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FIGURE INDEX

WEAVING INSTRUCTION PREFACE

Learning to warp and weave on an AVL loom will mean learning some new procedures and techniques even for the experienced weaver. Since the looms will not function to their full capacity unless care is taken to dress and operate them properly it is greatly worth your while to study the following instructions in detail. The time taken to really make these procedures your own will result in increasing your weaving speed and efficiency, and this leads to a greater enjoyment of the entire weaving experience.

PREPARATION FOR WEAVING

This section has been written with the beginning weaver in mind. If you do not find yourself in this category you can proceed to the section titled WARPING THE LOOM (see index).

You beginning weavers (we use the word "beginning" here to denote those people who are not, as yet, addicted to the act and the art of weaving) stay right here and we'll go step-by-step through the process of planning your first warp.

The step-by-step process that follows is meant only as an introduction to the weaving process. It is a simplified explanation only - a starting point, if you will, and is presented here to give the beginning weaver an overview and a small but firm foundation upon which he or she can build. Refer to the booklist for sources of further study.

EQUIPMENT NEEDED FOR WEAVING

In addition to your loom the following equipment is necessary:

1. Some means to measure warp threads, i.e., warping board, warping reel, sectional beam, and tension box or even two chair backs, spaced half as far apart as the length of your warp.

2. Some kind of raddle: either a homemade raddle or an AVL raddle will do. The AVL raddle is nice as it not only spaces the warp ends out evenly but centers them as well. This comes with a removable top which, when tied with a security cord, assures that the ends will stay in the raddle until you have wound all of your warp onto the beam.

3. Shuttle: some kind of shuttle boat, stick or otherwise, is needed to carry the weft through the warp. Available through AVL are boat shuttles, which have their own tensioner. Once the tensioner on the AVL shuttle is set, the infamous "beginner selvedge problem" is minimized and weaving becomes more effortless and less time consuming. These are appropriate for small to medium/large weft threads. If rags, large ribbons, or very heavy weft threads are to be used, a stick shuttle would work better.

4. Bobbins: If a boat shuttle is to be used, bobbins are needed. These can be ordered through AVL, six at a time.

5. Bobbin Winder: If bobbins are to be used, a hand or electric bobbin winder is essential, as improperly wound bobbins are a major cause of uneven selvedges.

6. A Bench: Some sort of bench or seat is necessary. It is important to have it be the proper height so that your feet rest comfortably on the treadles. A bench is available through AVL.

7. Sley Hook, scissors, pins, needles, a small hook for threading shuttles and a measuring tape.

HOW THE LOOM WORKS

A loom is a tool which enables a person to transform separate threads into a cohesive unit called cloth.

There are various methods of getting the warp threads measured and onto the loom. Only one example of each phase is given here. This section is given simply to present the reader with a general overall view of how a loom works.

A condensed version of the "thread to cloth" process, using fabric as the end result is as follows. (There are detailed instructions given in later sections.)

Design

This phase involves the planning of the length, width and the ends per inch of the fabric to be woven. The composition elements - the color, texture and pattern are also determined at this time.

Warping

This phase involves the measuring of the "warp threads" and the "dressing" of the loom.

1. Warping Board

   One of the tools used for measuring threads is called a Warping Board. A warping board is a frame with pegs around which individual strands, called warp threads, are wrapped. Located at either end of the warping board are two pegs around which individual threads or groups of threads can be crossed to keep each of them in the correct sequence. At one end of the warping board this crossing point is called the threading cross. At this point individual threads cross each other so that each is separate and remains in the order laid down. To visualize this cross simply cross the fingers of one hand into the fingers of the other hand so that they form an "X". This cross is used while threading the loom and insures that each warp thread will be in the correct order.

   The cross at the other end of the warping board, called the raddle cross is different than the threading cross in that the threads are crossed in groups. The groups correspond to the "dents" or spaced openings in the raddle. The AVL raddle has four dents per inch.

If the warp has eight threads per inch, then there would have to be two warp threads in each dent of the raddle. Therefore, the raddle cross groups would have two ends in each. (If the warp had 12 ends per inch the raddle cross groups would have three threads in each.)

2. Raddle

The raddle is a tool used to help spread the warp evenly across the beam while "dressing" or "warping" the loom.

The warp, after it is removed from the warping board, can be set into the raddle dents. This is done by placing one raddle cross group in each successive raddle dent thereby centering the warp as well as separating it for even distribution along the beam. The warp ends closest to the raddle cross are looped around a warp stick and set into the groove in the warp beam.

3. The Warp Beam

The warp beam is the beam around which the warp is wound prior to weaving. Once the ends are connected to the warp beam they can be wound around the beam. This is accomplished by one person holding the threading cross end of the warp under tension while the other person turns the warp beam crank.

4. The Heddles and Harnesses

The warp ends are then threaded through the heddles. Heddles, in this case, are polyester strings which are attached above and below the harnesses. Harnesses (also called shafts) are wooden frames which either go up or stay down during weaving, bringing with them the heddles and thereby the warp ends.

5. Reed and Beater

The reed is a metal frame with dents through which the warp ends are then threaded or "sleyed". The reed is a part of the beater and is used to beat the crosswise or weft thread into place.

6. Cloth Beam

The cloth beam is the beam around which the cloth rolls, after it has been woven.

7. Treadles

The treadles are foot pedals which, when depressed lift the harnesses thereby creating a "shed".

8. Shed & Shot

The shed is the space between the raised and unraised warp threads through which a crosswise or "weft" thread is placed. This weft thread is called a "shot" or "pick".

9. Shuttle

The shuttle is a tool used to carry the weft.

HOW TO GET FROM HERE TO THERE

What to Weave

The first thing you need to do is decide what you want to make. The choices are limitless on a 40" loom - scarves, shawls, blankets, dress and suit fabric, upholstery, towels, table linens, loom shaped shirts, etc. The object of this section is to get you, the beginning weaver, familiar with your new loom and with weaving so that you can continue your study with a foundation based on experience. For this reason we offer you instructions for a simple yet versatile warp that can be used to weave four 12" x 18" placemats. You can either follow along and actually use this information to guide you in creating your first warp or you can read it as one might read a book, using it only as a basis for which to design your own warp. If this is your first experience in weaving we suggest you follow the instructions and actually go through the steps. There is no better way to learn than "to do". It can be challenging and fun and you will have the added benefit of the finished product that you can display proudly or give to a special friend.

The Warp

The warp is nothing more than individual threads that will be made into a set of parallel strands called warp ends. These will then be wound around the warp beam, extended through the loom and wrapped around the cloth beam. Cloth is woven as certain warp ends are lifted and a thread is put between the raised and unraised warp ends, perpendicular (or crosswise) to the warp. This crosswise thread is called a weft thread.

Different weaving patterns are created simply by lifting certain warp threads at certain intervals.

Warp Setts

A warp set is the number of warp ends per inch. This is often referred to as e.p.i. For this warp we will use a 3/2 mercerized pearl cotton. The warp sett or e.p.i. will be 12. This means that there will be 12 ends for every inch of the width of the warp.

The width of this warp will be 13 inches. We want the finished placemats to be 12 inches wide. The extra inch will allow for shrinkage and draw-in. (We'll explain draw-in a little later.) This gives us 13 inches of warp, each having 12 warp ends. If we multiply these we come up with 156 warp ends. Each of these must be the same length.

Draw-In and Shrinkage

There is a certain amount of draw-in that occurs at the selvedges. This is due to the fact that the weft thread is being pulled against the end selvedge threads.

We have allowed a full one inch for draw-in and shrinkage. As you gain experience you may find that your draw-in is less. However, there will always be some shrinkage when you remove your weavings from the loom and more due to washing. It's hard to determine exactly how wide or long you can expect your finished product to be but with experience you can learn to judge this fairly accurately.

Warp Length

To determine the length of the warp requires a little figuring. We're going to weave four placemats, each 19 1/2 inches long. (Again, the extra inch and a half is for shrinkage.) There will be a one inch fringe or hem (depending upon the preference of the weaver) on either end of each placemat.

There is a certain amount of warp material that will inevitably be wasted at the beginning and end of each warp. This excess is called thrums and is approximately 12 inches at the beginning of the warp and 12 inches at the end of the warp. As you gain experience you may be able to decrease this waste by a few inches.

The length of the warp will be all of the above added together plus a bit for experimentation and just getting used to your new loom.

Thus we have:

4 placemats each 19 1/2 inches long	4 x 19 1/2	= 78
8 one inch fringes or hem	8 x 1	= 8
24 inches of loom waste		= 24
34 inches for experimentation		= 34
		144 inches

Now we need to convert this to yards since that's the unit that the yarn will be measured in. 144 divided by 36 = 4 yards.

Now we know that we need 156 warp ends each 4 yards long.

To figure out the total amount of yarn needed for the warp just multiply the "156 warp ends" by the "4 yards long".

156 x 4 = 624

The total amount of warp yarn needed then is 624 yards. Since we will be using a "balanced weave" pattern (i.e., there is an equal amount of warp and weft) you'll need to get about that much weft material as well.

Designing Your Warp

It's time now to design your warp. This involves choosing what you want your warp to look like, ie; whether it will be all one color or have a background color with border stripes or stripes all the way across. Use your imagination and your sense of balance. You'll need to determine how many yards of what color yarn are needed. It's a good idea to buy all of the yarn of one color at one time since the coloration from different dye lots can vary.

If you decide on a solid color warp and weft you'll need 624 yards for the warp and about that much for weft - 1248 yards of fiber. If you want a one inch border stripe down each side of the warp you'll need 2 inches (at 12 epi) of one color for a total of 24 warp ends. Since each of these would be 4 yards long you'd need 24 x 4 yards = 96 yards of the stripe color for the warp (double that if you want some weft stripes) and the remaining yardage would be the background color. (In this case 624 - 96 = 528 yards.) Remember to get yarn for the weft as well.

If you have a local yarn shop you can simply ask the clerk there to steer you to the 3/2 mercerized pearl cotton. If you have no local yarn shop you can send off for yarn samples through a weaving magazine and make your choices in your own home.

Kinds of Weaves

There are many different classes of weaves. We will explore only two of these - the plain weave or tabby and the 2/2 twill weave. These are both balanced weaves as half of the harnesses come up in each shed. Although the weaves themselves are simple, many different and beautiful effects can be achieved through the use of varying colors and textures of threads.

