48" OR 60" 16 HARNESS DOBBY LOOM WEAVING PROCEDURES
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INTRODUCTION

AVL Looms was formed in 1977 with the meeting of two unique individuals.

One of these individuals was Engineer/Designer/Weaver, Jim Ahrens. Jim produced the original designs for AVL. He has been weaving, designing and building handweaving looms for over 40 years and is considered by many weavers to be the greatest handloom designer in this country.

The other individual was Jon Violette, now president of AVL Looms. Jon studied Engineering at California Polytechnic College and Wood Technology at California State University, Chico. With his knowledge of engineering and his skills in woodworking, Jon heads the team of people who make the highly efficient designs of AVL Looms available to weavers throughout the world.

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 at full capacity unless care is taken to dress and operate them properly, it is worth your while to study the following instructions in detail. The time taken to make these procedures your own will result in increasing your weaving speed and efficiency, as well as enhancing your enjoyment of the entire weaving experience.

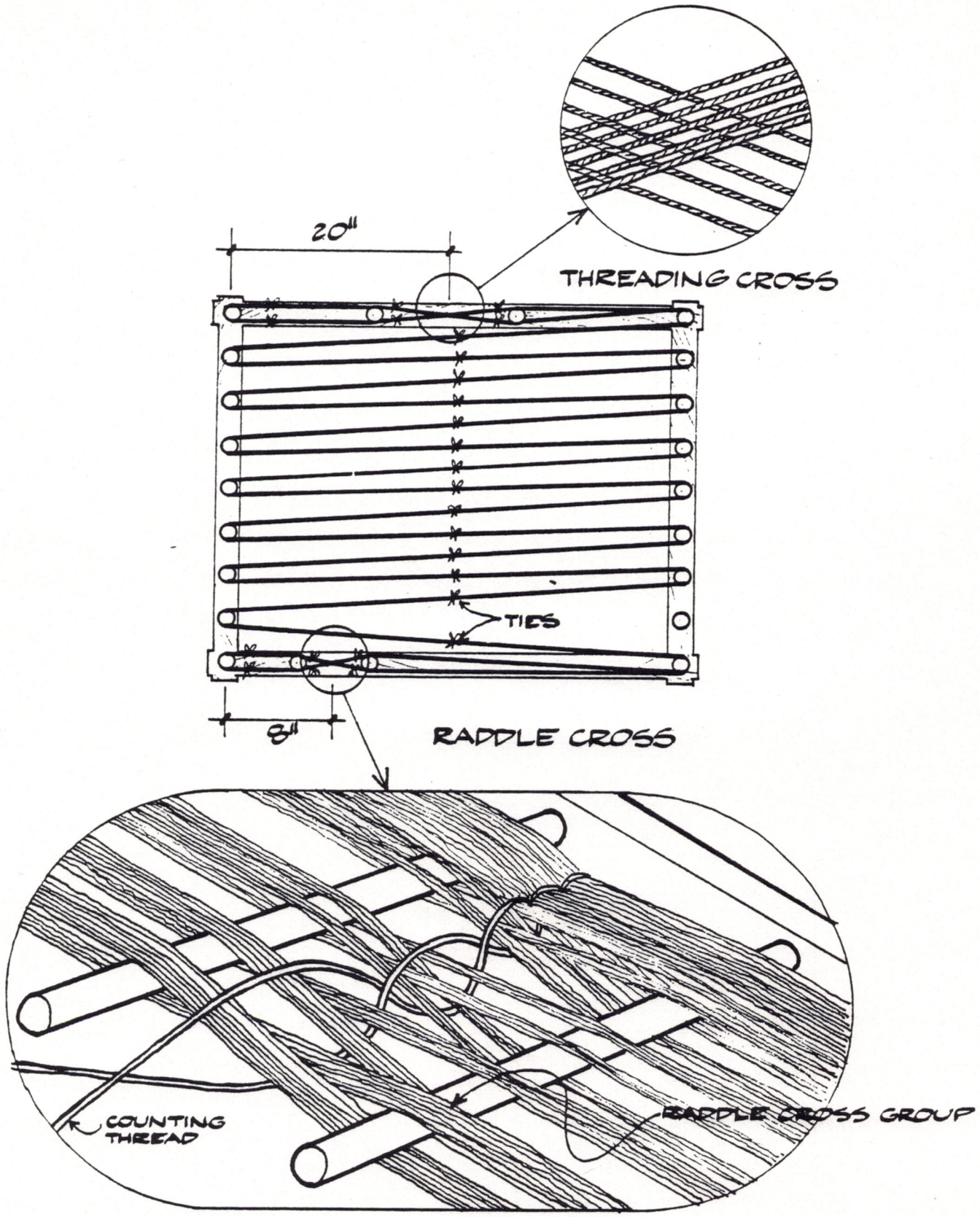
WARPING THE PLAIN BEAM

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

1. To begin, wind the warp on a warping board or reel. Make sure you put in two crosses, the threading cross, about 20" in from the first peg, and the raddle cross, 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. (See figure 1, page 5.) 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 do some figuring and have a different number of threads in each raddle cross group, as with 15 EPI and a 4 dent raddle, use the sequence 3,4,4,4 in the raddle cross groups.

   A still more satisfactory possibility, if possible, 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



WARP ON WARPING BOARD WITH TWO CROSSES

raddle than it is through the reed, this actually creates an ideal angle for the selvage 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 narrower than the warp to be sleyed or the selvage threads will be bent and poor tension will result.

