Per Inch} \\ \times 13'' \text{ Warp Width in Loom} \\ \hline 195 \text{ Total Warp Ends} \end{array}$$
3.
$$\begin{array}{r} 206'' = \text{Total Warp Length; or } 5.72 \text{ Yds.} \\ (206 \div 36'' = 5.72 \text{ Yds.}) \\ 5.72 \text{ Total Warp Length} \\ \times 195 \text{ Ends Per Inch} \\ \hline 1115.4 \\ \text{or} \\ 1116 \text{ Yards—Total Warp Needed} \\ \text{for the Project Plus} \\ \text{Tying-Off Length} \end{array}$$

Requirements and Technique of Winding Tube Spools

Number of Spools Required

Measuring your warp on mechanically wound spools is the secret of speedy warping. These inexpensive tubes that are converted into spools are perfectly satisfactory for all ordinary warping. For extra long warps that might not all be prepared on one set of spools, a second winding might be required for

those that exceed 20 yards. A second set of tubes is advised for those who expect to weave yardages over this amount.

Having determined the Total Warp Yards required for the warp of your project, you are now ready to estimate and subdivide the total amount of this yarn

for the spools of your creel. If you have the one-inch sectional beam as recommended, you will need:

One Spool for Each End Per Inch

For example, if you are weaving material that calls for 15 ends per inch you will need to wind 15 spools.

The two-inch sectional beam will require *double this number* of spools to be wound. Whatever disfavor creel warping may have met with in the past is largely due to the old-fashioned idea that sectional beams had to be made with two-inch sections and that the spools had to be purchased already wound from a manufacturer. The commercial or institutional use

of two-inch sectional warp beams, where hundreds of yards of the same kind of warp thread is used, should not be a determining influence for the individual weaver, since here the number of spools is no object because of the quantity used, and the fact that the full spools are used on the creel as they come from the manufacturer. The time saved in rolling larger two-inch sections does not offset the time required for the average handweaver to wind the extra spools involved.

So, for Simplicity and Speed—Wind One Spool for Each End Per Inch.

Calculating the Amount of Warp for Each Spool

Formula for Estimating

Warp Width × Total Warp Length + Tying-Off Length = *Total Amount to Be Wound on Each Spool.*

Tying-Off Length—In addition to the Total Warp Length, it is advisable to have a few yards of warp on each spool for tying-off the sections of warp on the beam, plus sufficient length from your creel to the loom. It is much better to have a bit of warp left on the spools than to run out during the winding.

Total Tying-Off Allowance (for Each Spool)—6 lineal inches per inch of warp width + 3 yards.

EXAMPLE

Warp Width of Project—13 inches.
Total Warp Length—5.72 inches.

Tying-Off Allowance:

13" Warp Width
× 6" Per Inch Allowance

78" = 2 Yds. + 6 Inches
+ 3 Yds.

5+ or 6 Yards, to be Added on Each Spool (15 spools require 90 yds. of warp)

Calculation:

5.72 Yards, Total Warp Length
13" Warp Width

74.3
+ 6 Tying-Off Allowance

81 Yards, Total to be Wound on Each Spool

Counting the Warp Thread Onto Spools

By Lineal Measurement

The Mechanical Warp Counter—There are several on the market. The ideal is the one which allows you to wind at any desired speed, recording accurately on a dial the yards run through it.

It is placed between the original cone of thread (usually put on the floor so that the thread unwinds freely from the top of the spool or cone) and the tube spool being wound. The instructions accompanying the counter should be followed.

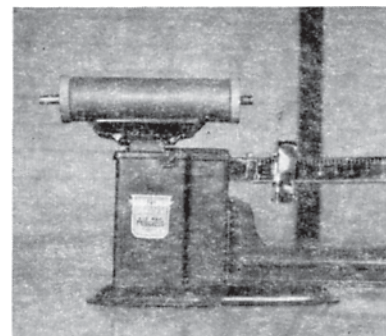
By Weighing the Yarn

Air-Mail Balance Scale—An accurate air mail balance scale weighs small amounts of yarn as closely as 1/4 ounces, and is an adequate and satisfactory means of counting warp yarn.

How to Weigh Your Warp with a Balance Scale

Calculate Weight at Which to Set Scale:

- (a) Determine yards per pound of your material.
- (b) Determine yards per ounce of your material by dividing yards per pound by 16.
- (c) Calculate net weight of the yarn needed for each spool (estimated on previous page) by simple arithmetic.
- (d) Weigh the adapter ends and paper tube to obtain *Tube Spool Weight*. See View 1.
- (e) Add: Net Weight of Yarn + Tube Spool Weight = *Weight at Which to Set Scale*



View 1

Example

From Previous Example:

- (a) Material—14/2 Linen @ 2100 Yd. Lb.
- (b) $2100 \div 16 = 131$ yds. per oz.
- (c) Each Spool—81 yds. to be wound on each spool.

$$\frac{81}{131} \text{ or } 81 \div 131 = .61 \text{ oz., or approximately } \frac{2}{3} \text{ oz., Net Weight of Yarn To Be Wound.}$$

- (d) Adapters and Spool Weight—1 ounce.
- (e) $\frac{2}{3} \text{ oz.} + 1 \text{ oz.} = 1\frac{2}{3} \text{ oz., Weight at Which to Set Scale.}$

After these few simple calculations, set your scale at the total weight to be indicated. By winding one spool and carefully weighing it you can easily judge the amount to wind on the others. Few trial weighs will be necessary. With a bit of practice you can soon make the weighing of spools a speedy operation. See View 2.

Note: If desired, one of the adapter ends can be left on the motor shaft or bobbin post, and only one adapter end weighed with the paper tube. To weigh small parts of ounces it may be necessary to fasten the counterweight of the scale firmly with scotch tape to prevent it from shifting. Allow the balance arm to *fully* rise in balancing to avoid short weight.