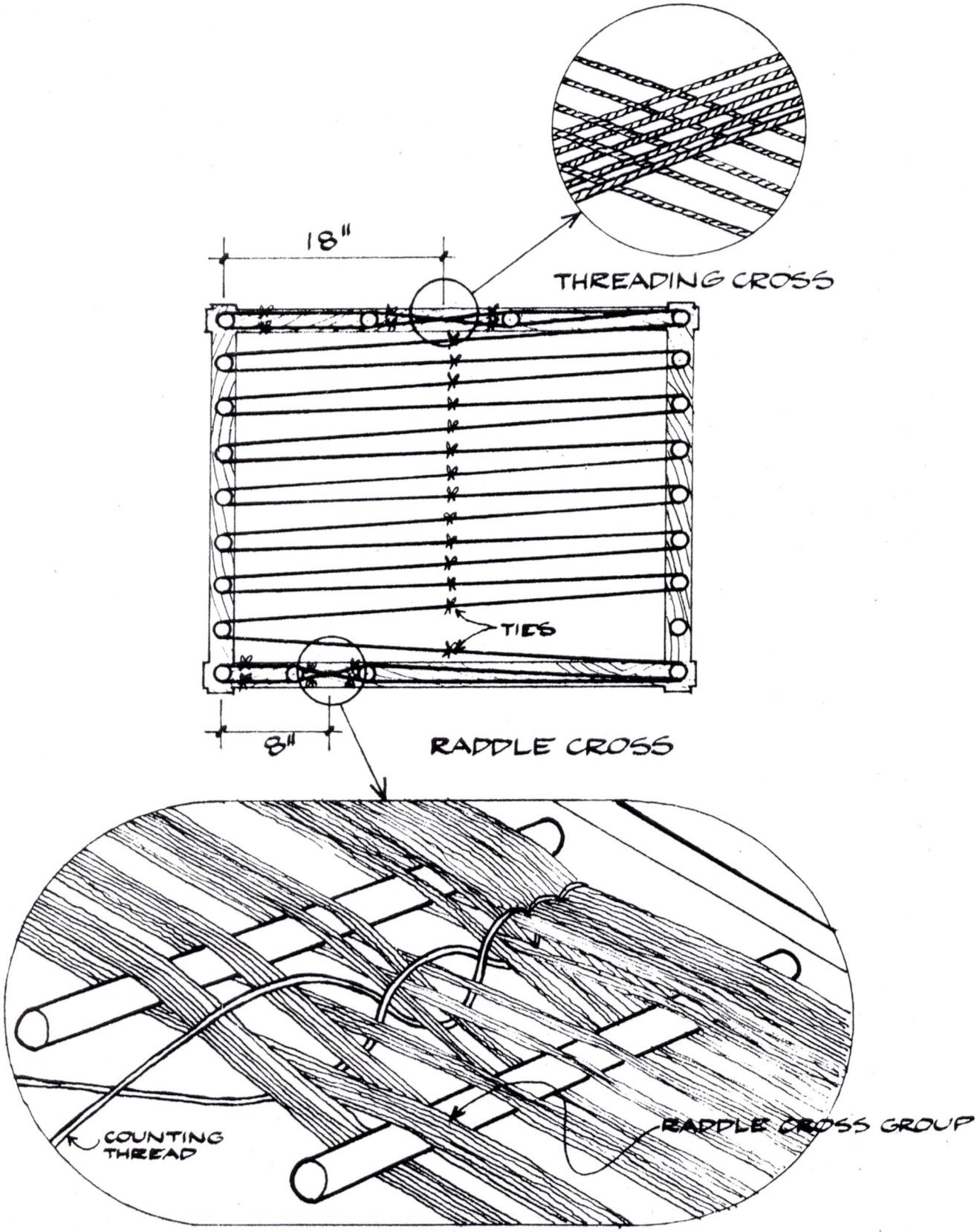
Selvedges

The threads on the sides of the warp are referred to as selvedge threads. For our purposes there won't be any differentiation between these and the rest of the warp threads. Often times however, in more complicated patterns the four to six threads on each side of the warp that comprise what is called the selvedge are threaded differently then the rest of the warp. They are threaded so that they will weave a plain weave, no matter what the rest of the warp is weaving (more about this later). This is

done to insure a nice, even edge and is good practice as it adds to the quality of the finished product.

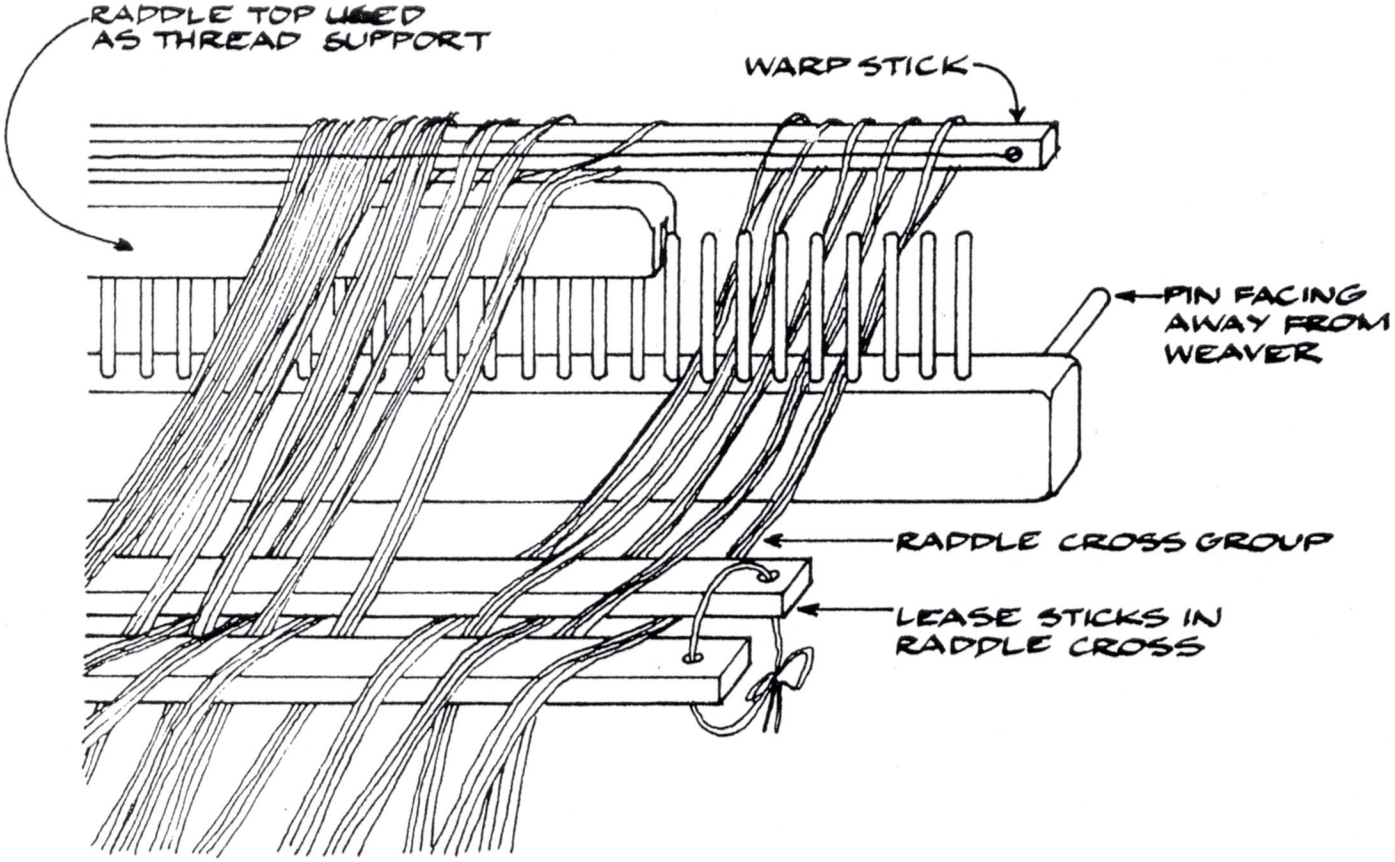
That's all there is to planning a simple warp. There is much to learn and experiment with - as we said this is just a starting point.

Now that you have your warp planned we'll be joining the more experienced weavers in the next section. Here we go!



WARP ON WARPING BOARD WITH TWO CROSSES

FIG. 37



THREADING THE RADDLE

FIG. 38

WARPING THE LOOM

1. Plan your warp width and length.

   For looms ordered without the rear cloth storage system it is important to consider how fast the cloth will build up on the front beam. If the cloth builds up too high in front it will cause the bottom shed to be tight and the top shed to be loose. To avoid this, plan your project so that the fabric can be taken off the cloth beam in sections. These looms are especially designed so that this can be done very easily in a few minutes (there is a simple method described later). The length of the woven sections depends on the thickness of the materials used. In general, these sections could be as long as 12 yards for a fine fabric, 9 yards for a medium fabric and 4 yards for a thick fabric. You will find what works the best with a little experience.

2. For looms ordered with the rear cloth storage system, the cloth can be routed to the back of the loom after weaving approximately 2 yards. This process will be described in a later section.

3. Various warping methods can be adapted to the AVL looms. However, we recommend the following method in which the warp is wound on from the back of the loom with use of a raddle. Please study this method and try it. We have found that it aids in getting a uniform warp tension which is especially important when dealing with warps of 20 yards or more.

   To begin, first wind the warp on a warping board or reel (see Figure 37). Make sure you put in two crosses. The threading cross is about 18" in from the first peg and the raddle cross is about 8" in from the last peg. In the threading cross, each thread crosses the next thread in opposite directions. In the raddle cross, groups of threads cross each other. The number of threads in a raddle cross group is determined by the number of ends to be placed in each section of the raddle. Since this will vary with each warp, take a minute before starting to wind your warp on to your warping board or reel to figure out how many threads will be in each raddle cross group. To determine this you must first know the number of ends per inch in your planned weaving and the number of divisions per inch in your raddle. Sometimes this will be merely a matter of division as with 12 EPI and a 4 dent raddle; there will be three threads in each raddle cross group. Other times you may have to fool with it more and have different numbers of threads in each raddle cross group. For example with 15 EPI and a 4 dent raddle you could use the sequence 3, 4, 4, 4, in the raddle cross groups (the AVL raddle is a 4 dent raddle).

Another possibility is to plan on threading the raddle a few inches wider than the warp will be sleyed. For 15 EPI and a 4 dent raddle, use three threads in each raddle cross group. This will mean your warp will be threaded through the raddle at 12 EPI even though it will be sleyed through the reed at 15 EPI. As long as the warp is no more than 2 or 3 inches wider on either side of the raddle than it is through the reed, this sleying creates an ideal angle for the selvedge threads traveling across the loom as they won't be bent by the draw-in at the web of the fabric. Never plan on threading the raddle thinner than the warp will be sleyed or the selvedge threads will be very bent and poor tension will result.

4. As you are winding your warp onto the warping board or reel, it is a good idea to use a counting thread at the raddle cross to keep track of your warp threads (see Figure 37). If you are using 3 threads in each raddle cross group you know you will have 12 threads when four raddle groups intersect. As the winding process proceeds, keep the raddle cross groups somewhat spaced apart and forward on the pegs so that you can see them easily and until 4 raddle cross groups are complete. Then twine the counting thread, once around all four groups. This bundle can then be pushed back on the pegs. Continuing in this manner it should be easy to count the number of bundles. Divide the number of threads in each bundle into the total warp ends needed to find out how many bundles will be needed. When you are sure you have the correct number of warp threads remove the counting thread.

5. Now secure both crosses and make <u>TIGHT</u> choke ties. Do <u>NOT</u> cut the end loops; instead secure them firmly with two or three ties so that the ends maintain their loop and cannot fall apart. This will save you time later. Then remove the warp from the warping board by chaining (or better still, using a drum or other device for keeping the warp taut) from the threading cross to the raddle cross.

6. Place two thin 3/16" lease sticks in the raddle cross and secure together with string or plastic ties through the holes in the ends of the sticks (see Figure 38). Then place one of the fatter 7/16" warp sticks in the end of the loop of the warp closest to the raddle cross. If you secured the loop properly this only takes a second, otherwise you have a mess.

   Take a long piece of string and run it across the warp stick, through the holes in both ends, around the other side and tie it together forming a security cord so the loops cannot slide off. Now remove the original ties from the ends loop and raddle cross and spread the warp out on the sticks.

Note: On the subject of lease and warp sticks, you may find it helpful to paint half of your sticks white and paint the rest of them black. The object here would be to use the black sticks on lighter colored warps and vice-versa, thereby giving you a higher contrast between the lease or warp stick and the warp ends. This tends to make thread selection easier during threading.

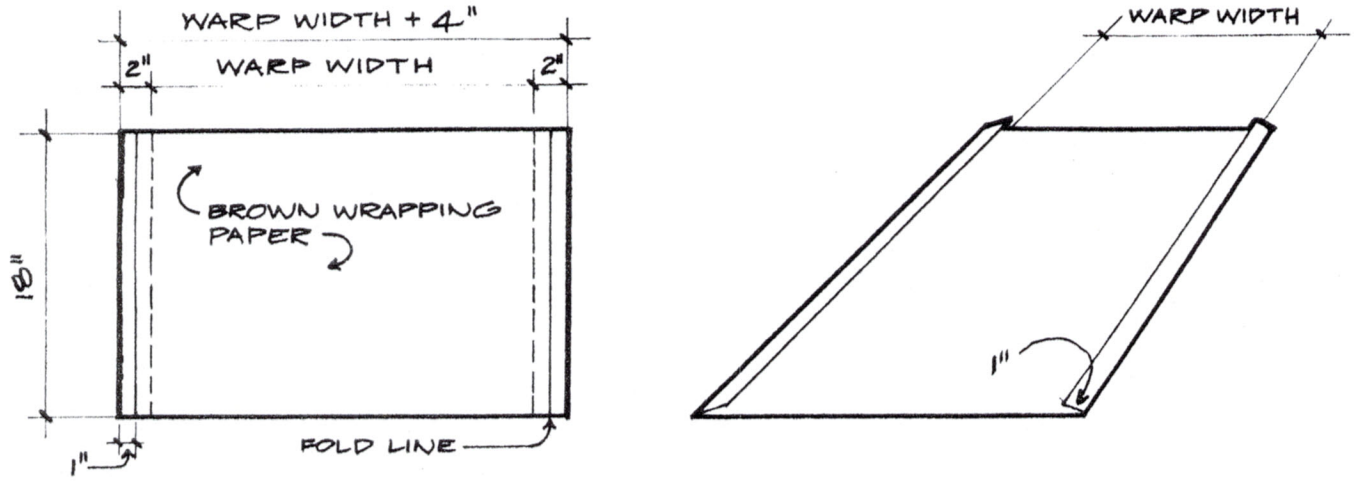
7. Working at a table, distribute yarns through the raddle by dropping each raddle cross group into a dent in the raddle as in the diagram. Make sure the warp is centered and secure and the pin is oriented as it is in the drawing. If you are using a sliding raddle cover secure it with 2 or 3 cord ties so it can't come off. Remove the lease sticks when this is completed.