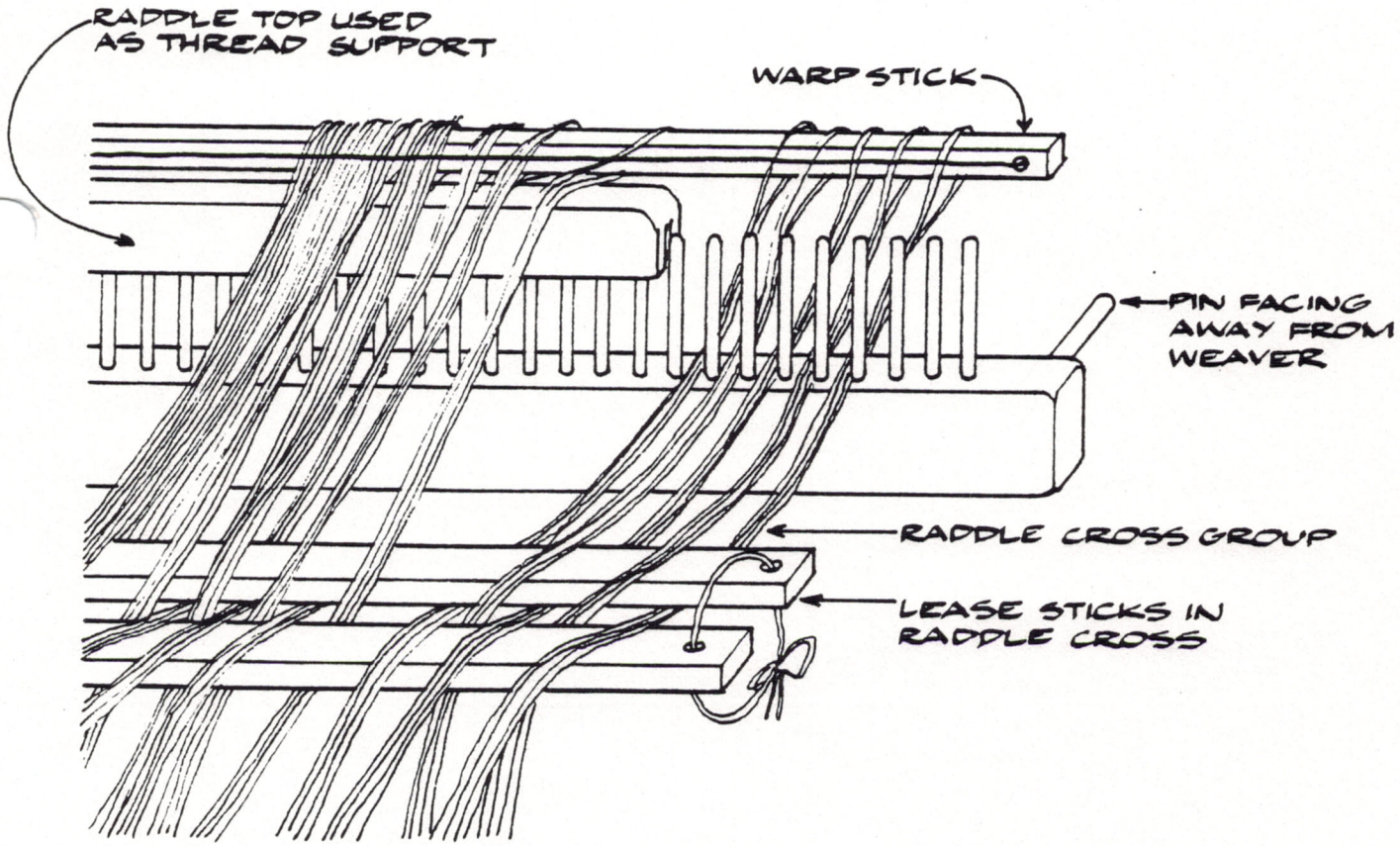
2. As you are winding your warp onto the warping board or reel, it is a good idea to use a counting thread at the raddle cross to keep track of your warp threads. If you are using 4 threads in each raddle cross group, you know you will have 16 threads when four raddle groups intersect. As the winding process proceeds, keep the raddle cross groups somewhat spaced apart and forward on the pegs, so that you can see them easily, until 4 raddle cross groups are complete. Then twine the counting thread once around all 4 groups making a bundle and push it together and back on the pegs. Continuing in this manner it should be easy to count the number of bundles, (in our example, we have 16 threads in each bundle). 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.

3. 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 loops 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.

4. Place two 3/16" lease sticks in the raddle cross and secure together with string or tie-tapes through the holes in the ends of the sticks. Then place one of the 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.

5. 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. If you are using an AVL raddle with a sliding cover, slide it on after the raddle is threaded and secure it with two or three cord ties so it can't come off. Remove the raddle cross sticks when this is completed. (See figure 2)



THREADING THE RADDLE

FIG. 2

6. Before winding on the warp, there are a few small things to take care of on the loom. First, check the tension device to make sure the rope is wrapped three times around the tension drum and that the rope end is clipped to the spring (see figure 7, page 32 for details). This will prevent the warp beam from slipping backwards during winding and threading. Also make sure the stop pin is in its place in the rear cloth take-up drum so it won't unroll (see page 55, section 2 for details). Check the cloth take-up weight. Turn the cloth take-up handle until the weight is in its top most position.

7. Now secure the raddle to the back of the loom. If you have an AVL raddle, simply slip it into the set of holes in the back of the rear vertical members. If you are using some other raddle you will need two 1/4" pieces of doweling six inches long. Insert the dowels into the same holes and then tie your raddle to these. When winding on, the warp threads should go through the middle of the raddle.

8. Next, the warp stick (with end loops centered and distributed evenly) is brought over the top of the warp beam roller and then is attached to the warp beam. Here there are two alternative methods which you can use: the warp stick can be placed directly into the groove in the warp beam, or an apron can be wound around the beam and the warp stick lashed to the apron bar.

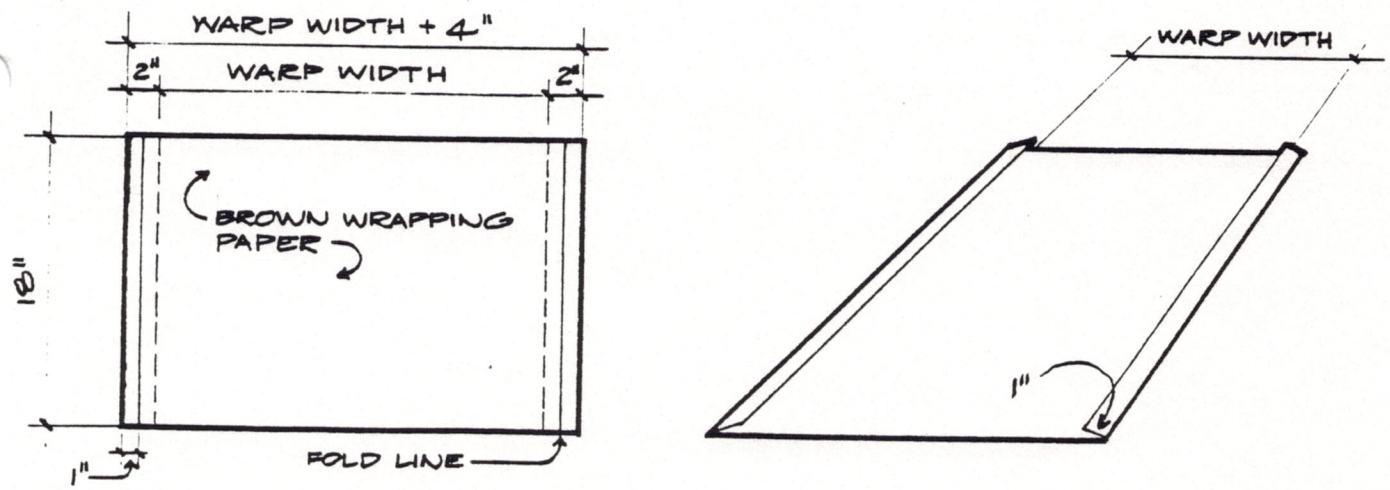
Jim Ahrens recommends that the warp stick be placed directly in the groove in the warp beam. The idea behind this is that the warp can be wound on very tightly and smoothly without any lumps or bumps, thus giving a perfect tension in the weaving thereby creating professional results, especially with longer and finer warps. In order to extend the end of the warp so that there is very little warp waste, the weaver must release tension when there are only a few feet left on the warp. Remove the warp stick from the groove, wrap the apron around the warp beam, and lash the warp stick to it. This is quick and easy to do and is explained in more detail later on. Try this method and see how you like it. If you are using heavy yarn and find that it is difficult to get

the warp stick in the groove, it is okay to apply pressure or even use a mallet if necessary. Use something like a screwdriver to pry the stick out of the groove.

As an alternative, the warp stick can be lashed right onto the apron before warp winding begins. This eliminates having to extend the warp toward the end of weaving. However, it also means you won't be able to wind your warp on as tightly since the layers of apron around the beam will be a softer surface for the warp threads. If you do want to use an apron for winding on, you will have to order an extra one from us. Take your apron and make sure a metal rod is inserted into both ends. Place the hemmed edge of the apron with its metal rod into the groove in the warp beam and wind it around the beam (see figure 14, page 54) until the metal rod inside the hem with openings in it is only a few inches away from the beam. Take a strong cord and lash the wooden warp stick onto the metal rod as in the diagram.