Technique of Winding Tube Spools

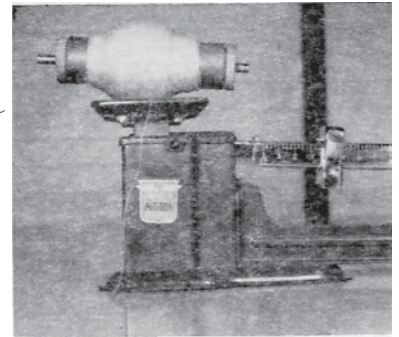
1. Place adapter ends in paper tube. See View 3.
2. Place the rubber coupling on the bobbin winding post of the sewing machine or any $\frac{1}{4}$ -inch motor shaft. See Views 4 and 5. Motor is shown with guide posts to gauge the spread of the yarn on the spool.
3. Hold an ordinary sewing spool over the free end to steady the spool as the thread is guided with the right hand.

Do

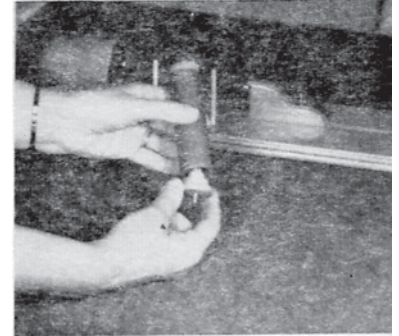
Do guide the thread back and forth abruptly and rather quickly across the paper tube. By doing this the yarn is prevented from falling off the ends of the tube. Keep some tension on the thread as it winds. Build the layers of yarn back from the ends as it accumulates on the tube so that it forms a mound in the center. See View 6.

Don't

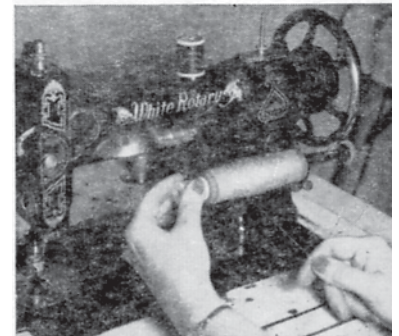
Don't allow the yarn to pile up in any one place as it is wound.



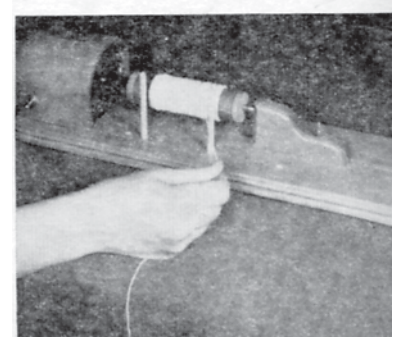
View 2



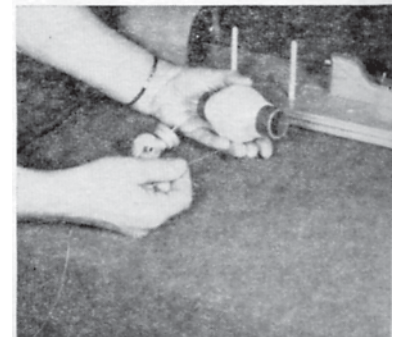
View 3



View 4



View 5



View 6

The Creel

How to Set Up a Creel

A warp frame provides a very satisfactory creel by converting it for use by means of dowel rods fastened across to hold the tubes of wound yarn. See View 7.

1. Fasten Dowels to Frame—Use large rubber bands. Bend one around the left upright of the frame and pull one end through the other. Place the end of the dowel rod through this loop to hold it in place. Do this at the *left* end of each rod, only, until the spools are placed on them, then fasten the right end likewise.
2. Place the wound spools on the creel so that the spools unwind in the same direction in order that they turn freely. Put the spools on the rods from the right, beginning with the top rod, then the next rod below, followed by a spool on the third rod down, etc. The threads will then appear in this same sequence side by side on the sectional beam after they are wound.
3. Stand the creel about 3 or 4 feet from the front of the loom (the beater side). Now draw the ends of warp through a one-inch section of the reed approximately in the center. See View 8.

Do

Draw the "end" from the *top left spool first*. Then follow with the one *directly below*, and continue until the left end row of spools is used. Follow with the second row down, and proceed in the same manner with each row until all the ends from the spools are drawn through the reed.

Use the sley hook and pull them sufficiently through the reed so that they will not slip back.

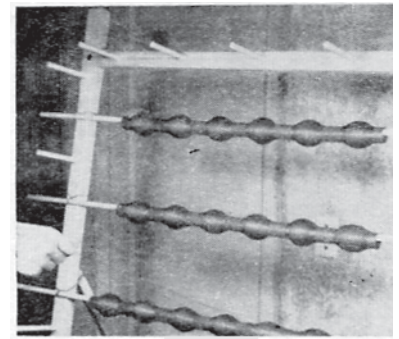
Don't

Don't cross the threads to the reed unless absolutely necessary.

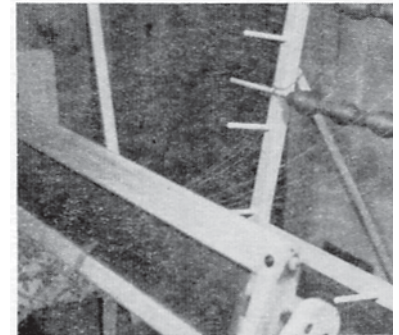
4. When the ends are all through the reed, tie all together into a hard knot at the end. See Views 8 and 9.
5. Grasp the knot and pull warp threads across through the open harness frames and over the rear breast beam. Fasten knot to warp extender with a cinch loop. See View 9.