8. Now secure the raddle to the back of the loom. If you have an AVL raddle simply slip it into the set of holes that are underneath the warp beam. If you are using some other raddle, you will need two 1/4" pieces of doweling six inches long. Insert these into the same holes and then tie your raddle to these.

9. Route the warp stick and ends between the separation rollers and either up to the standard beam or down to the second beam.

10. Making sure the loops in the end of the warp are centered and distributed evenly along the warp stick and place the stick into the groove in the warp beam. If an unusually thick warp is used, apply pressure or even a hammer if necessary. Secure the stick in the groove by binding either side of the warp with string. Note here, that the purpose of the grooved warp beam is not only to eliminate the time spent either lashing sticks together or cutting and tying ends at the back of the loom, but more importantly to create a warp roll which is smooth and free of lumps and bumps. This feature is a great aid in creating an even tension in the weaving and creating professional results especially with longer and finer warps. (A special system will be described later for extending the last few feet of the warp so that there is very little warp waste.)

11. Next prepare paper for winding between warp layers. Again, for the most professional results and few tension problems, we suggest that the warp be as smooth, tight and compact as possible. This would mean not using corrugated paper or sticks as they will make the wound on warp too fat and/or lumpy. Corrugated paper is just too soft and the warp can never be wound tight enough with it. A heavy wrapping paper works well, 70 lb. Kraft paper is good. It is not necessary to add to the bulk of the wound on warp by winding paper throughout as a tightly wound warp eliminates any cutting of one layer of warp into another. Actually with a



PREPARED PAPER WITH FOLDED EDGE

FIG. 39

tightly wound warp the paper's only purpose is to support the edge yarns so they will not fall off themselves and create a poor selvedge tension. An 18" long length of paper wound in about every 1 1/2 yards of the warp is sufficient for this.

So cut lengths of paper 18" long and at least 3" or 4" wider than the warp width with enough to have one about every yard and a half of the warp. If you are going to be using smooth slippery warp yarns like fine linens or perle cottons, the edge yarns are going to need extra help in order not to slip off of themselves. To do this, cut your paper 4" wider than the warp width and then fold over the edges an inch on each side. Be sure the warp is wound between the two folded edges but not overlapping them (see Figure 39).

12. Before winding the warp onto the beam most of the tension should be released from the tension system. This can be done quickly and simply by removing the steel ring at the end of the tension cord from its mounting post and placing it on the screw provided on the edge of the folding leg. To protect the smaller spring from overstretching, this procedure should be done whenever the beam is turned in this direction. Using this method you can easily reduce the tension without having to readjust your tension each time you have to back up the warp.

13. When winding the warp onto the upper beam from the back, that is with the warp spread out in back of the loom, turn the warp beam handle in a clockwise direction (see Figure 40).

When winding the warp onto the lower beam from the back, turn the handle in a counter clockwise direction.

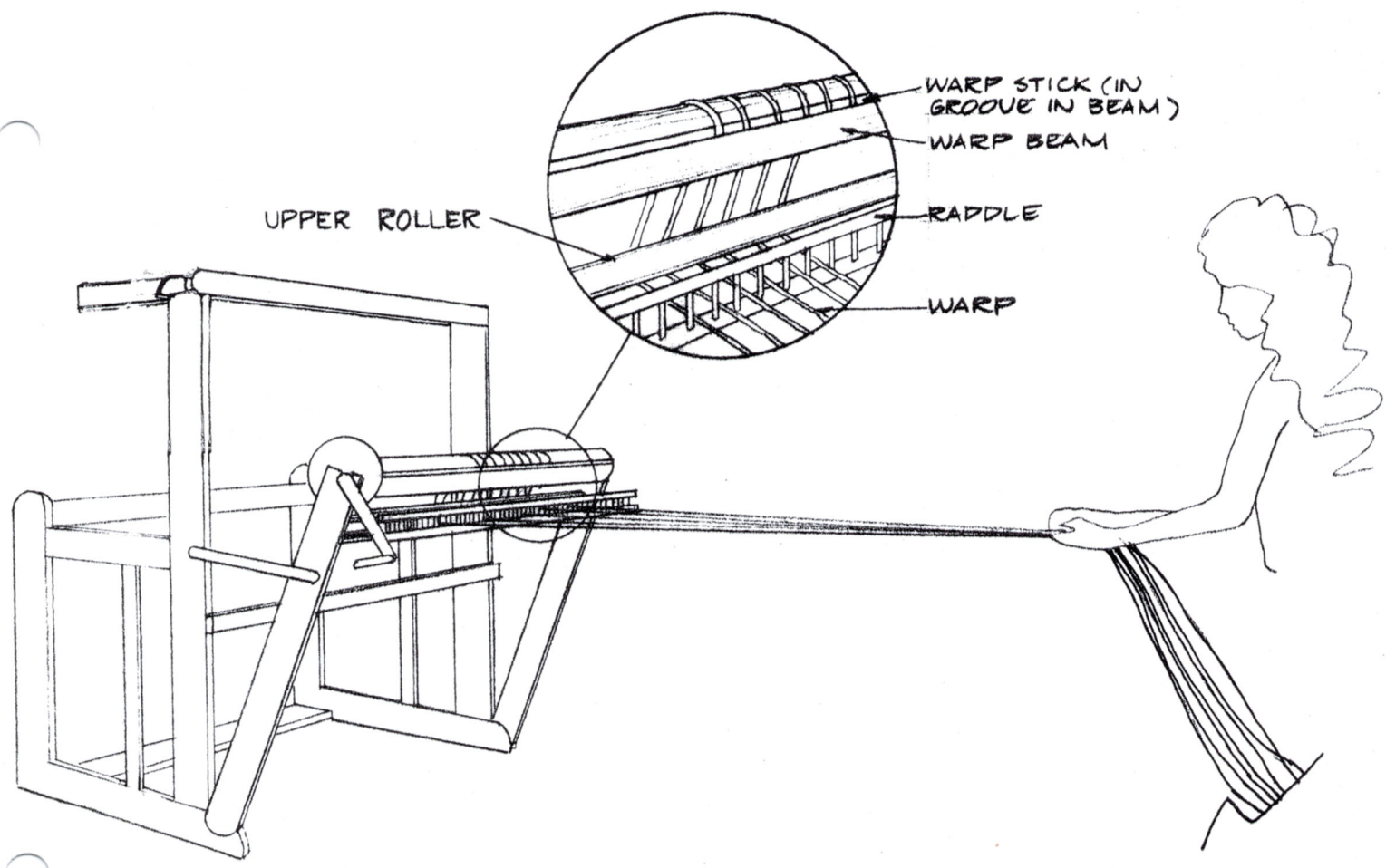
Remember to wind the warp **TIGHTLY** under alot of tension. This will vary with each warp material but a good rule to remember is that the tension of the wound on warp must be greater than that put on it during the weaving operation. For a wide, heavy warp several helpers may be required. If the choke ties are very tight and enough tension is applied to the warp, most of the combing should be unnecessary. Watch the edge yarns and wind in a layer of paper when they have built up to a point where they will no longer support themselves.

14. If your warp has wound on nice and even without a lot of combing, try this method for winding on the last two or three yards of warp: put a square warp stick through the loop in the end and put the two thin lease sticks in the threading cross. Tie all sticks so they can't fall out and put a heavier stick through the loop to pull on. Then remove all the ties and spread the warp out. Continue winding until the threading cross is about 1 1/2 feet from

the warp beam. This method will eliminate the acute angle which is formed as the end of the warp comes close to the warp beam. With narrow warps this is not necessary.

15. When the warping is completed, free the warp from the raddle. If you have an AVL raddle first untie the security strings, lift the raddle top off and remove the warp from the raddle. Afterward replace the top on the raddle and leave it in its place on the back of the loom if so desired. It will not interfere with the weaving process.

16. Route the warp ends and sticks over and through the separation rollers in the manner shown in Figure 41.



WINDING ON THE WARP

FIG. 40

THREADING, SLEYING, and TYING ON

1. To prepare for threading, lift out the beater then remove the cloth beam. This is done by loosening the hex bolt found on the left, above the cloth beam. Keeping one hand on the cloth advance handle lift the cloth beam up and out.

2. Insert two lease sticks into the threading cross and secure with string or plastic ties through the holes in the ends. Remove the choke ties. Tie the lease stick that is closest to the back beam to the cross bar at the top of the loom, making sure that the threading cross is even with the eyes of the heddles. Cut the warp ends so they will be ready for threading.

   Unfasten the chains from the bottom of the lower harness sticks so that the heddles will move easily.

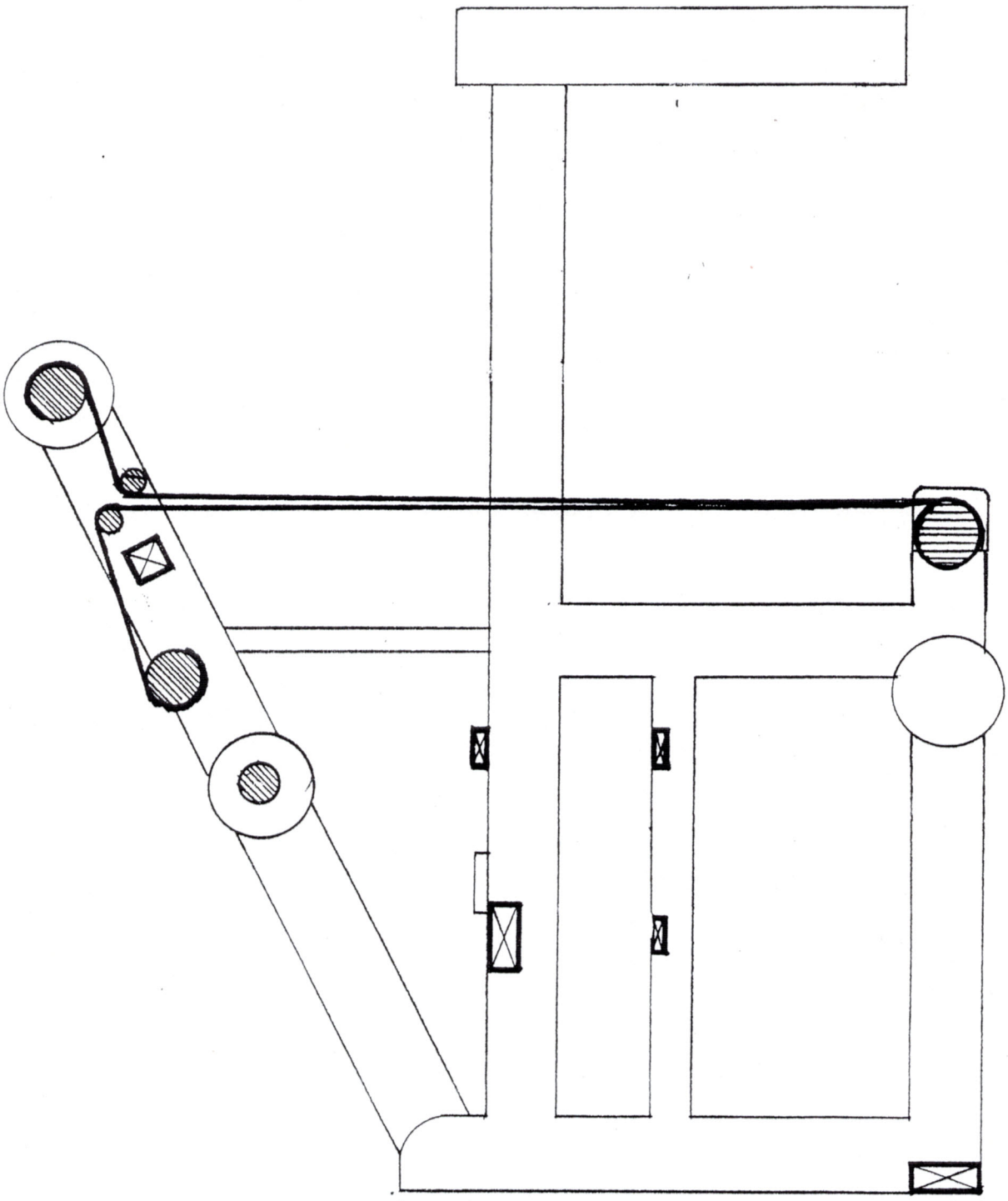
3. Place a small stool in front of the loom to sit on while threading. Ideally, the threading seat should be just the right size so that the heddle eyes are at your eye level or a little higher (see Figure 42). If the eyes of the heddles are lower than your eye level you may experience some discomfort while threading.