9. 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 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 craft paper is good. It is not necessary to add to the bulk of the warp by winding paper throughout, as a tightly wound warp eliminates any cutting of one layer of warp into another. Actually with a tightly wound warp the paper's only purpose is to support the edge yarns so they will not fall off and cause poor selvage 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, at least 3 or 4 inches 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 themselves. To do this, cut your paper 4 inches 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, not overlapping them. (See figure 3)



PREPARED PAPER WITH FOLDED EDGE

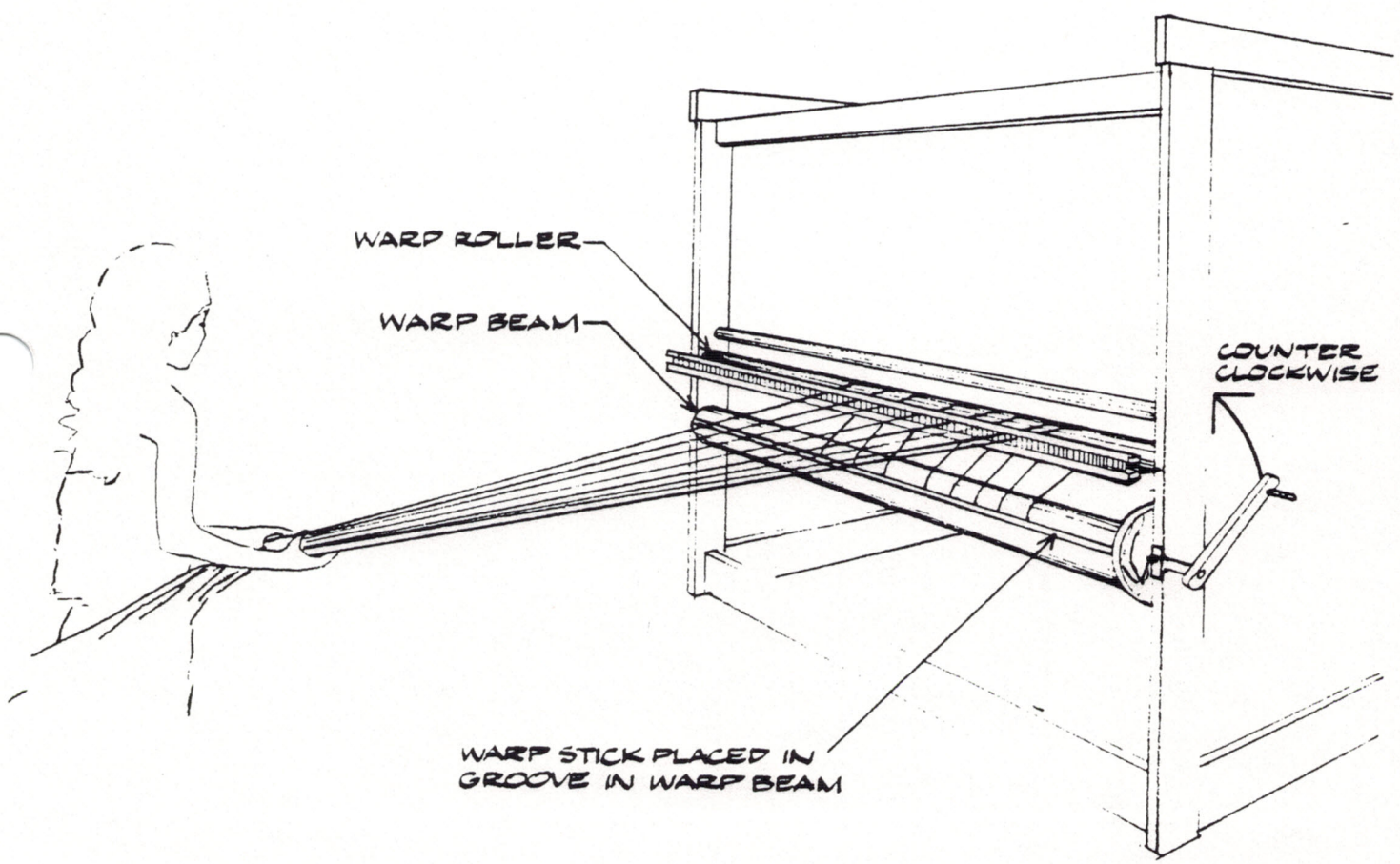
FIG 3

10. **Warp Beam Flanges** are available from AVL Looms.

These flanges are used to support the edge yarns while warping and weaving and their use eliminates the need to wind paper in with the warp. The warp must be wound on tightly in order for this to work.

Prior to installing the flanges you should have the warp stick and ends in the groove of the warp beam and the fiber through the raddle and ready to be warped. To install the flanges simply remove the bolts connecting the flange halves together. Now fit them around the beam to the outside of the warp, making sure the flat faces are toward the warp. Adjust the flanges so that they are <u>exactly</u> in line with the center of the raddle pins on the outside edge of the warp. Tighten the bolts securely. Continue with the warping process.

11. When winding the warp on from the back, i.e. with the warp spread out in back of the loom, turn the crank in a counterclockwise direction so that the warp comes in from the bottom. (See figure 4, below)



WINDING ON THE WARP

FIG. 4

12. Remember, wind the warp on TIGHTLY under a lot 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 the tension 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, then combing should be unnecessary.

    Watch the edge yarns, and wind in a layer of paper when they have built up to the point where they will no longer support themselves, or every yard and a half to two yards to be safe.

13. If your warp has wound on even without a lot of combing, try the following 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. Remove all the ties and spread the warp out. Continue winding until the threading cross just reaches the rear of the harnesses. This technique is important for wide warps to 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.

14. 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. Afterwards replace the top on the raddle and leave it in its place on the back of the loom if so desired as it will not interfere with the weaving process. Then be sure to bring the end of the warp around the separation roller so that it now travels into the loom. See figure 5, page 24.

15. For those who ordered the second plain beam, it is wound in exactly the same manner as the first warp beam except that the warp goes under the second warp beam separation roller and up to the second warp beam.

WARPING THE SECTIONAL BEAM

The AVL sectional beam is designed to be warped in two inch sections with 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. Not only does this system save time but it makes it possible to wind on very long warps which would never fit on a warping board or reel.

1. First you must calculate the number of spools or cones of yarn you will need. Each two inch section is wound onto the sectional beam, so you'll need to have one spool or cone for each end in that 2 inch section (with 16 EPI that would be 32 spools or cones of yarn). Your total number of spools or cones of yarn needed will depend upon the total yardage needed, repetition of color patterns planned, amount of yardage on the spools or cones, etc. For example, if your warp is 10 EPI, 40 inches wide and 10 yards long and all the same color, you will need 20 spools or cones with 200 yards of yarn on each. 20 X 200 = 4,000 which is the total warp yardage needed (10 EPI x 40 inches = 400 total ends x 10 yards = 4,000 total warp yardage). In this case, the same 20 spools, or cones of yarn can be used to wind all the 2 inch sections needed for the warp. In other cases, the spools or cones of yarn may need to be changed at various times during the warping process.

   It is important to make these calculations in advance, so that you can purchase your yarn in spools or cones corresponding to the amount of yardage needed on each. (It is more likely, however, that you will want to plan your project around the size of available spools or cones.) Sometimes this is not possible and you will need to wind your own spools from yarn that is in larger packages. For doing this you will need empty plastic spools, a bobbin winder (preferably electric) and a yardage counter. These items are available from AVL.