Instructions for making warp extenders in the Terraspool Method of Warping are found under the chapter on Equipment Plans and Specifications. The warp extender is a short strong cord that is fastened directly to the sectional beam and extends around the rear breast beam to within approximately 6 inches from the heddle eyes of the rear harness. See View 9-A. There should be a cord for each section of the beam. The knot of the group of threads is fastened to the extender. This saves about 18 inches of warp length on all threads of warp! The cinch loop is most convenient, for one may put the yarn in or take it out of the noose at any time easily and without having to untie knots. It holds securely as little as one thread or as much as needed.

6. With the left hand draw the inch of warp against the top of the reed. You can hold the yarn from pulling through the reed by leaning the body against the warp and the front breast beam. This will quickly arrange the threads uniformly even for placing the comb in them for tensioning. See View 10.
7. Place the comb in the warp, *keeping the teeth up*. See View 10. Have a short piece of masking or scotch tape handy and cover the ends of the comb teeth so that the warp cannot slip out.



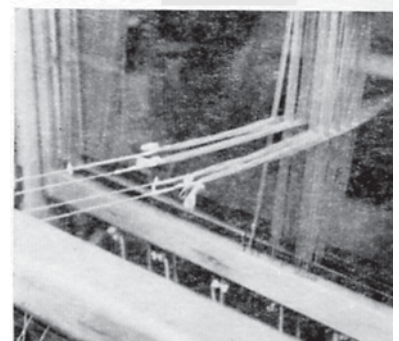
View 7



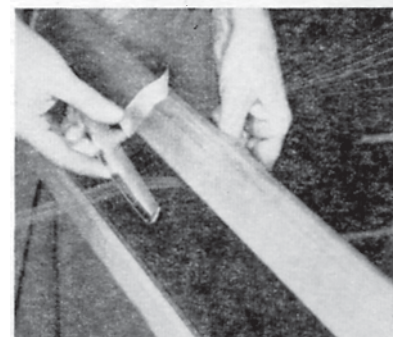
View 8



View 9



view 9-A



View 10

8. Hold the warp from unwinding and slide the comb along the warp threads and over the rear breast beam for the tensioning of the warp as it is rolled onto the sections of the warp beam. See *View 11*.

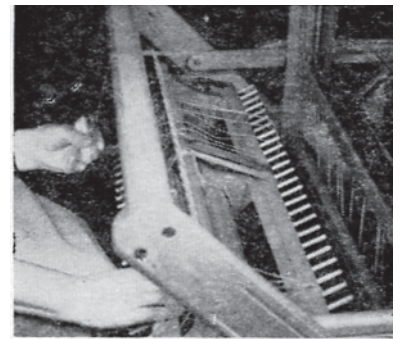
Winding and Tensioning the Warp on the Beam

You are now ready to sit at the rear of your loom and wind the warp from the creel onto the sectional warp beam. See *View 11*.

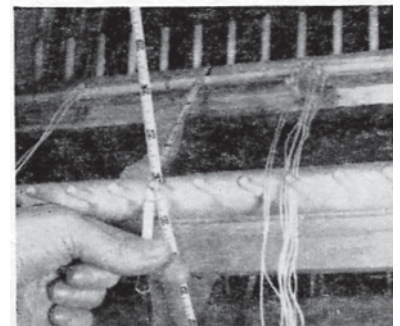
1. Measure the distance around your beam. See *View 12*.
2. Calculate how many turns of the beam are necessary. Divide the Total Warp Length needed by the distance around beam. Keep your calculations in inch measurements.

Example: $206 = \text{Total Warp Length}$
 $206 \div 25\frac{1}{2} = \text{Eight and Four-fifths Turns of the Beam}$
 Make this nine turns, since you have a few inches of allowance.

3. Count the turns of the sectional beam from the point of the knot fastening. Mark the starting place on the beam if desired.



View 11



View 12

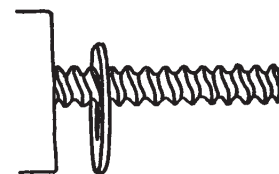
Three Ways of Counting Turns of the Beam

By Voice Aloud—It cannot be overemphasized that the *correct count* of the turns is most essential. Otherwise you will end up short on some section! So, count aloud, and do not let anything interfere with your counting. By counting *aloud* you will remember more easily should the phone ring or someone interrupt by speaking.

By a Reset Counter—These are procurable from larger hardware companies and are a standard product. They may be mounted on the loom at the end of the sectional beam with a striker on the beam which hits the arm of the counter as the beam is turned and causes the count to register on a dial. It is the most satisfactory of all counting methods.

By a Screw Thread and Ring—A counter may be innovated by affixing a large "screw thread" to the center of the end of the sectional beam with enough threads protruding for the maxi-

imum number of turns that will be eventually used. Mount it by threading it in the wood or metal hub of the sectional beam in a horizontal position. Use a flat metal washer with sufficient diameter to fit over the outside diameter of the threads and thin enough to fit inside the individual screw threads. Set the washer on one of the threads, *counting the correct number of threads back* to correspond with the turns desired. As the beam turns the washer rides along the threads of the screw. When the washer drops on the floor the required turns are completed.



Screw Thread and Ring

Winding and Tensioning the Warp

1. Release the brake of the loom so that the sectional beam turns freely.
2. Slide the comb along the warp to about 6 inches from the knotted end at the sectional beam. Your comb will be in position with the teeth down. Hold the comb in the left hand. Place the index and middle finger around the inch of warp threads and press the fingers gently together at *back* of comb, and hold the thumb *under* the yarn at the *front* of it. See *View 11*.
3. Now rest your left hand containing the comb and

warp *on your left knee*. It is important that you *keep it there* during winding so that the tension will be consistent, and you will have your hand braced in a firm position to avoid tiring.