   The important thing in threading is your comfort. Take the time to position everything so that your body feels at ease while threading.

   If you prefer, you can use the "shortcut" threading position. This involves simply sitting on the weaving bench with the beater and cloth beam in place. This saves you the time it takes to remove the beater and cloth beam but is not quite as comfortable. It is not too bad, however, if your threading time isn't long. You may want to place a cloth over the cloth beam so the abrasive surface won't scratch you and position the lease sticks so that you can see the cross from your sitting position.

4. Initially you may find that the polyester heddles take you longer to thread than metal heddles because they don't move on the harnesses quite so easily. However, we feel that a multi-harness loom capable of production use should have a light harness action. Therefore we offer as standard equipment, feather light polyester heddles.

   Some weavers, especially designers who thread many short warps, may prefer steel heddles. These may be specially ordered through AVL Looms. There is, however, an increased effort required to treadle the extra weight of steel heddles and harnesses.



SECTION THRU LOOM

ROUTING OF WARP

FIG. 41

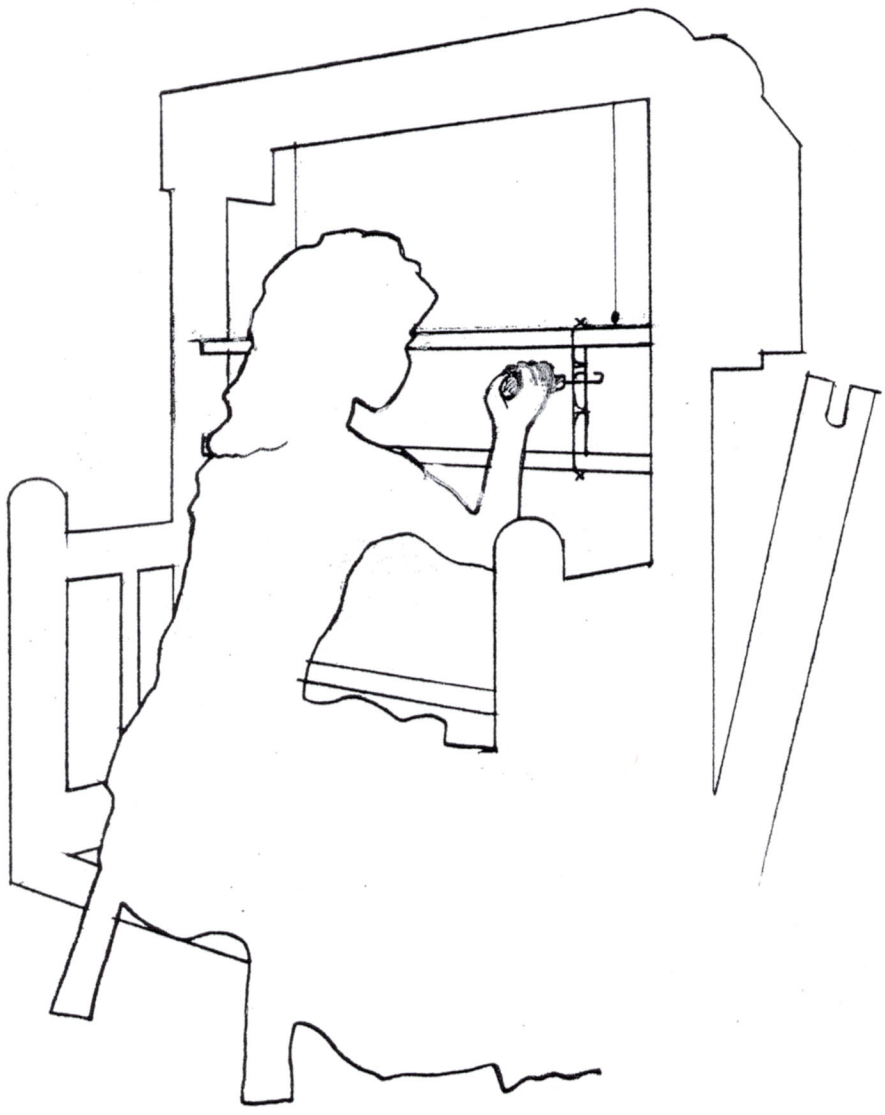


FIG. 42

THREADING POSITION

5. For a plain weave the loom is threaded 4, 3, 2, 1, 4, 3, 2, 1, 4, 3, 2, 1,. That is to say that the first thread on the right side of the warp is threaded through the eye of a heddle on the fourth harness, the second thread through the eye of a heddle on the third harness, the third thread through a heddle on the second harness and the fourth thread through a heddle on the first harness, etc. all the way across (the harnesses are numbered starting from the front most harness).

6. After the heddles are threaded, replace the beater and secure it in a middle position using binding cords. The top of the beater is then removed for sleying. A "ten dent" reed comes standard with the loom. This means that there are ten spaces per inch. With a warp containing 10 ends, per inch you would put one end per slot, written as (1, 1, 1, 1, 1, 1, 1, 1, 1, 1). For 15 epi. you'd put one end in the first slot, two ends in the second, one in the third, written as (1, 2, 1, 2, 1, 2, 1, 2, 1, 2). For 12 epi you could use (2, 1, 1, 1, 1, 2, 1, 1, 1, 1).

   After sleying is completed make sure that the harnesses are in their lowered position and all the chains are attached to the bottom eyelets of the harnesses before continuing with tying on. Make sure that the chains are attached to the right harnesses or the loom won't work properly.

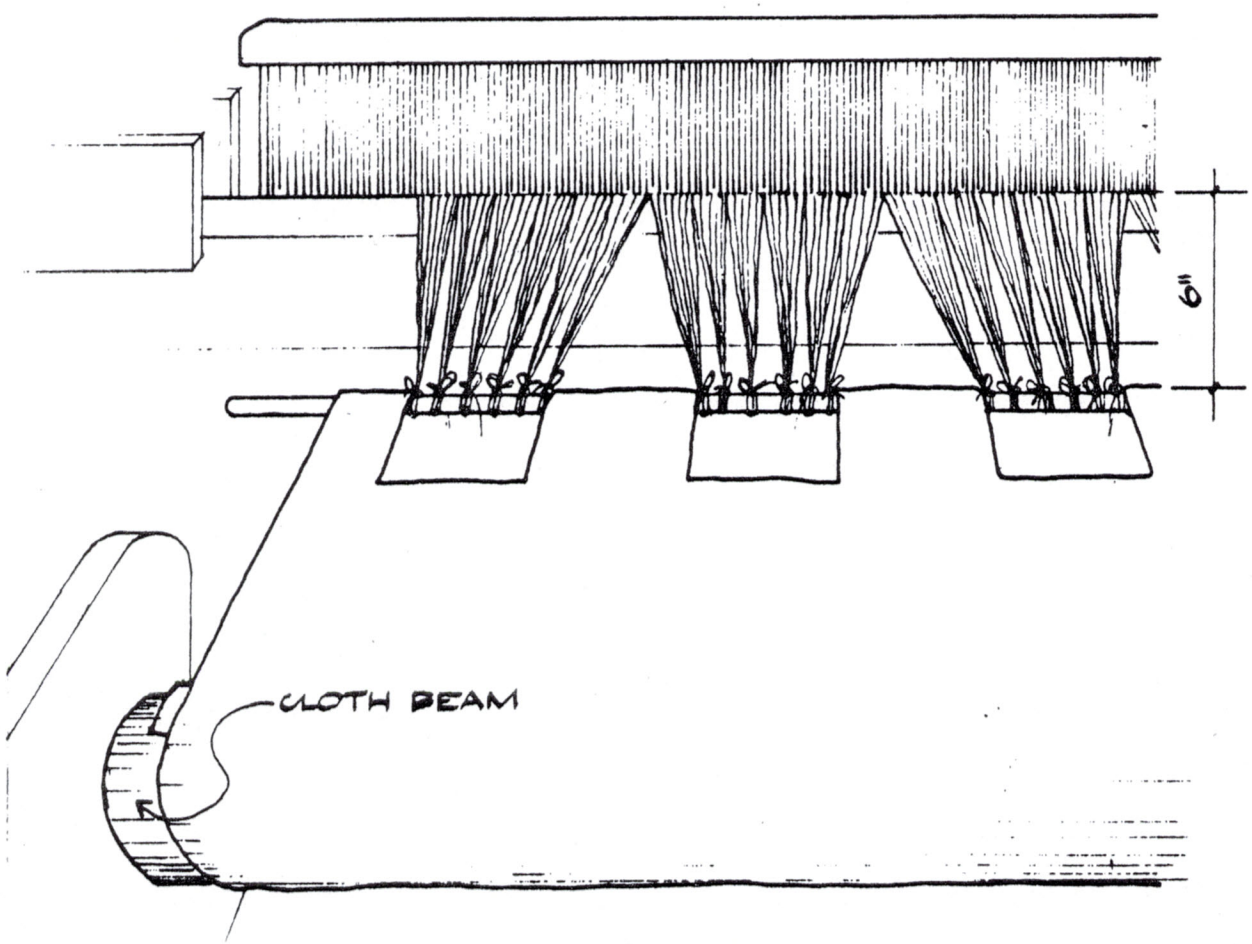
7. Locate the cloth apron that comes with the loom. We call this a temporary apron because it is not attached to the loom and it will be removed early on in the weaving process. (Due to shrinkage problems we suggest that you do not wash your apron.)

   Notice that it has two hemmed ends. One is a hem with openings and the opposite end has a plain hem. Take one of the metal rods and slide it into the hem with openings. Place the opposite end of the apron flat along the cloth beam and wrap it around the beam as is Figure 43 until the metal rod can be extended over the top of the beam to within 6 inches of the beater in its rearward position.

8. The warp is now tied on to the metal rod inside the openings. Tie the yarns on evenly and tautly, but you need not spend a long time fussing with them as once you have set the tension device and woven in two lease sticks (instructions for this are coming up soon) your warp threads will automatically have a completely even and perfect tension.

9. At this point make sure that the unused heddles are all pushed to the outside of your warp. For balance there should be an equal amount of unused heddles on both sides of each harness. In some cases, as when you have a wide warp with a lot of unused heddles on the ends of the harnesses, you may need to tie each group of unused heddles into a tight bundle with tie-tapes or string to keep them from falling off the ends of the harness sticks. Or you may need to take heddles off the loom. (We suggest that you not remove heddles for the first few warps to allow the heddles to stretch.) If you take heddles off your loom after the first few warps, make sure to mark each bundle of heddles with its harness number so it can be put back on the same harness. It is not a good idea to switch heddles to a different harness as the heddles on each harness stretch to different sizes. Mixing them up once they have been stretched out will affect the evenness of the shed.