2. You must make a permanent set of extension cords to use when warping the sectional beam. Make them out of a strong non-stretchable linen or cotton cord. You will need to make one extension cord for each 2 inch section in your sectional beam. For each extension cord cut a piece of cord 3 yards long. Take the two ends of the cord and knot them together (an overhead knot works well) 1/4 inch from the ends, thus forming a closed loop measuring slightly less than 1 1/2 yards. All the extension cords should be exactly or very close to the same size. (See diagram page 17)

3. Next, place a cone or spool rack about five or six feet behind your loom. We recommend the AVL cone rack as it holds both cones and spools, whereas a conventional spool rack will only hold spools. Place the spools or cones for the first two inch warp section on the cone rack. Make sure to line them up with the tension box which should be directly behind the first two inch section at the right end of the sectional beam (side farthest away from the crank).

4. Before winding the sectional beam make sure to disengage the tension system so that the beam will turn counterclockwise swiftly. To do this unhook the tension rope from the spring and completely unwrap the plastic cord from around the tension beam drum. Also remember to remove the weight from the tension arm.

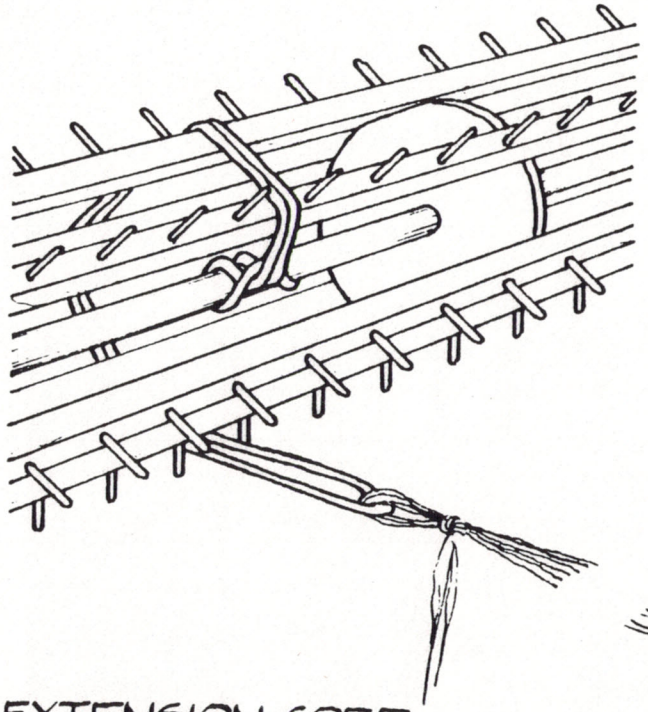
5. Now thread the tension box. For description sake only, we shall go through the various parts of the tension box as if all the threads are threaded first through one part then through the next part, etc. In actuality, however, it will work best if you take one thread from the cone rack and thread it all the way through all the parts of the tension box, then the next thread all the way through. It also works well to use the threads 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 up in a vertical column. When you have reached the top of the first column start at the bottom of the next one and so forth.

Now, 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 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. 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.

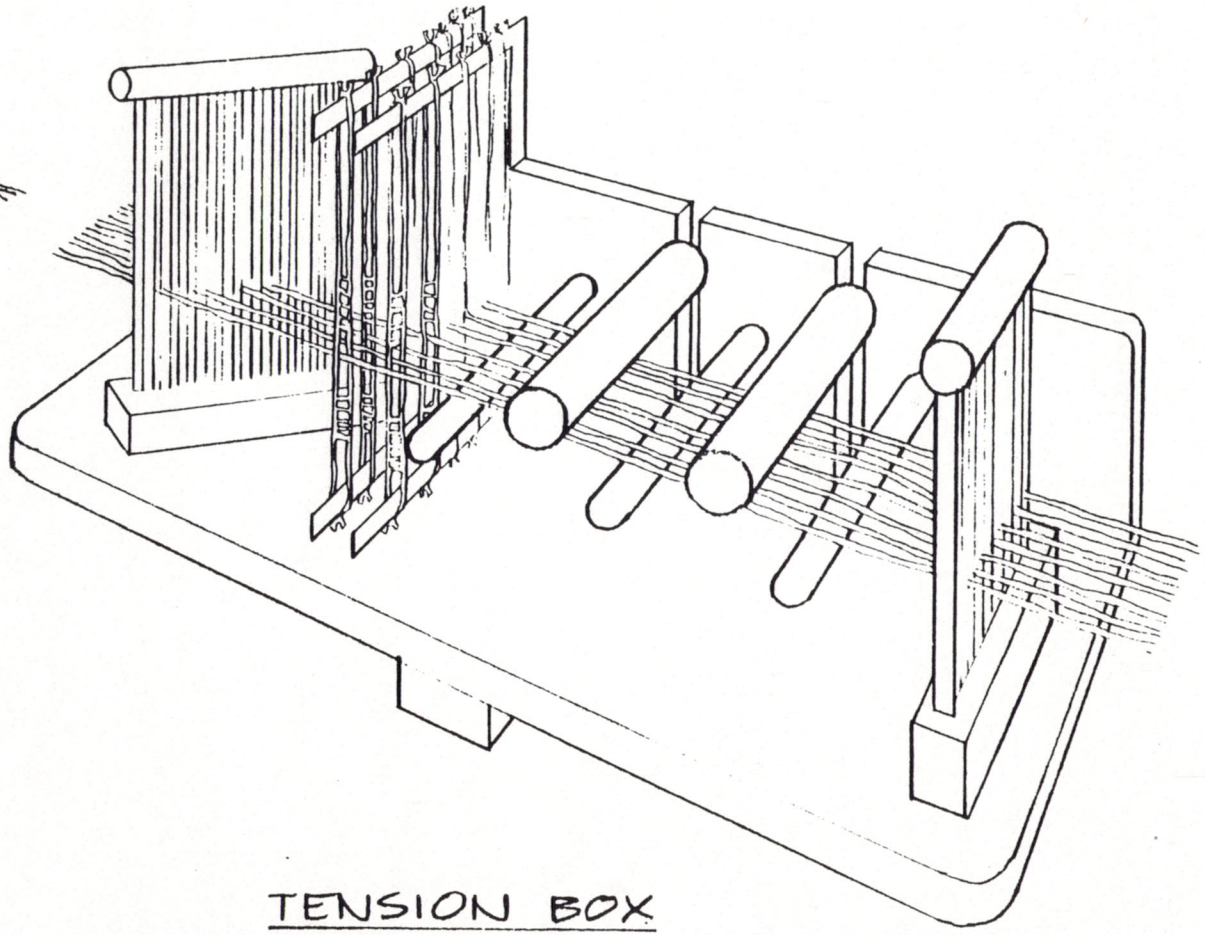
Next, thread the ends through the two sets of heddles: the first thread goes through the front set of heddles and the next thread goes through the rear set of heddles. Repeat this alternating heddle threading for the rest of the ends. The heddle system will be used later to create the threading cross.