4. Turn the sectional beam with the right hand *in the proper direction for your particular loom*.

Warning: Be sure to check your creel to see that all the spools are unwinding and that all the "ends" are being wound on the warp beam.

DO

If you count aloud, it is advisable to say the turn number when the turn is complete, and say the word "and" at the *halfway* point around the beam; i.e., "1 and 2, etc.". This helps keep them clear in your mind.

To avoid catching the yarn on the pegs slightly

tip the comb a bit so that the threads are on a diagonal. They then slip into position easily.

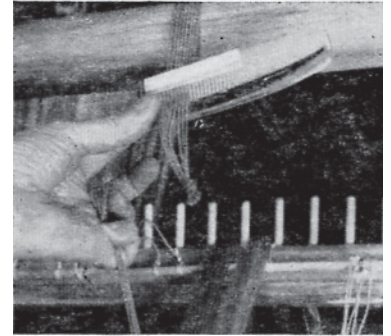
Restrain the beam from unwinding between holds during the turning by placing the right knee against the pegs, keeping a slight tension against the warp at all times.

5. As the beam turns, the yarn flows through the comb teeth and fingers and is thus tensioned onto the beam in the respective sections. Wind and count the turns until the correct length of warp is applied, always keeping a slight pressure of the fingers against the comb.
6. When the yarn is completely wound in the individual section, hold the yarn and cut about 6 inches beyond the end of the last completed turn. See *View 13*. Hold and tie a hard knot in front of the comb teeth *first* so that the yarn does not slip out. Next, fasten the end of the warp on the loom in its respective section of the beam. See *View 14*. Look at your spools occasionally during winding.
7. Fasten the tied knot into the cinch loop of the warp extender of the adjacent section and wind in the same manner as the first section. Continue until the warp width is completed. Wind from the center sections toward the outside on plain warps, so that your *project will be centered* on the loom. Mark the center pegs of the beam to make this easier.

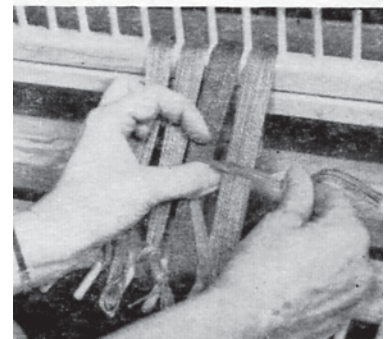
For variations and suggestions on mixed warps and information on their application see the chapter under that heading.

After your warp is all wound in the sections of the warp beam the width of your project, you are ready to thread the heddles of your loom by a new speedy method.

This is given in detail in THE TERRASPOOL METHOD OF WARPING.



View 13



View 14

Chapter III

HOW TO PLAN AND APPLY MIXED WARPS

Subjects Explained in This Chapter:

- The Cartoon and Its Use
- How to Make Cartoons
- How to Use the Cartoon in Weaving
- How to Plan Mixed Warps

The Cartoon and Its Use

The cartoon is either a full size design, proportionate study sketch, or chart which serves as a model. The use of the cartoon is much overlooked by many weavers, who, in the attempt to do all their planning of a project on the loom, find themselves restricted in both the design and its execution. Everyone knows the stimulation afforded by seeing sketches of the actual woven piece. Why not develop some of your own drawn to small scale on paper. Experience the thrill of your own creativeness, in addition to saving a lot of time, effort, and even thread.

Principal Uses of the Design Cartoon

To Show Over-All Proportions of Width and Length.

To Plan Design Areas and Finishing Allowances.

To Detail Colors or Proportions of Them.

To Use as an Actual Pattern.

To Plan Warps of Mixed Colors, Textures, Stripes, or Plaids.

Materials Needed for Cartoons

Have on hand the following items:

- (a) Several yards of butcher or wrapping paper.
- (b) Sharp soft pencils and eraser.
- (c) Squared graph paper ($\frac{3}{16}$ " or $\frac{1}{8}$ " squares).
- (d) Ruler and crayons or water colors.

How to Make the Cartoon

Layout

Whether you are copying a project laid out by another or developing your own, remember the proportions of width and length of the whole must be appropriate for both use and user. Any necessary alterations of these measurements can be tested or changed in the cartoon.

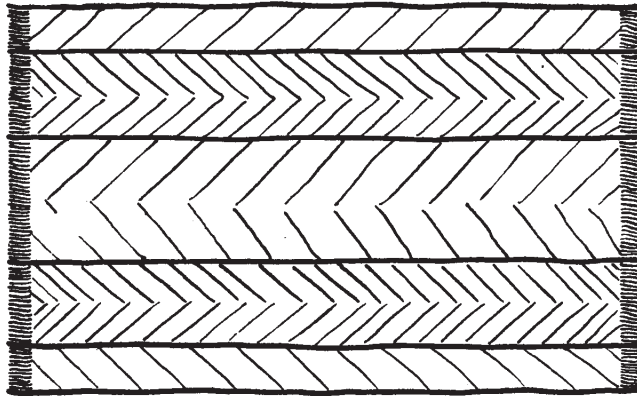
1. Where it is practicable, make a paper dummy of your project actual size. Using a ruler, mark out the width and length on butcher paper. For larger projects, such as drapery lengths, a fair size drawing to scale is sufficient. This should include the proportionate size of the window or opening for which it is being designed. The chief questions solved by the cartoon have to do with the length, width, and the placing of borders, areas, or trim, in respect to these, plus any details of the weaving. The cartoon can give the approximate effect of the whole.
2. If project is to be hemmed, include the complete turn-under for finishing. If fringed, include fringe lengths in the pattern. Fold the paper under to imitate hems or draw the fringe area with pencil.
3. Try the pattern out for size if possible. Place-mat patterns, for instance, can be put on a table and real place settings arranged on them. Several can be made to test the appropriateness of their shape for the table. Aprons or skirts can be held up in front of a mirror to test their proportionate length and design.