   If you are threading a full width warp, and will have extra heddles, you may want to distribute the unused heddles among the threaded heddles as the threading is taking place.



TYING ONTO APRON

FIG. 43

SETTING THE TENSION DEVICE

Warp tension is controlled by a special spring-actuated tension drum which insures a constant tension at all times. The tension is easily adjusted and the warp beam is released automatically as the cloth is advanced.

1. First familiarize yourself with the tension device which is located on the left end of the lower beam and at the right end of the upper beam. (The right side of the loom is the side to your right as you are looking at it while sitting in the weaving position.) Notice that the tension system consists of a wooden drum around which a white dacron cord is wrapped four times, one end of the cord being attached to a large spring underneath and the other end attached to a smaller spring on top. Further note that between the end of the cord and the small spring is a small adjusting cord held in position by a plastic clamp (see Figure 44). At the end of this cord is a steel ring that is attached to a bolt on the metal warp tension bracket.

2. Now move the warp forward three or four inches using the front ratchet handle and feel your warp for tension. If it is too loose, increase tension by pulling the two ends of the adjusting cord attached to the small upper spring. If the warp tension is too tight, decrease tension by pressing in on the plastic clamp and letting the adjusting cord out. Then move the warp forward another three or four inches and check again to see if the tension is what you want. Continue this process until the desired tension is achieved. Notice that each time a new tension adjustment is made the warp must be moved forward before the tension is set. Once the correct tension adjustment is made, however, it will be maintained automatically as the weaving is advanced. You will find that you can weave with less warp tension with an automatic tension system than with a conventional ratchet system.

3. In making these adjustments, the warp may be wound too far forward. To wind it back on the warp beam, first unlock the front ratchet handle so that the front tension is released, then go to the back of the loom and turn the warp beam handle in the direction used to wind the beam. Remember that **EVERY** time you are winding any material onto either warp beam you should reduce the amount of tension within the tension system. This can be done quickly by removing the steel ring at the end of the tension cord from its operating position and temporarily hooking it on the nearby screw provided on the edge of the folding leg.

If the tension isn't loosened the small spring may become stretched out of shape. If this happens warp tension problems will result.

After winding the warp back onto the warp beam, check to make sure the cord has not become crossed on the drum.

Wind the warp forward again with the front ratchet handle until the warp tightens and is in the correct position.

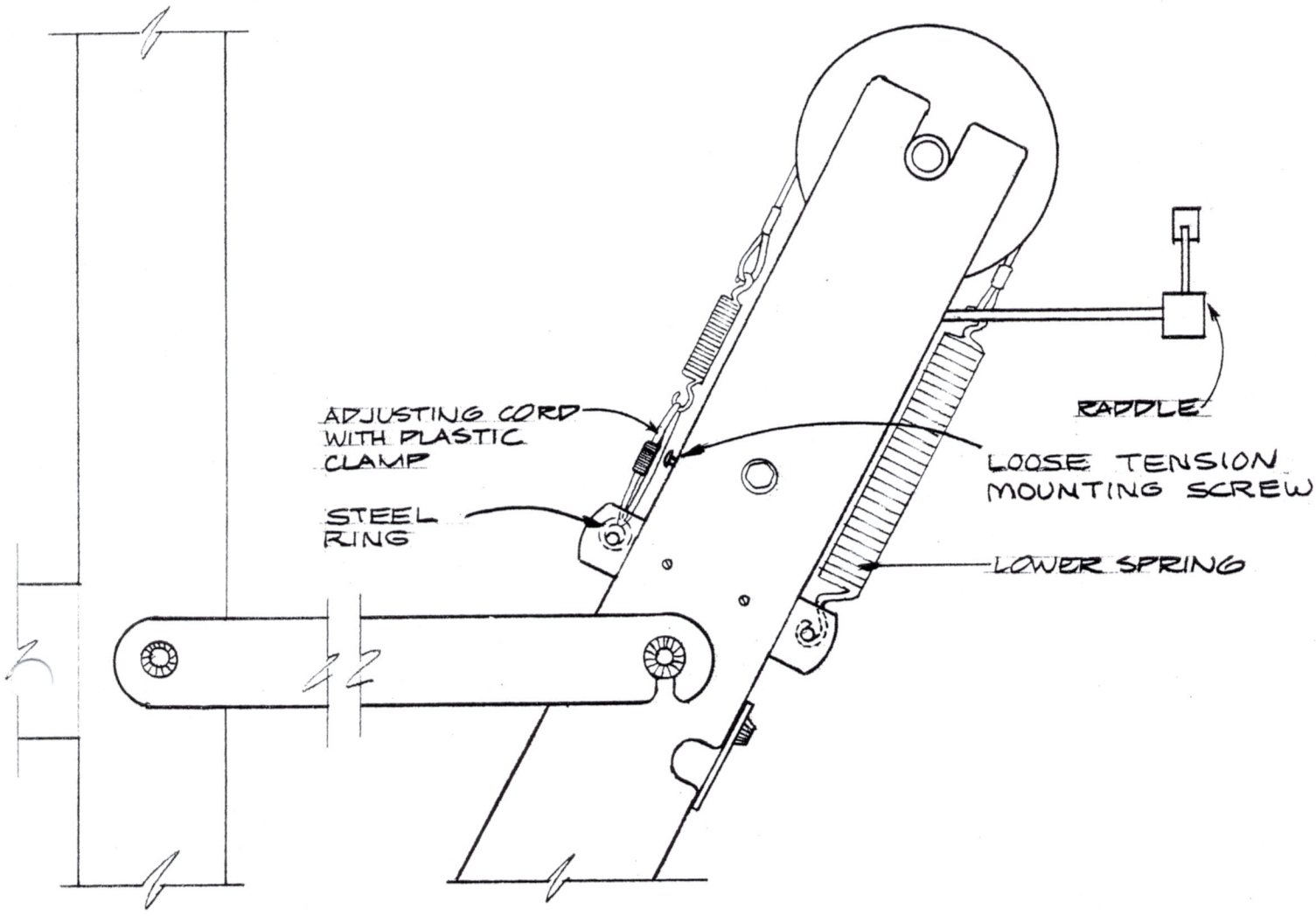


FIG 44

TENSION DEVICE

CONNECTING THE PATCH CORDS

With an AVL modular loom all treadle to harness tie-ups are done at the side of the loom by connecting pre-tied cables to metal clips. This eliminates the necessity of having to climb under the loom and having to make time-consuming cord adjustments as is necessary on conventional looms.

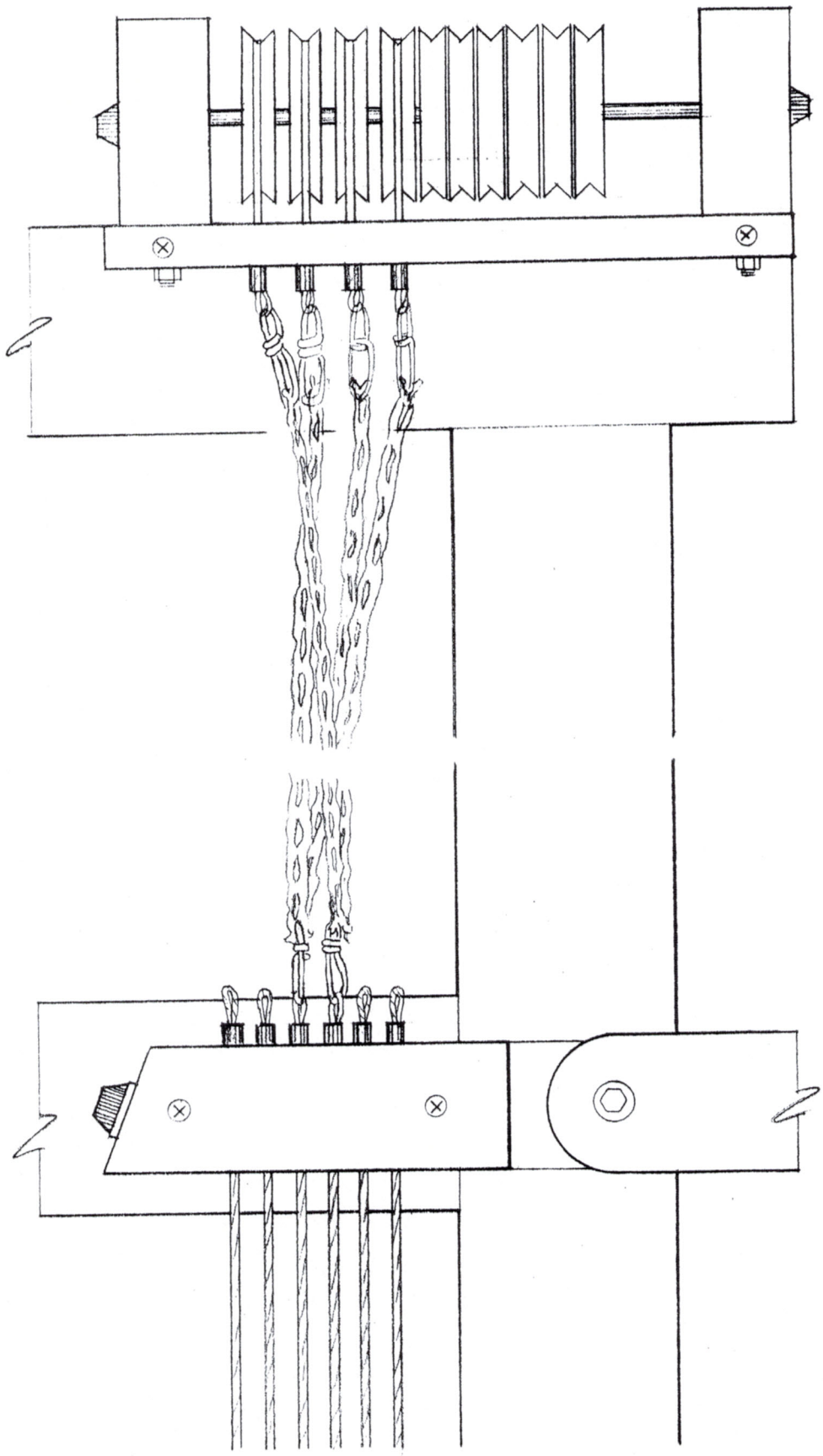
1. On the right side of the modular loom there are two sets of clips-a lower set of treadle clips and an upper set of harness clips (see Figure 45). In the upper set of clips there is one clip corresponding to each harness. In the lower set there is one clip corresponding to each treadle. First tie-up your loom for a plain or tabby weave. It is easiest to make all treadle connections first and then all of the harness connections. For a tabby weave using four harnesses, first connect two patch cords each to the clips corresponding to treadles 1 and 2 (the two centermost treadles). Next, connect the two patch cords from one treadle clip to the clips for harnesses one and three, and from the other treadle clip to harnesses two and four as shown in Figure 45.

   For a 2/2 twill tie-up you may want to use four treadles. Connect one patch cord each to the clips corresponding to treadles 1, 2, 3 and 4. Now connect the patch cord for treadle #1 to harness #3. Connect patch cord #3 to harness #4, patch cord #2 to harness #2 and patch cord #4 to harness #1.

   By depressing the treadles on the left one twill shed is produced and by depressing the treadles on the right the other twill shed is created.

   With this tie-up you can easily alternate between tabby and twill or any other 4 harness weave that is applicable.

2. With more complex weaves using four treadles or more, it is helpful to use a "walking" technique for the treadling. Using this method the tie-up is made so that treadling begins at the two innermost treadles and you can "walk" to the outside treadles using alternate foot movements. With this method you never lift more than one foot at a time and thus are not thrown off balance, and it is easy to establish a weaving rhythm--so important for speed and uniformity in the cloth. You will have to rearrange conventional tie-up plans which read from left to right in order to do this.