Now, 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" wide as possible. Thread the reed as close to two 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, which will vary the width of the band of threads being fed onto the sectional beam so that the ends will just fit in



EXTENSION CORD

POSITION OF PEGS WITH TENSION APPLIED



TENSION BOX

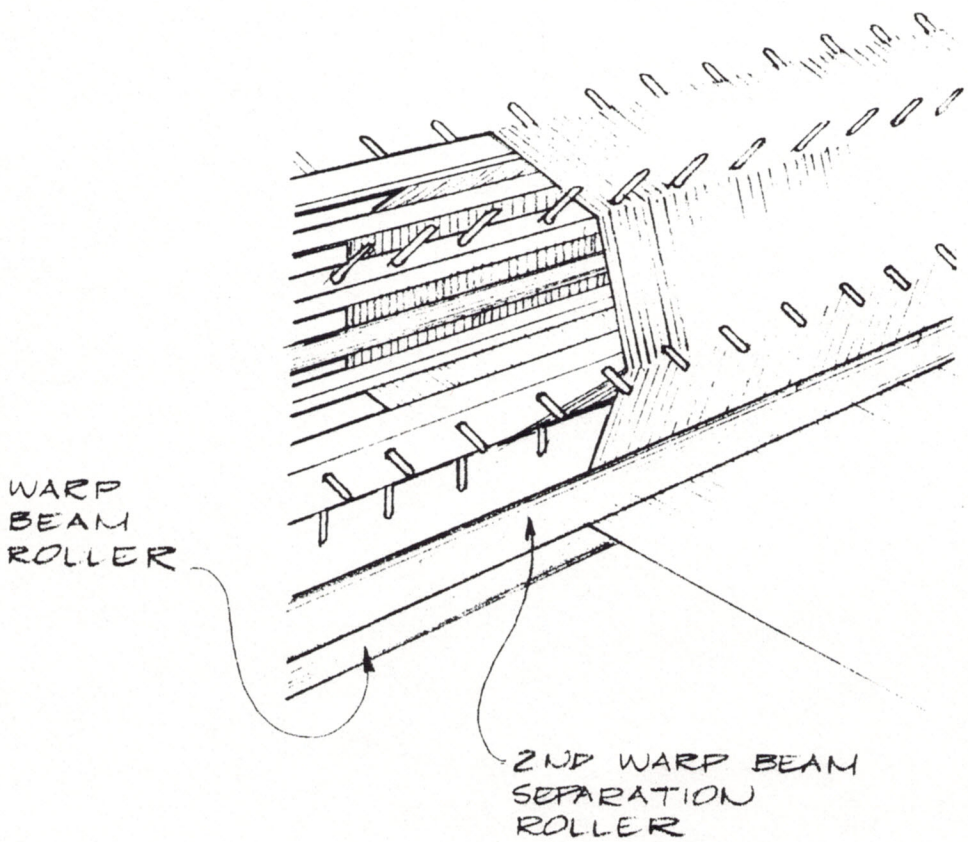
between the pegs of the sectional beam. This is an important time saver as it alleviates the problem of having threads hang up on pegs.

Once the tension box has been threaded it is not always 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.

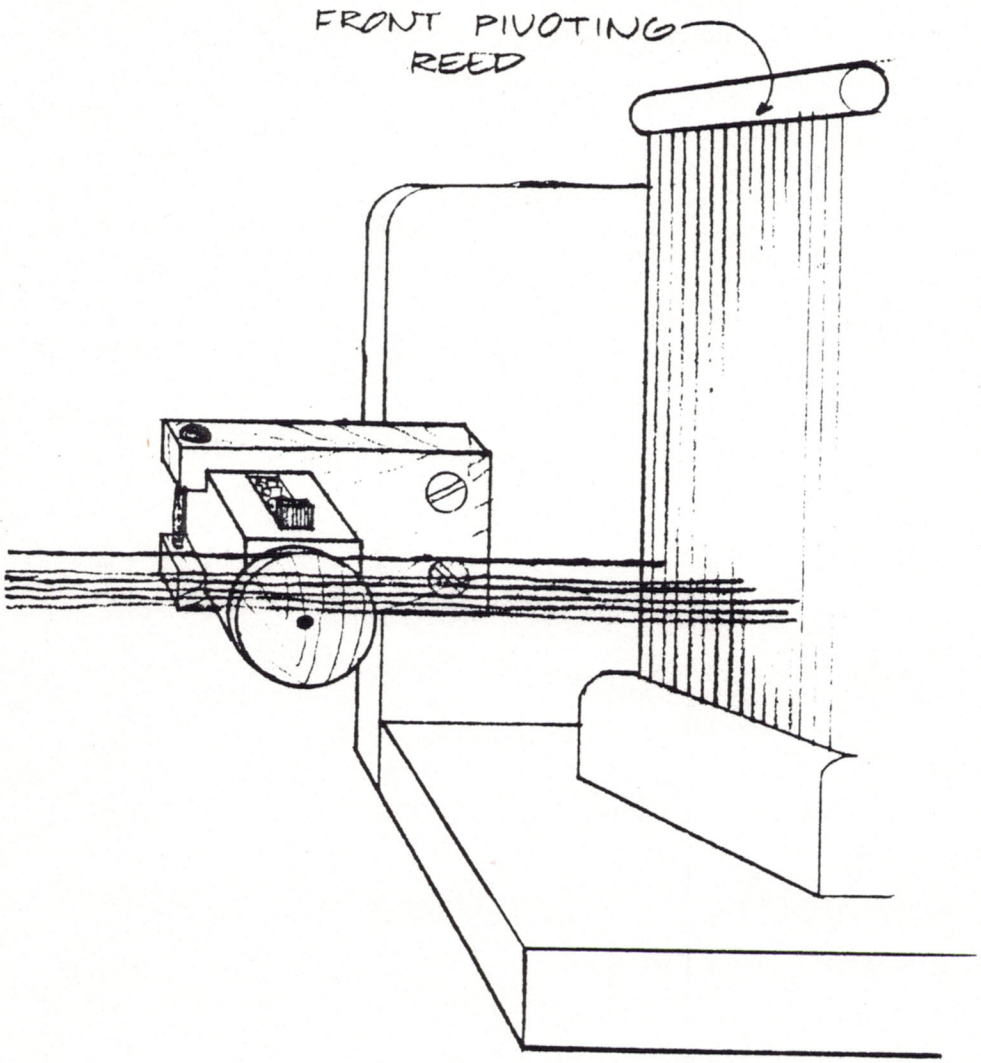
6. Attach one of the extension cords to the central pipe of the sectional beam in the first two inch section using a larks-head knot (see diagram page 17). Turn the sectional beam in a counterclockwise direction so that the extension cord is wrapped around the beam as in the diagram on page 17. Now tie the group of ends which you have just threaded onto the end loop of the extension cord. Continue turning the sectional beam counterclockwise so that the ends are wound on from the bottom of the beam. Make sure all extension cord knots fall in between rather than on the crosspieces of the sectional beam. Otherwise they will interfere with the smoothness of the wound on warp. (See page 19)

7. The circumference of the sectional beam is approximately one yard. For short warps you can count yardage by counting revolutions of the warp beam handle. However, since the circumference of the beam increases with every yard wound, we recommend the use of a revolution counter for an accurate count of longer warps. (The revolution counter may be purchased through AVL Looms and can be attached to the front of the tension box, see page 20.)

8. When there is about 1/2 yard left to go it is time to make the threading cross. Open the heddles so that the front set of threads is up and the bottom set down to get one side of the cross, and slip in a marking tie. 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 secure with a knot. Wind the rest of the first section on, cut the ends, and secure with masking tape. Continue winding all the sections in the same manner by moving the tension box along its track.



ROUTING OF YARN
ON SECTIONAL BEAM



ATTACHING COUNTER TO TENSION BOX

9. When all winding is complete, remove the masking tape, rewind a few feet of the warp, and slip a pair of lease sticks through the entire threading cross. Secure the lease sticks with string or tie-tapes through the holes in the ends, then remove the marking ties. Now bring the warp and lease sticks around the second warp beam separation roller so that the warp goes into the loom (see page 19). Then tie-up the lease stick, so that the ends are in a comfortable and visable position for threading.