Areas of Design

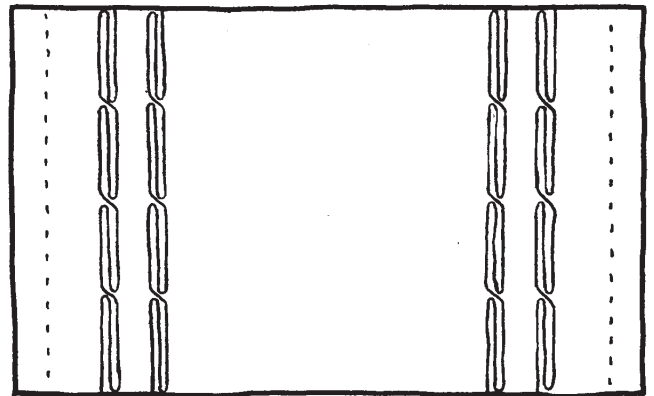
4. Before filling in the paper dummy with the detail of the weaving layout, make several preliminary sketches to small scale on graph paper. Your work is simplified if you let each square

on the graph paper represent 1 inch. For instance, you would draw a series of the mat sizes without detail and then fill in various effects *approximately* in proportion.

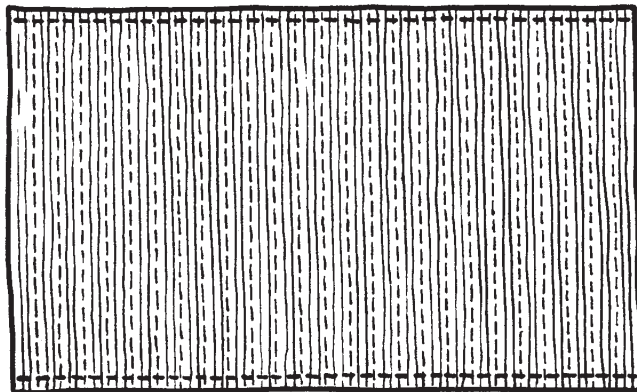
Example: Place Mats (12x20 Inches Finished)



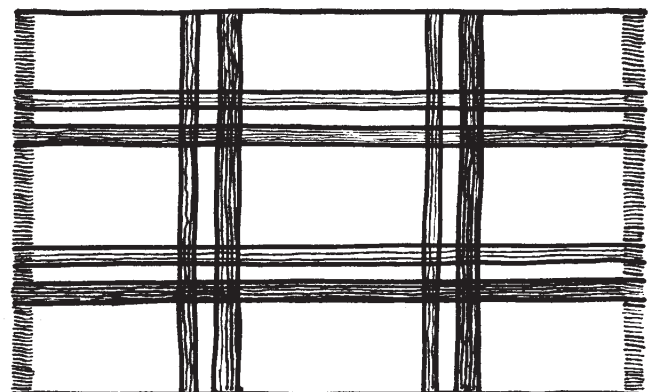
Featured:
Area of Stripes
Threading
Coarse Texture



Featured:
Finger Lace
Simplicity of Line
Smooth Texture



Featured:
Warp Interest
Color
Tiny Edge Hems
Fine and Medium Smooth Threads



Featured:
Giant Plaid
Simplicity
Coarse Smooth Texture

Suggested Order of Design Development:

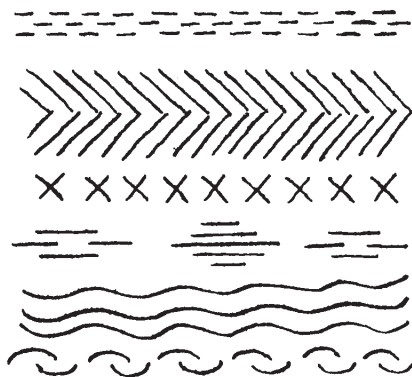
- (a) Determine the chief interest or feature of line.
- (b) Determine the dominant color.
- (c) Plan the supporting interest or color.
- (d) Consider textural effect desired.

These steps are preliminary to any weaving because they are all involved and affect the basic step of warping and loom set up. Your small sketches will be self

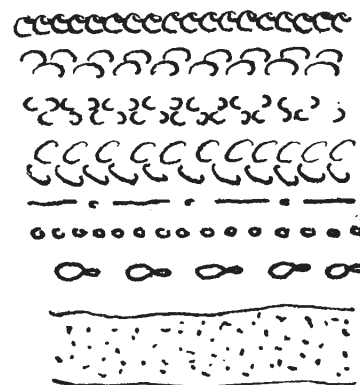
suggestive, and give you a feeling as to how the whole project will appear. If drawn to scale, though ever so small, they will be true, and any misplaced proportion can be more quickly detected and adjusted. Work these out in small scale before applying the detail to the paper dummy. Draw what appeals to you and then test it for the above listed characteristics.

In applying the detail actual size to the paper pattern, you do not have to be an artist to sketch in lines to simulate the weaving or color. A few are suggested:

WEAVE



TEXTURE



The important information gained is the ratio of the pattern areas to the whole and the feeling of line evidenced. These in turn often help suggest the sizes of yarn and textural effects suitable for the project.

5. Fill in with color if desired. Colors are more difficult to show realistically, but even if only approximated, they help establish a feeling about their compatibility. Experiment with water colors. Try "graying" colors with mixtures of black and white. A touch of the color's complement will help soften a color. Remem-

ber that any color you make can be achieved by dyeing the weaving yarns.