PATCH CORD TIE-UP

FIG. 45

ADJUSTING THE BEATER AND SPRING LEVERS

1. In preparation for weaving, the AVL beater is adjusted in vertical as well as horizontal position. First place the beater in one of its three horizontal positions depending on your personal preference and/or how hard the fabric will be beaten. For a very heavy beat, the beater can be placed in its rearmost position. For a very light beat it can be placed in its front most position. Then adjust the height of the beater by using the adjusting wing nut screws near the bottom of the beater legs so that the bottom half of the shed is just touching the shuttle race in the open shed position. To open the shed press downward on any connected treadle.

2. The springs of the spring lever return system should be adjusted so that there is positive harness return. The harnesses should stay all the way down in their bottom position with the least amount of effort needed to raise the harness. This will vary according to the weight of the warp. In general lightweight, less dense, looser tensioned warps with a smaller weaving width will need less spring tension. To tell if the harnesses are returning all the way, open several sheds by working the treadles. To open the shed press down on any connected treadle. Watch the unlifted harnesses and if the tops of their heddles become loose and tend to move around, the spring tension should be increased just enough to get the harnesses to stay down and no more or your treadling effort will be made greater than it has to be.

3. To adjust the spring tension, simply unhook the spring and then rehook it one chain link shorter. This tightens the spring and makes it pull down harder on that particular harness. Test the warp again by doing some more treadling and if more spring tension is still needed, try one or more chain links less. With a medium tight warp it may be necessary to remove the chain link and use only the spring. Under unusual conditions (perhaps a very tight rug warp) two springs on some or all of the harnesses may be necessary. If all the springs are set the same, the back harnesses will have a looser tension than the front. This is because the back spring levers and their hooks are longer since the back harnesses travel farther when a shed is made. Accordingly the back spring levers might have to be adjusted shorter to give the same tension as the front ones. It may even be necessary to cut springs down if you need extra tension back there. The important thing to remember is that the system is designed so that it can be "fine tuned" for each particular warp, so experiment with it. In general, for most medium tension warps you will find that a lot of adjusting is not necessary. The loom comes with as many springs and chains as there are harnesses. If extra springs

are needed you can use 10" screen door springs which can be purchased in almost any hardware store. You can also get extra chain there.

WEAVING PROCEDURES

1. With everything properly adjusted, weaving is an easy and enjoyable process. Sit up straight and comfortably at the loom so that your body remains stationary while your arms and legs work the loom. Start by pushing downward on the treadle to the right of center so that a shed is open and throw the shuttle. Pull the beater forward with a quick wrist movement, then close the shed and open a new one by pressing downward on the treadle to the left of center.

2. To advance the cloth you simply wind it forward by using the ratchet handle while the beater is in its forward position. Make sure the fell of the cloth does not go beyond the beater so as not to have to wind it backwards (see number 3 of **SETTING THE TENSION DEVICE** if this occurs). This easy, rapid method of advancing the cloth makes it practical to wind the cloth up about every two inches of weaving. By maintaining this two inch weaving space the swing of the beater and the shed angle are kept more nearly constant and this makes it much easier to weave a uniform fabric.

3. At the onset of weaving, first weave in 1" of a strong, medium weight weft with the tabby weave. Check the tabby weave for errors. Any errors in the threading or sleying will show up here and it is an excellent time to make corrections. In case of threading error, use the following method for insertion of a new polyester heddle:

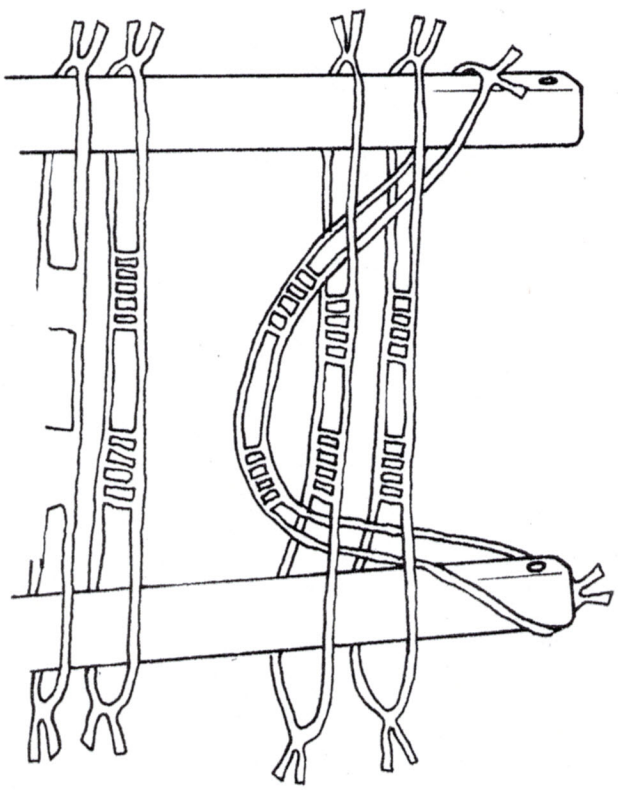
   a. Remove the harness wire from the nearest end of the harness and slip the top loop of the new heddle around the top harness stick and bring it through the top loops of all the heddles until it reaches the place needed.

   b. Take the bottom loop of the new heddle through the bottom loop of the heddles, around the bottom harness stick and back through the bottom loops of all the heddles until it reaches its place (see Figure 26).

   c. Replace the harness wire.

4. Next weave in two thin lease sticks on alternate sheds, followed by another 1/2" of tabby weave. Cloth strips are unnecessary as the two woven-in lease sticks will even out the warp for you.

5. Proceed with your weaving until the woven-in lease sticks have wound around the roller about 1 1/4 times: in other words, until the woven cloth overlaps the lease sticks on the roller.



INSERTION OF NEW HEDDLE

FIG. 46

6. Then release the ratchet on the cloth beam and unwind the weaving back to the beginning. Unwind the weaving and apron from the front roll. Then remove the apron by cutting off the knots which tied the warp to the metal bar, but do NOT cut off the tabby hem or the woven-in lease sticks from the end of the warp (see Figure 47).

7. Place the two, thin woven-in lease sticks flat on the front cloth beam making sure they are centered and parallel to the beam.

   Wind the weaving back on the cloth beam holding the lease sticks in place until the weaving is wound back over itself and holds itself in place. Take up the tension by using the ratchet handle until the warp tightens and continue weaving. Now that you have a smooth cloth roll in front you will not have to be weaving over knots or bumps and an even tension will be maintained.

8. If you want to remove part of the cloth from the loom before the warp is woven off use the following procedure:

   a. When the piece to be removed has been woven, weave one inch of tabby.

   b. Weave in two lease sticks followed by 1/2" of tabby as in 4 above.

   c. Start new weaving.

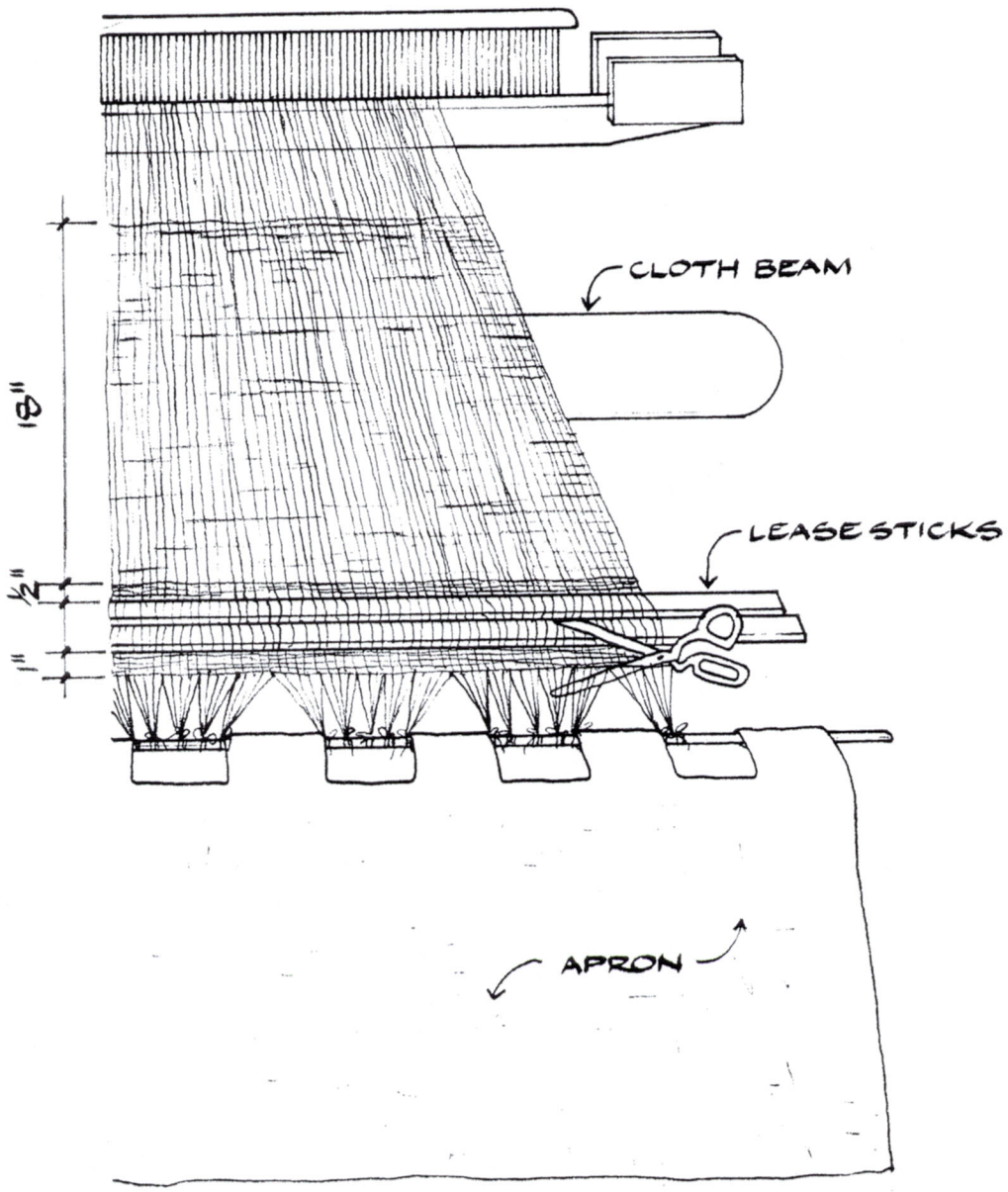
   d. Weave until the lease sticks are wound 1 1/4 times around the front cloth beam (or about 18" if weaving is being taken off the rear cloth storage roller).

   e. Unwind and cut off the piece to be removed just before the tabby hem and woven-in lease sticks as above.

   f. Follow step 7 above.

      This method takes very little time, there is practically no waste and a uniform warp tension is maintained.

9. Near the very end of the weaving the temporary apron will be used again to extend the end of the warp beyond the warp beam, thus decreasing yarn waste. You should already have binding cords around the warp beam so that the warp stick will be held in its groove just before it makes its last turn. Just when the warp stick is ready to fall out of the groove, remove bindings, wind the warp backwards a little to relieve tension and lift the stick with warp ends out of the groove. Take your apron which should already have a metal rod inserted in the hemmed end with the openings and insert a second metal rod in the plain hem at the opposite end.