   To keep the warp from slipping forward during the threading process, rewind the tension rope around the pulley and tension drum and clip the rope end to the spring. Remember to replace the tension weight at this time.

10. 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 by 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 appropriately, and use the AVL warping drum or get an assistant to apply tension to the end of the warp as you turn the crank (use 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 and proceed to the next two inch section.

11. In setting the tension, the adjusting cord should be set so that when the warp is advanced the tension arm raises to about 45° above horizontal

before it slips. Then as you continue weaving, the arm should fall back to a near horizontal position and remain there until the warp is advanced again. The thing you want to check here is that the arm is not riding down so low that the weight is resting on the sectional beam tension drum thus preventing proper tension from being placed on the warp.

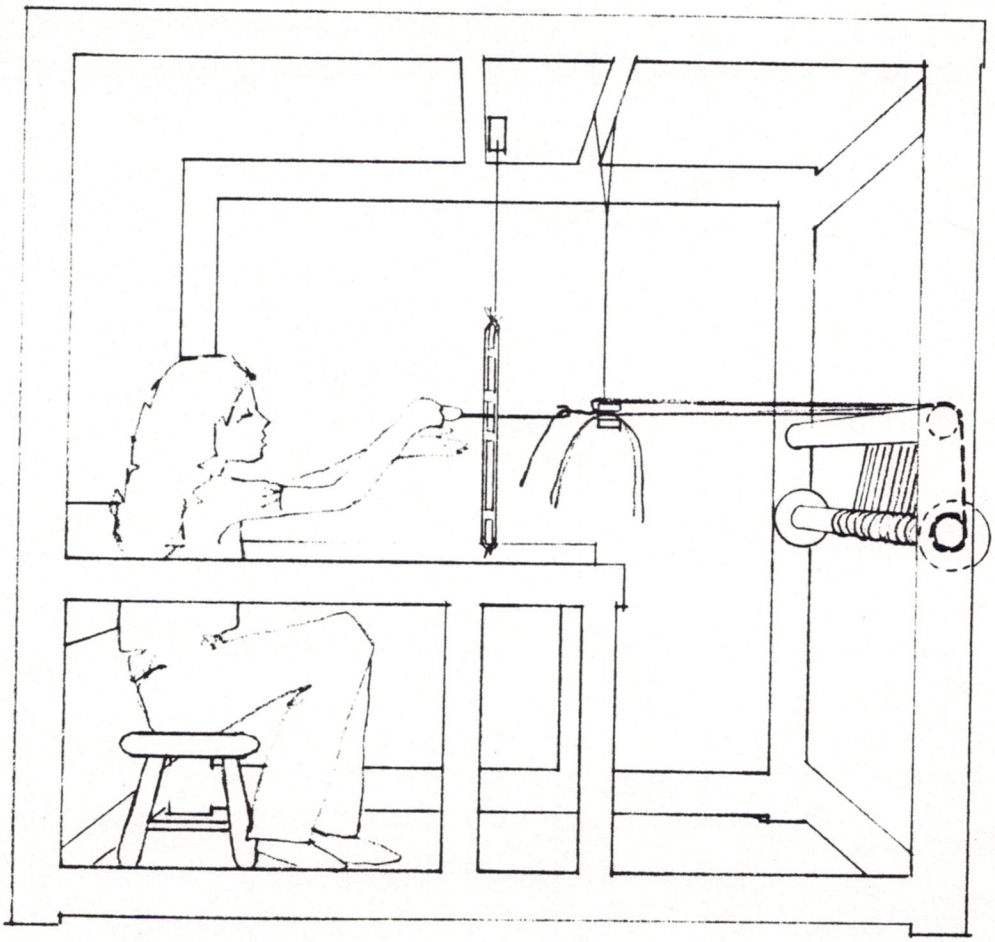
THREADING, SLEYING, AND TYING ON

1. To prepare for threading, tie the threading cross sticks up to the rear harness pulley support with lengths of string so that the cross is in a comfortable and visable position for threading. Now cut the warp end loops (if you are using the AVL plain beam warping method) so they will be ready for threading and unfasten the chains from the bottom of the lower harness sticks so that the heddles will move easily.

2. For those with overhead beaters, threading can be done sitting up on the bench with the overhead beater and cloth beam in place. Place a cloth over the cloth beam so that the abrasive surface won't scratch you. You will also find it helpful to raise the harnesses. To raise the harnesses first remove all chains from the dobby head. Then pull the dobby arm down to the bottom of its slot without raising any harnesses. Secure the arm in this downward position either by binding the arm down with heavy cord, or by placing a block in the dobby head.

3. For those with looms with floor mounted beaters, another threading position is possible which may prove to be more comfortable (see figure 5, page 24). First lift out the beater, then remove the front cloth beam by unscrewing the upper left bolt in the cloth beam support with a small wrench. Remove the lower bolt on the side of the built-in bench and tilt it to a vertical position so you can use it as a back rest. Place a small stool on the floor in front of the bench. Taller people may want to raise the harnesses as described above. It is always worth the extra time to position everything so that threading will be as comfortable as possible.

4. After threading is complete make sure that the unused heddles are all pushed to the far sides of the harness sticks between the hooks and the ends of the harness sticks. For balance there should be approximately equal numbered groups of unused heddles on both sides of each harness. In some cases such as a very wide warp with a lot of unused heddles on the ends of the harnesses, you may need to tie each group of unused



THREADING POSITION FOR FLOOR MOUNTED BEATERS

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. In the first six months of using a new loom with polyester heddles, the heddles stretch out to adjust to the harnesses and the heddles on each harness get stretched out to different sizes. For this reason we do not recommend removing heddles from the loom for six months. When heddles are removed they should be marked so they can be returned to the same harnesses. For the same reason, once the heddles have been on the loom for awhile it is not a good idea to switch heddles to different harnesses. Mixing them up once they have been stretched would affect the evenness of the shed. What some weavers do with wide warps, in order to avoid having to take off extra heddles, is to distribute the unused heddles among the threaded heddles as the threading is taking place.

5. Now sley the warp ends through the reed. Some weavers start from the right side, some from the left, some in the middle - but in all cases be sure to measure accurately before starting so that the warp will be centered in the reed. Weavers have various ways of positioning the reed for sley. Here's one that you might try: secure the beater in a middle position using binding cords, then remove the top of the beater and slant the reed forward.