One interesting experiment is found in drawing on graph paper adjacent stripes of various widths and filling them in color, trying dark, medium, and light tones of 1 to 3 hues. Note the effects of the proportions of the various colors on each other.

Another is the planning of plaids. Where colors cross each other, allow for strong or neutralized effects.

Using the Cartoon

Using the Cartoon as a Guide

1. The cartoon will first serve you in charting your warp as described in the following pages.
2. Your paper pattern with hem or finishing allowances and design areas can later also serve you directly as a guide in your weaving. Much time in measuring is saved, and you have the reassurance that your design placement will be where you want it. Small variations or changes

in treadling or in the threads *within the allotted areas* are still possible, but over-all lines and layout of the project should be retained or changed at the outset.

Pin one corner of your paper pattern to the edge and end of the web on your loom and weave according to its length and the plot you have charted on it.

Using the Cartoon to Plan Warps

No weaver will get along without eventually using a pencil and paper at some stage of his experiences. It is in the warping of a loom where you will find that charting your procedure pays real dividends.

Types of Warps Encountered in Weaving:

- Plain Warps—Of one color or kind of thread.
- Mixed Warps—Regular alternation of colors or kinds of yarns.
- Mixed Warps—Random arrangement of color or kinds, in close intervals.
- Stripes and Plaids—Various widths.

The matter of applying plain warps is dealt with in the previous chapter, so will not be considered here.

Mixed Warp by Regular Alternation

This is a warp of two, three, or four colors or kinds of threads placed together to alternate in regular se-

quence across the full width of the project. Example: A rotation of brown, natural, and white.

In applying such warps to the sectional beam efficiently, know:

- (a) *Odd or Even* "Ends Per Inch" of your material.
- (b) Number of colors or kinds of thread to be used. Rarely are more than four colors used in this type of warp. See under "Random Arrangements".

The Work Chart for Alternate Threads

To facilitate warping any combination of alternate threads, a work chart has been developed, accompanied by a page of instructions explaining its use to:

- Apply 2 colors, 3 colors, or 4 colors in *even ends per inch* on the sectional beam.
- Apply 2 colors, 3 colors, or 4 colors in *uneven ends per inch* on the beam.

WORK CHART

ALTERNATE THREADS

To APPLY ANY NUMBER OF EVEN ENDS PER INCH

SAMPLE ARRANGEMENT OF THREADS ON SECTIONAL BEAM

KEY YOUR COLORS

1	2		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 SECTION 3 NOTE: EACH SECTION IS WARPED ALIKE BEGINNING AT LEFT END OF TAPED AREA OF BEAM		
2	3		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 SECTION 3 NOTE: EACH SECTION IS WARPED ALIKE * UNLESS THE NUMBER OF ENDS PER INCH IS DIVISIBLE BY 3		
3	4		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 NOTE: ALTERNATE SECTIONS ACROSS BEAM THE SAME * UNLESS THE NUMBER OF ENDS PER INCH IS DIVISIBLE BY 4 TO APPLY ANY NUMBER OF <u>UNEVEN</u> ENDS PER INCH		
4	2		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 NOTE: ALTERNATE SECTIONS ACROSS THE BEAM ARE THE SAME		
5	3		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 SECTION 3 NOTE: EVERY 1st. AND 4th. SECTIONS WARPED ALIKE * UNLESS THE NUMBER OF ENDS PER INCH IS DIVISIBLE BY 3		
6	4		KEY	YOUR COLORS
SITUATION	COLORS	BEAM SECTION 1 SECTION 2 SECTION 3 SECTION 4 NOTE: EVERY 1st. AND 5th. SECTION WARPED ALIKE * UNLESS THE NUMBER OF ENDS PER INCH IS DIVISIBLE BY 4		

* IF DIVISIBLE BY THESE NUMBERS, WARP EVERY INCH ALIKE.

Explanation of Work Chart

1. The divisions between the sections represent the pegs of your one-inch sectional beam.
2. Each kind of symbol represents a different color (or kind) of thread of your warp. For example: x=red; o=gray; v=blue.
3. These symbols on the chart have been arranged in a diagonal position to make it easier to read than if they had been placed side by side.
4. The number of "ends per inch" given in the chart is only a *sample*. You are to chart on graph paper your own problem as instructed, drawing the sections and filling in the number of ends needed to represent your project.

How to Use the Work Chart:

Step 1. Choose the Situation at the left side of the Work Chart that fits your warping problem according to:

- (a) Odd or Even Number of Ends Per Inch.
- (b) Number of Colors or Kinds To Be Alternated in the Warp.

Step 2. Mark off on squared graph paper a similar diagram with the *same number of sections* pictured under that Situation.

Step 3. Using the symbols to represent the threads, fill in, by similar diagonal arrangement the number of ends per inch of your proposed material; i.e., if 23 ends per inch, you will show 23 symbols between the divisions on your graph.

Step 4. Wind and arrange your spools on the creel according to your graph by the following instructions:

To Prepare Your Creel:

Spool Preparation: Wind spools using the previous information given in this book as to the *amount of thread* and *method of winding* spools.

Number of Spools: For alternate color warps you need to wind *as many spools of each color as the largest number of these colors* found in any one section of your cartoon problem.

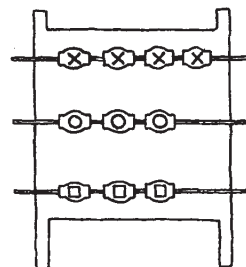
Example: Using Situation No. 2 on the Work Chart, you would need 4 spools of each color. If the ends per inch were divisible by 3 one would wind an equal number of spools of each color.

Arrangement of Creel:

Set up your creel with the spools of colors *always* arranged in order from *left top to bottom*, continuing

across frame, reading their order from your cartoon graph from *left to right*.