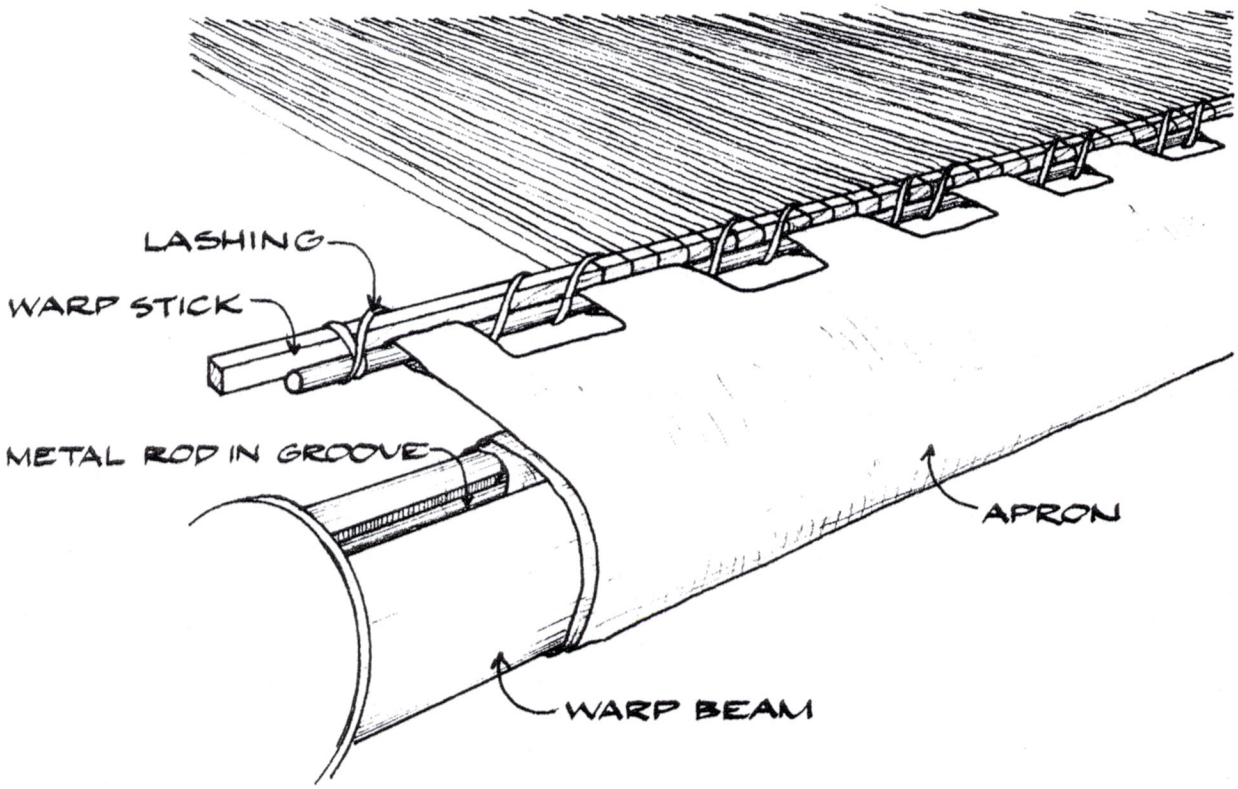


REMOVING THE APRON

FIG. 47

Place this second metal rod into the groove in the warp beam and wrap the apron around it in the same direction as the warp is wound onto the beam until the first metal rod is only a few inches away from the beam (see Figure 48). Take a strong cord and lash the wooden warp stick, with the warp ends on it, onto the metal rod in the end of the apron. Wind the warp forward from the front of the loom until the cord slips on the warp beam drum and continue weaving until the warp end is just behind the harnesses.

Extra aprons can be ordered through AVL for those of you who would rather use an apron from the beginning instead of extending it after most of the warp is woven off.



EXTENDING END OF WARP

FIG. 48

USING THE CLOTH STORAGE SYSTEM

When weaving long lengths of fabric, the material is taken around the front cloth beam and through the loom to the rear cloth storage roller which can accommodate a roll up to 10" in diameter. The cloth storage system which consists of 3 rollers, cord, weight, pulley and 2 drums is designed to automatically wind the cloth onto the storage roller as the warp is advanced. A looser tension is maintained on the storage roller than on the weaving. This eliminates any unnecessary strain or matting of the fabric. The special abrasive surface of the cloth beam holds the proper weaving tension while allowing a lighter tension to be maintained for cloth storage. This also makes it possible to weave long lengths of fabric that have an uneven surface which would ordinarily cause poor tension because of the uneven build-up on the front beam.

1. Allow the first two yards of weaving to roll up on the front cloth beam. Then release the front ratchet and unwind the fabric. Route it over the cloth beam, over the upper cloth roller, under the lower cloth roller and over the rear cloth storage roller as shown in Figure 49.

2. The stop pin should be in its place in the rear cloth storage drum and the weight should be in its topmost position. Remove the lease sticks from the fabric so that it will wind on smoothly. Place the fabric on the roller making sure it is centered and parallel to the roller. Fasten it on using 4" to 6" pieces of masking tape placed vertically at about 6" intervals. Next, remove the stop pin and allow the fabric to turn onto the roller until tight. You'll need to use some caution here because as soon as the stop pin is removed the weight will start falling very fast and the roller will wind up very quickly if uncontrolled. To avoid this, hold the roller firmly and let it slip slowly through your hands. When finished, wind the weight back up to its topmost position by turning the take-up drum which is located on the right side of the loom directly beneath the cloth take-up drum.

3. Now advance the cloth, using the cloth beam handle, until the weaving tension is reached and continue weaving. As the weaving proceeds and the cloth is wound forward the weight will gradually descend. Before the weight hits bottom, wind it back up to the top using the take-up drum.

4. If you are weaving a very thick fabric or rug which would build up quickly on the front beam, you may want to connect the warp directly to the cloth storage roller without having to wind around the front beam for the first 2 yards. You will need to use your long apron for this purpose. With the weight at the top, and the stop pin in place, tape the plain edge of the apron to the storage roller. Then wind the

apron once around itself so that it holds itself in place. Then simply route the apron under the rear cloth storage roller, under the lower roller, over the upper roller and over the cloth beam as in Figure 49. If necessary, release the stop pin and gently wind the apron up until the metal apron bar is in the proper position for tying on to.

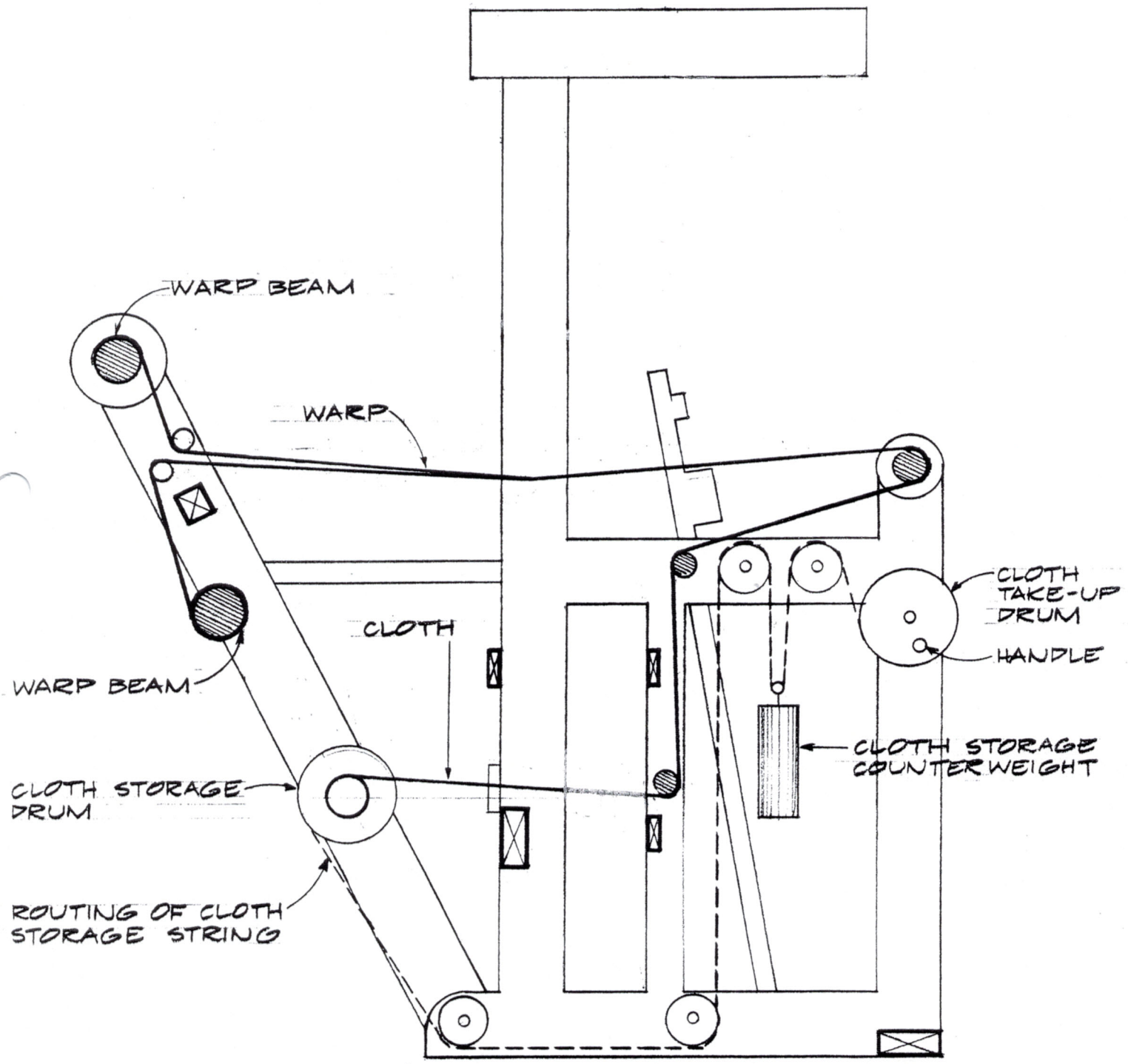
5. After you've completed your yardage use the following procedure for removing the cloth from your loom.

First bring the weight to its topmost position and replace the stop pin in the rear cloth storage drum. Cut your cloth off where desired and lift it off the cloth beam. Now go to the back of the loom and grasp the cloth storage roller at both ends. Lift the right side of the roller up and toward you until it disengages with the drum on the left. Manually wind the excess cloth onto the storage roller. Now you can empty the roller but before you replace it you may want to rewind the cord that routes from the rear cloth storage drum to the front take-up drum and handle. To do this, first take off the weight and set it aside. Remove the rear cloth storage drum pin and swing the little ratchet pawl off so that it disengages the ratchet. (The ratchet pawl can be found on the right side of the loom to the outside of the cloth take-up drum and handle.)

Turn the rear cloth storage drum so that the cord winds back onto it evenly. This can be done quickly and easily by inserting the pin of the Drum Rewind Handle into the stop pin hole.

Replace the empty rear cloth storage roller, stop pin and the weight.

This process needn't be done after every warp is removed. Once it is practiced a few times, however, it becomes fast and easy and if incorporated into your finishing ritual may save you from running out of string in the middle of a warp and interrupting your momentum.



SECTION THRU LOOM SHOWING ROUTING OF WARP AND CLOTH STORAGE STRING

FIG. 49

WARPING THE SECTIONAL BEAM (Optional Equipment)

The AVL sectional beam is designed to be warped in separate two inch sections with the use of a tension box. The yarn travels directly from cones or spools which are mounted on a rack behind the loom, through the tension box and onto the beam. Throughout the warping process the tension box automatically keeps a constant and uniform tension on the warp.

1. You must have enough spools or cones to be able to have one for each thread in each two inch section of your warp width. (With 16 EPI you will need 32 spools or cones, with 20 EPI you will need 40 spools or cones.) Figure out how many spools or cones you will need and how much yardage should be on each. This will vary according to the size and the spools, total yardage needed, repetition of color patterns in the section, etc. You may be able to work right from spools or cones that you buy or you may need to wind your own from yarn that is in larger packages. (You can purchase empty plastic spools from AVL Looms.) You will also need a spool or cone rack to mount the spools or cones onto.

2. You must make a set of 20 extension cords to use when warping the sectional beam. Make them out of strong non-stretchable linen or cotton. Cut 20 pieces of cord exactly 3 yards long. Then knot the two ends of each piece together (an overhand knot works well) so that a closed loop is formed measuring just under 1 1/2 yards. Make sure the knots on all the cords fall in precisely the same place so that the extension cords are exactly the same size. Tie each of these to the sectional beam axle.

3. Place your spool or cone rack behind the loom about six feet away and place on it the spools or cones for the first two inch warp section. Make sure to line them up with the tension box which should be in the back of the first two inch section at the left end of the sectional beam (side farthest way from the crank).

4. Next, thread the tension box. For description's sake only, we shall go through the various parts of the tension box as if all the threads are threaded first through one part, then through the next part, etc. In actuality, however, it will work best if you take one thread from the rack and thread it all the way through all the parts of the tension box, then the next thread from the rack in a vertical order rather than a horizontal order. In other words, start with a spool or cone at the bottom of the rack and work upward in a vertical column. When you have reached the top of the first column, start at the bottom of the next one, etc.