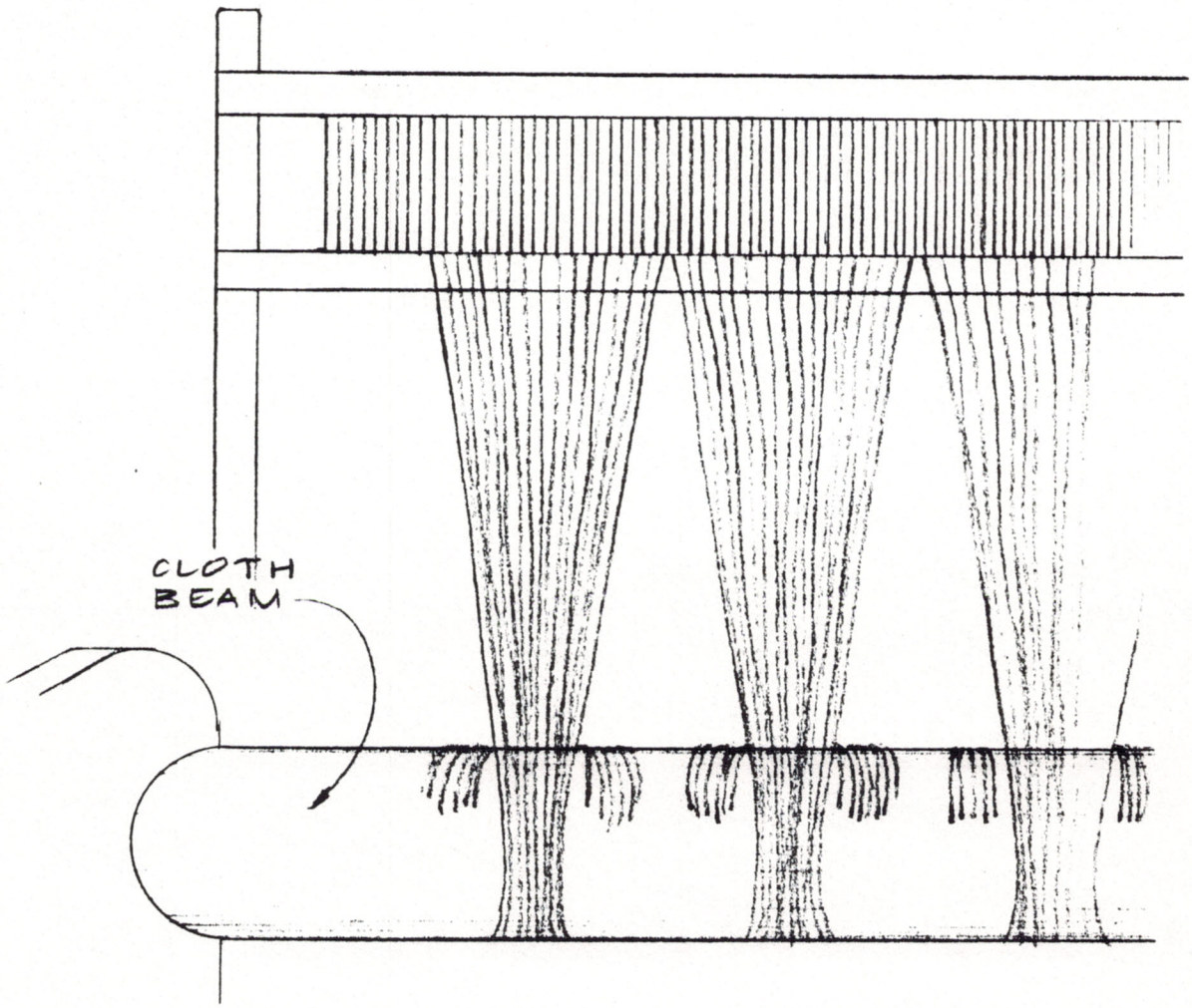
6. Now, we'll discuss the use of a "temporary" apron. We call it a temporary apron because it is not attached to the loom and it will be removed early in the weaving process. (Due to shrinkage problems do not wash your apron.) Notice that the apron has two hemmed ends, one end has openings in it and 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 cloth beam until the metal rod can be extended over the top of the beam to within 6" of the beater in its rear position. For those who have a cloth storage system with a long apron please read section #4 using the Cloth Storage Roller to find out how to use the long apron.

7. The warp is now tied on to the metal rod inside the openings. Tie the yarns on evenly and tautly making sure there are no loose or sagging ends. It is not necessary to spend a long time fussing over slight tension irregularities as these tend to even out after the automatic warp tension system is applied. After tying on is completed, attach chains to the bottom eyelets of the harnesses.

8. Shortcut method: you can skip using an apron altogether if you don't mind wasting about one more foot of warp. Wind the warp beam forward (raise tension arm while doing so) until enough warp is released so that warp ends will extend about one foot past the front cloth beam. Take groups of warp 4 or 5 inches wide and simply wrap them around the cloth beam. The yarns will stick to the abrasive surface. Remember to attach chains to bottom eyelets of harnesses after tying on is complete. (See page 27)

9. A new warp can be tied on to an old warp, thus eliminating the threading and sleying process, if the new warp introduced into the loom uses the same threading pattern and EPI as the last warp. This process is especially good for production weavers as it saves time. It also takes less concentration and there is less chance of making mistakes in threading.

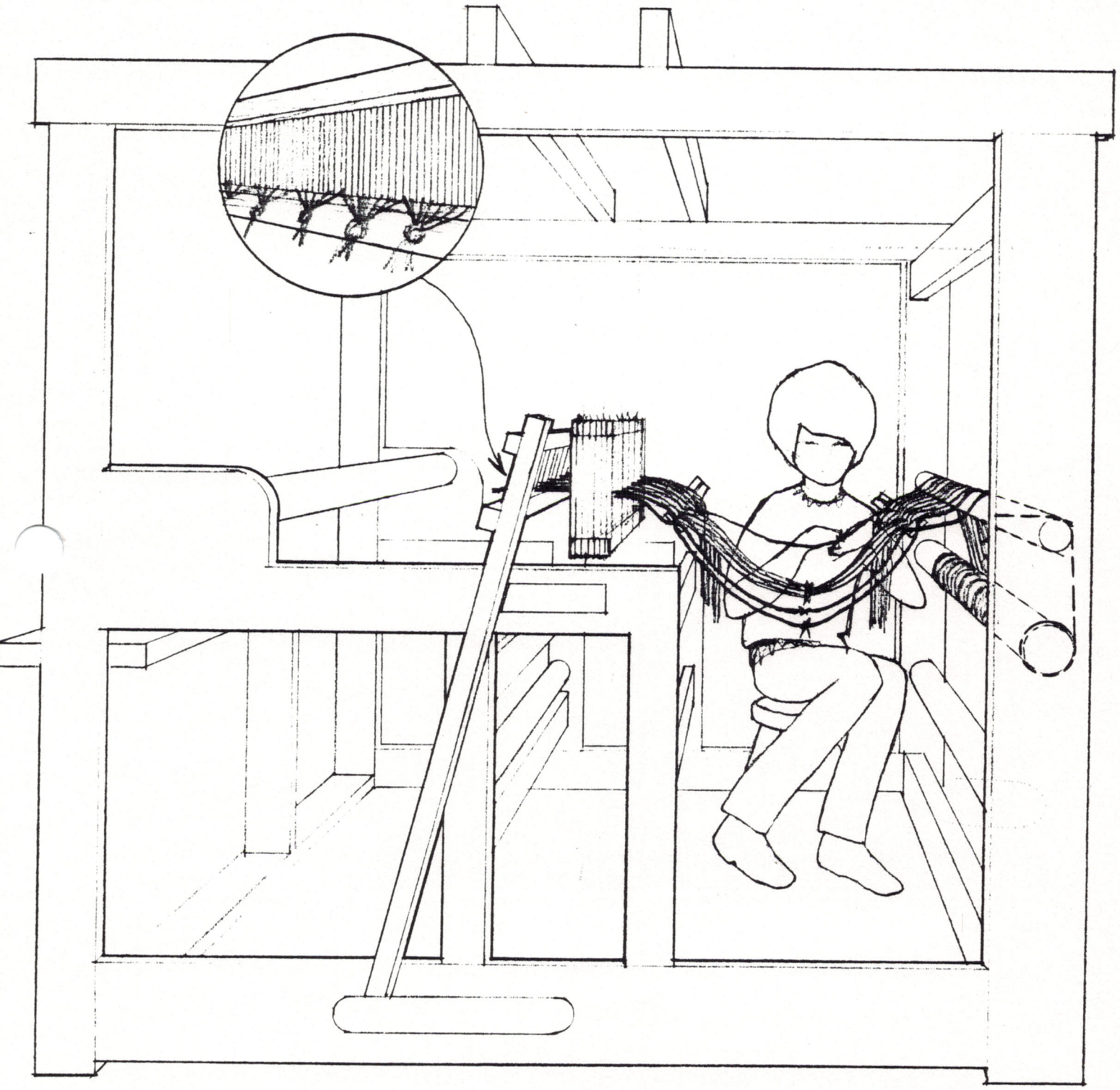
   The tying on process starts when you are finishing the last warp on the loom. Before you cut off the fabric make sure to leave enough unwoven warp to extend one foot behind the harnesses, through the heddles and about six inches past the reed when the beater is in its rear position. Now, open two opposite tabby sheds and insert lease sticks into these sheds <u>behind</u> the harnesses. Secure the sticks together with tie-tapes through the holes. Now carefully cut the fabric from the loom and tie bundles of warp coming through the reed together so the yarn can't slip through. Cut the warp in back (leaving one foot past the lease sticks) and also tie bundles of yarn together for security.