Illustration of the First Creel Arrangement of Situation No. 2 on the Work Chart.



To Wind Sectional Beam:

1. Mark off with masking tape the area of the sections on the beam to be warped.
2. Begin at left end of taped area. Wind on the first inch section and all sections of the taped area corresponding to it. The order of these is noted on the Work Chart under the respective Situation diagram.
3. Rearrange the spools on the creel to similarly correspond with the second section of your cartoon graph.
4. **Note:** It is never necessary, in alternate arrangements, to remove all the spools from the creel in making these changes. One only need shift the *outside* spools around to make the adjustment.

Wind the second inch section of your beam and all sections corresponding to it.

5. Continue rearranging the spools on the creel and winding for each respective section *on your graph* until the warp on the beam is completed.

Planning Random Warps

This kind of warp affords many possible color combinations and opportunities to use up your odds and ends of thread effectively. It is characterized by the absence of the fixed sequence. Various sizes and colors are placed adjacent without regard to their strict arrangement.

There are two ways of doing this, each with distinctive effects:

- (a) Complete random arrangement.
- (b) Free distribution of measured warp thread.

The Complete Random Arrangement of Warp:

- Step 1. Select the yarns to be used together.
- Step 2. To estimate the ends per inch to be used, experiment with a few of these threads by wrapping combinations of them around a small card, covering an inch area. Allow space between the threads to represent the approximate density desired. Count the number of ends of each type or color in the chosen arrangement and wind one spool of each, containing the amount equal to: $\text{Project width} \times \text{Total Warp Length} + \text{Tying-Off Length}$.

To Wind Beam

- Step 3. Mark off your sectional beam with masking tape. Place the spools on the creel in any irregular arrangement, and wind every third inch of your beam within the taped area.
- Step 4. Rearrange the spools on the creel and wind every second inch of the area.
- Step 5. Rearrange the spools once more and wind the remaining sections of the area with this final arrangement. You will now have a complete distribution of mixed colors or kinds in your warp.

Free Distribution of Measured Warp:

- Step 1. Gather together compatible colors and kinds of yarns to be used.
- Step 2. Estimate yardage of each or preferably, measure by running through a mechanical counter. Calculate the number of warp ends obtainable of each by dividing the total yards on hand by the Total Warp Length of your project.
- Step 3. Make the card experiment described above to determine the approximate or average number of ends per inch.
- Step 4. Wind spools of the greatest quantity of yarn on hand first. If possible, have some with sufficient yardage to equal $\text{width} \times \text{Total Warp Length}$. Distribute the other lengths on various numbers of spools.

Step 5. Arrange spools on creel:

- (a) Set up your creel first with the spools to be used in every inch (or containing the greatest amount). Next, add the spools with the least number of yards or ends on them. If these are not sufficient to make the desired ends per inch, add spools with the next smallest amount of thread on them to do so.
- (b) Wind each edge or end section first. Continue winding first one end and then the other until the smallest spools run out.
- (c) Replace these with other spools and continue winding alternate end sections working toward the center until the beam is filled in.
Note: This winding order of the beam can also be reversed, working from the center out.
Suggestion: Use simple weft of the same colors or materials as the warp. Simplicity is most effective.
- (d) Don't be afraid of adventuring a little in warping. A few tries and you see infinite possibilities in this easy method of distributing your allotted warp threads and colors.

HOW TO PLAN AND APPLY STRIPES AND PLAIDS IN THE WARP

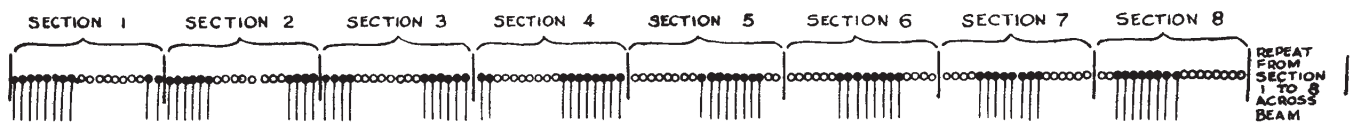
There are generally two kinds of stripes:

- (a) Stripes of equal size.
- (b) Stripes or areas of unequal size.

Stripes of Equal Size:

1. Make a sketch of the proposed stripes actual size on plain or graph paper, so that you will know the plot width by inches. If possible, end the edge of the stripe with the end of the inch section.
2. To chart the threading, a simple type of diagram can be made on plain paper, using tiny circles to represent your threads per inch on the beam drawn in between lines representing the pegs.

EXAMPLE:



This is a diagram for the following:

Checked material 18 ends per inch, to be 36 inches wide.

Design: Equal size stripes of two colors in the warp and weft, alternated.

Weave and Threading: 16 thread herringbone twill.

Any color combination for warping stripes or plaids can be similarly diagrammed, but *the whole repeat* of the design must be included. Notice in the above chart that the edge of the stripes *are not* contingent with the ends of the inch section, so it is necessary to extend it to the point where the diagram repeats itself. Your work is greatly simplified when the *edge of the stripes are even with the ends of the inch sections.*

- Each of these sections are wound on the sectional beam as described for alternate color warps, reading the diagram from left to right in the same way, placing the spools on the creel in the same way, and winding the sections of the beam in their respective order. In the above diagram, for instance, section 1, 9, 17, etc., would be wound first.
- For calculating amount, see under "Plaid Example" to follow.

Directions for Winding Spools for Stripes

As they are wound place the spools of the first section on the creel in their respective position. Place the others in rows on a table, each row representing the various sections of the repeat.