So let's go through the sequence for threading the tension box. First move the two adjustable tension pegs up above the stationary pegs as shown in the diagram on the next page. Now sley the threads through the rear (stationary) reed section using a sley hook. Since this reed is 8 dents per inch, you will divide the EPI into 8 to find out how many ends will be in each dent (with 16 EPI, put 2 ends in a section). If your EPI does not divide equally by 8, you can either vary the number of ends in each dent (with 20 EPI, alternate 2 and 3 ends in the dents), or else you could thread the dents a little wider than two inches (with 20 EPI put 2 ends in each dent, with 40 ends the reed will be sleyed 2 1/2" wide). Next bring the threads straight through the tension peg section in between the larger adjustable tension pegs and the smaller stationary pegs as in the diagram. After the tension box is completely threaded, the larger pegs are moved downward to apply tension. The farther down they are moved, the more tension will be applied to the yarn. This is an adjustable system as different yarns require more or less tension. With a heavy wool the pegs may only need to be moved half way down; whereas, with a fine silk the pegs may need to be moved all the way down and the yarn wrapped an extra time around one of the stationary pegs to get the proper tension. Next, thread the ends through the two sets of heddles: the first thread goes through the front set of heddles and the next thread goes through the rear set of heddles. Repeat this alternating heddle threading for the rest of the ends. The heddle system will be used later to create the threading cross. Last, thread the ends through the front pivoting reed. Here you have a choice of using an 8 dent or 10 dent reed. Pick the one that can be sleyed evenly and as close to 2" side as possible. Since there is not exactly a 2 inch space between the sectional beam pegs because the width of the pegs take up some of the space, and since it is important that the ends lie flat in the sections so that an uneven build-up does not occur, we have designed this special pivoting reed. Thread the reed as close to 2 inches wide as possible, this will make it just slightly wider than the space between the pegs. Then pivot the reed by loosening the wing nut underneath. This will vary with the width of the band of threads being fed onto the sectional beam so that the ends will just fit in between the pegs of the sectional beam.

Once the tension box has been threaded, it is not necessary to rethread it. If you need to change cones or spools, simply tie the new ends on to the old ends just before the rear stationary reed, then gently pull on the old ends until the new ends have come all the way through the box.

5. Attach the group of ends you have just threaded through the tension box to an extension cord. To do this, simply make a larks-head knot with the extension cord and tighten it around the bundle of warp ends. Don't knot the warp ends. Leave about 1 1/2" between the end of the warp and the knot.

   Route the warp ends and extension cord between the two metal rollers and either down to either the lower beam or up to the upper beam.

   Now turn the warp beam handle in a clockwise direction for the upper beam, counter clockwise for the lower beam until about 8" of warp is wound onto the beam. Using masking tape or scotch tape, simply tape the ends to the beam so that they don't cause any lumps and continue winding until you reach the point one yard before the desired yardage. (A yardage counter can give you an accurate count. These can be ordered from AVL Looms.) At this point you will make the threading cross.

   Open the heddles so that the front set of threads is up and the bottom set down to the one side of the cross and slip a marking tie (plastic dobby chain ties work well) in between the tension box and the loom. Then push the front set of heddles down and the back set upward to get the other side of the cross, slip the marking tie in again and securing with a knot. Wind the rest of the first section on, cut the ends, and secure with masking tape or a rubber band to the peg nearest to it which is away from the direction of the next section to be wound. Continue winding all the sections in the same manner by moving the tension box along its track, then undo the masking tape and slip a pair of lease sticks through the entire threading cross. Don't forget to route the warp through the separation rollers as shown in Figure 49.

6. If you are winding a very fine warp, say 40 ends to the inch or more, and do not have or do not want to wind a lot of spools or cones it may be more convenient to wind separate two inch warp sections on a warping board or reel and go from there directly to the sectional beam. If you decide to do this however, your warp will be limited in length to what will fit on the warping board or reel. If you choose this method, first wind separate warps for each two inch section on a warping board or reel, marking the threading and raddle crosses and making choke ties on each. Chain each warp section off so that the raddle cross is available. For the next step you will need a moveable reed section (available from AVL Looms) which will mount on the tension box track. Now thread the raddle cross groups in the reed sections. Pivot the reed approximately and have one person apply tension to the end of the warp as you turn the crank using extension cords as above. When the threading cross reaches the moveable reed section, remove the warp from the reed and

continue winding the rest of the warp section on. Secure the end of the warp to the beam with masking tape as above and proceed to the next two inch section.

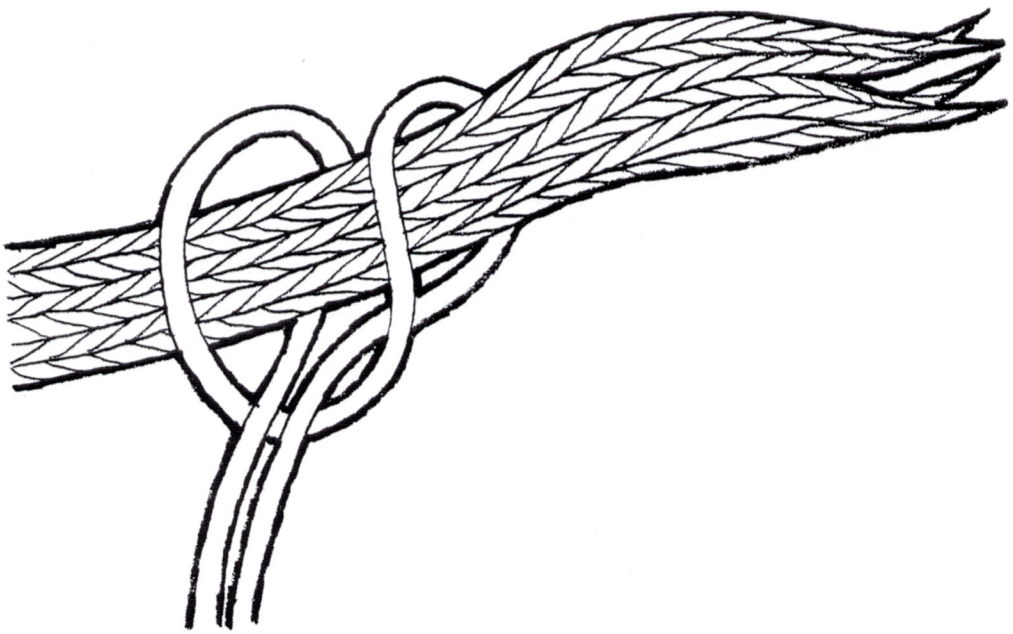
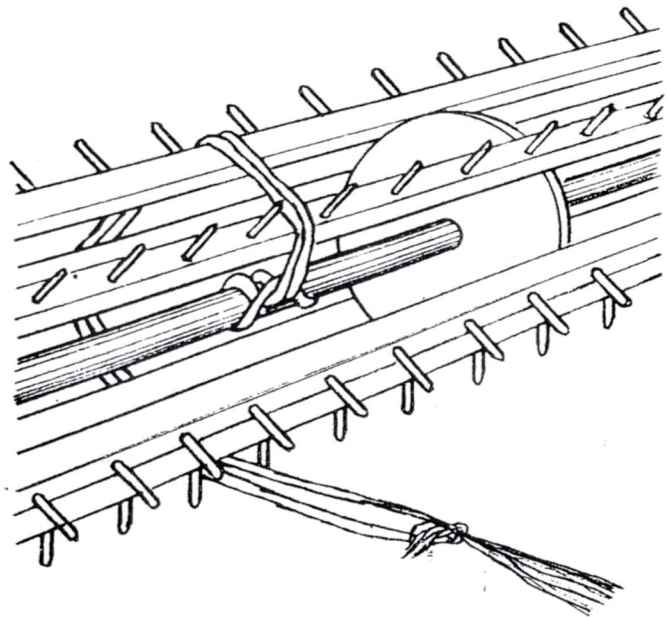
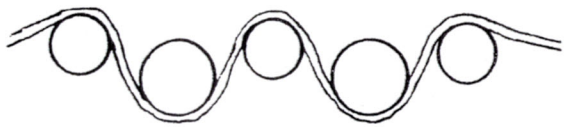


FIG. 50

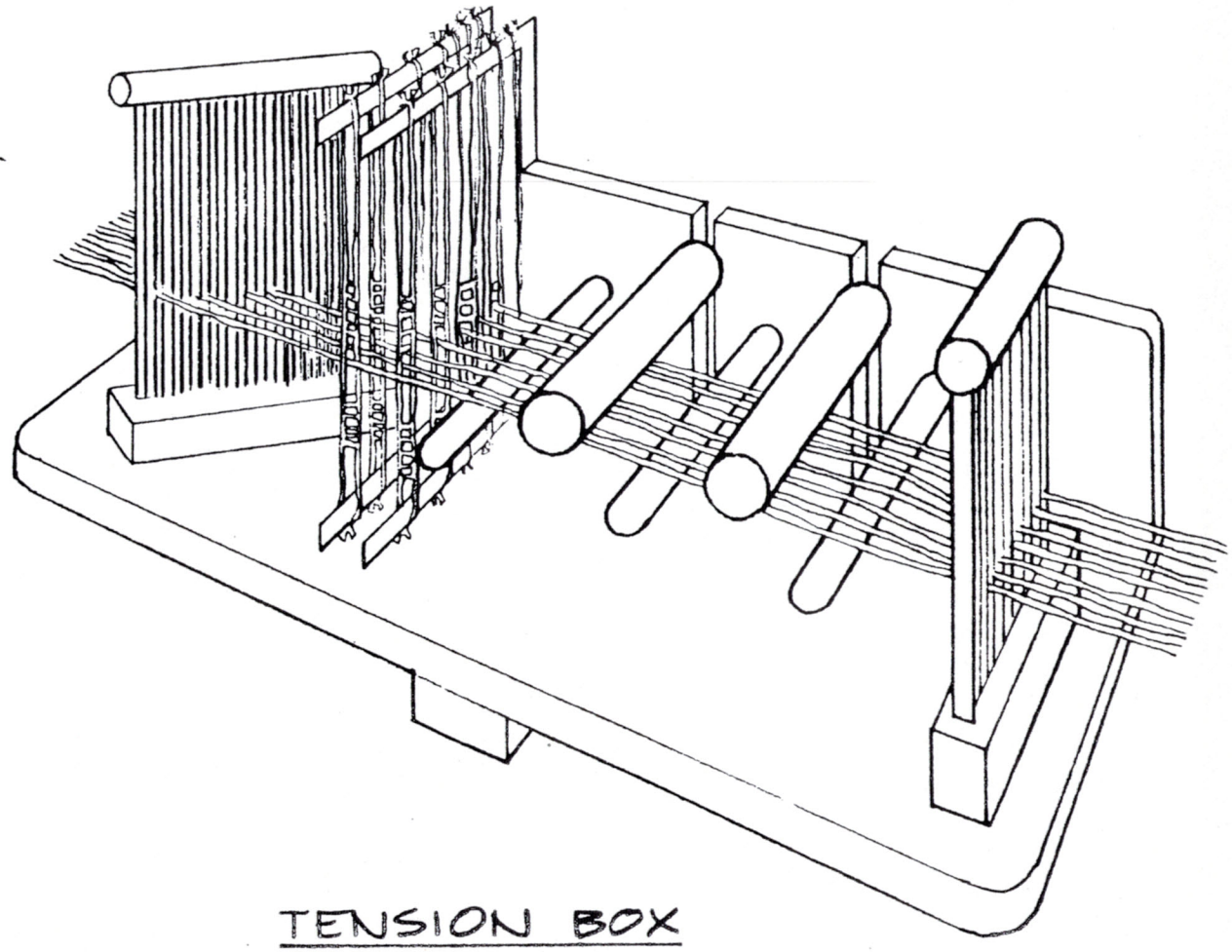
TYING EXTENSION CORD TO WARP ENDS



EXTENSION CORD



POSITION OF PEGS WITH TENSION APPLIED



TENSION BOX