- Have a graph cartoon of one full "repeat" of your design. Determine the number of repeats in the width of your project.
- Begin at left side of your graph. Wind one spool for each colored thread in the first inch section of the "repeat". Each spool will contain the Total Warp Length \times Number of "Repeats".
- Next, wind the threads of the second inch section calling for the same color and material. You can use as many spools as necessary of those already wound, adding yarn to them. Amount to be added: Total Warp Length \times Number of Repeats. Don't overload your spools. If necessary wind additional ones.
- Wind separate spools for ends of any of the other colors of the section, each containing the

amount of Total Warp Length \times Number of Repeats + Tying-Off Length. Adjacent sections calling for the same respective yarn may be added on spools already wound if desired, as before.

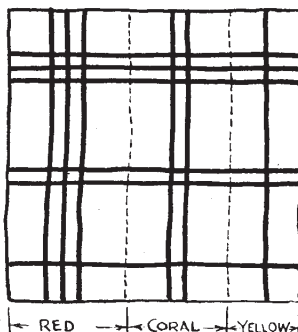
- Continue until you have prepared sufficient spools of colors to correspond to those in the repeat of your design.

To Wind Beam:

Follow your graph and arrange creel for each inch section of your repeat.

- Wind the first section of all repeats across the beam, using the spools having the multiple ends first.
- Wind the second section, using spools with the multiple ends again, if necessary.
- Continue, similarly winding each succeeding inch section of the repeat until the beam is warped.

Example of Planning and Warping a Simple Plaid



The Design Cartoon:

The full "repeat" of pattern occupies 3 inches of width.

Material calls for 24 ends per inch.

Color Proportion in Warp:

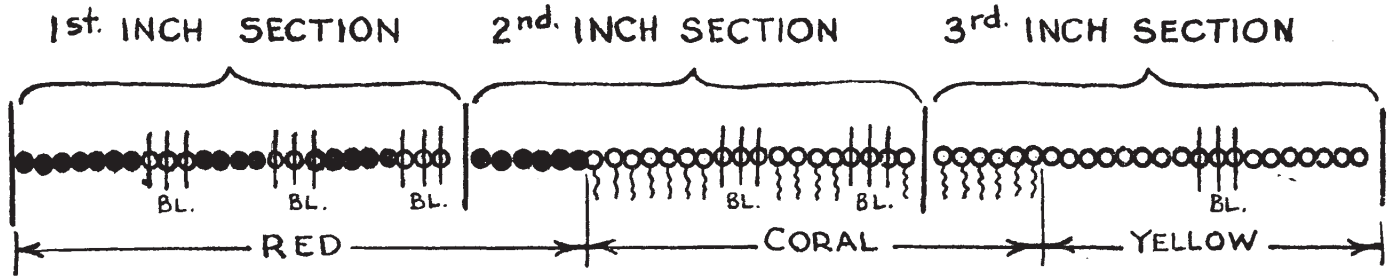
1 1/4 inches of red area = 30 ends.

1 inch of coral area = 24 ends.

3/4 inch of yellow area = 18 ends.

Each black stripe = 3 ends. There are 3 black stripes in the red area, 2 stripes in the coral area, and 1 in the yellow, each replacing respective ends of color in those sections.

The Graph Cartoon:



Order of Spool Winding:

On 36-inch material, total warp length of 7 yards:
 $36 \div 3 = 12$ pattern "repeats".

First Section:

Wind 15 spools of red:
 $7 \text{ yds.} \times 12 \text{ repeats} = 84 \text{ yards each.}$
 Wind 9 spools of black:
 $7 \times 12 = 84 \text{ yards each.}$

Second Section:

Add to 6 red spools of first inch:
 $7 \times 12 = 84 \text{ more yards of red.}$
 Add to 6 black spools of first inch:
 $7 \times 12 = 84 \text{ more yards of black.}$
 Wind 12 coral spools:
 $7 \times 12 = 84 \text{ yards on each.}$

Third Section:

Add to 6 coral spools of second section:
 $7 \times 12 = 84 \text{ more yards of coral.}$
 Add to 3 black spools of second inch:
 $7 \times 12 = 84 \text{ more yards of black.}$
 Wind 15 yellow spools:
 $7 \times 12 = 84 \text{ yards on each.}$
Note: Add Tying-Off Length on all spools.

Creel Arrangements:

	CREEL ARRANGEMENT	KEY	SPOOLS
1 st INCH SECTION	⊗ + ⊕ ⊕	+	BLACK
	⊗ + ⊕ ⊕	⊕	BLACK 168 yds.
	⊗ + ⊕ ⊕	⊗	BLACK 252 yds.
	⊗ x x	x	RED
	⊗ x x	⊗	RED 168 yds.
	⊗ x x		
	⊗ x x		

	CREEL ARRANGEMENT	KEY	SPOOLS
2 nd INCH SECTION	x ⊗ + ⊕	x	RED
	x ⊗ + ⊕	+	BLACK
	x ⊗ v	⊕	BLACK 168 yds.
	x ⊗ v	v	CORAL
	x ⊗ v	⊗	CORAL 168 yds.
	x ⊗ v		
	⊗ + ⊕		

	CREEL ARRANGEMENT	KEY	SPOOLS
3 rd INCH SECTION	v o o o	v	CORAL
	v o o o	+	BLACK
	v o + o	o	YELLOW
	v o + o		
	v o + o		
	v o o o		

Calculating Amount of Yarn Needed:

1. In projects where warp colors are in equal quantities, divide the Total Warp Ends of the project width by the number of colors used.

Example: Red, purple and blue stripes of equal width. 864 Total Warp Ends of 7 yd. Total Warp Length.

Total quantity of each color needed for project:
 $864 \div 3 = 288 \text{ ends} \times 7 = 1976 \text{ yards of each color for warp.}$

2. In estimating amounts of each color for warp in striped material:

Multiply number of ends of each color in the repeat \times the number of repeats \times total warp length = Amount of Warp of Each Color Required.

NOTES