WRAPPING WARP AROUND CLOTH BEAM

Now, after winding on the new warp you can sit on a small stool placed in between the harnesses and back of the loom and tie corresponding yarns from the two sets of lease sticks together. An overhand knot works well. This may seem slow at first, but you will work up a faster rhythm with some practice. A good goal to reach would be to tie 200-250 ends together an hour.

When all ends are tied together, go to the front of the loom and gently pull on the bundles of yarn going through the reed to pull the new warp through the heddles and reed. Then either tie-on to an apron, or simply wind the ends around the front cloth beam. See figure 20, page 29 for details.



TYING NEW WARP TO OLD WARP

SETTING THE TENSION DEVICE

Warp tension on an AVL Loom is controlled automatically by a special weighted tension arm which insures a constant and even tension at all times. The tension is easily adjusted, and the warp beam is released automatically as the cloth is advanced.

1. You should already have the cord wound round the tension drum and the cord end clipped to the spring. This should be done before winding the warp on to the plain beam to prevent the warp beam from turning backwards while winding on and threading. In the case of the sectional beam, the cord is entirely unhooked and unwound from the pulley and drum during the warp winding process; then is rewound and clipped on to the spring just prior to threading. Be sure to check with the diagrams to make sure you are doing this correctly. The cord should make three turns around the drum and must start from the correct position. Always check to make sure the cord has not crossed over itself.

2. To set the warp tension, move the weight to its rearmost position (next to the wooden pulley). Wind the warp forward slowly using the ratchet handle on the cloth beam. Continue winding until the weighted lever rises and stops when the rope slips on the brake drum.

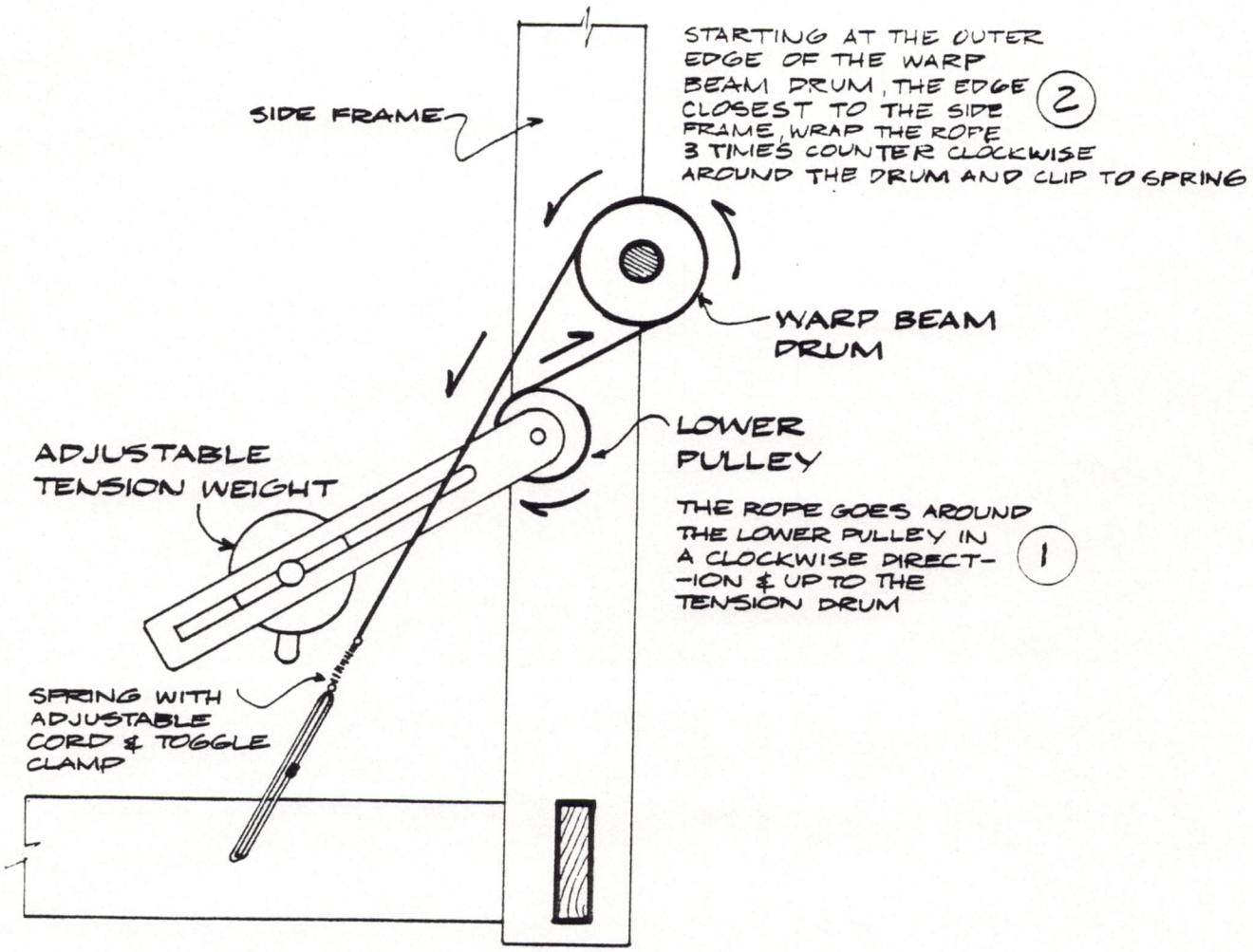
3. Ideally, the tension arm should rise (as you advance the warp) to about 45 degrees above horizontal, then slip and rest at an approximately horizontal position. If it stops above horizontal, let the adjusting cord out at the spring. If it stops below horizontal, shorten the cord. The length of the adjusting cord is changed by squeezing the ends of the small plastic toggle clamp together and then pulling the cord through it.

4. Now feel the warp for tension. If the warp is too loose, set the weight further out on the arm. Wind the warp forward a little and check again. Once you feel you have attained the proper warp tension, make certain that the tension arm is rising and slipping correctly. If it isn't, tighten

or loosen the adjusting cord as needed. You will find that you can weave with less warp tension with a weight control than with the conventional ratchet system. Once the correct tension adjustment is made, it will be maintained automatically as the weaving is advanced. For light, fragile warps it may be necessary to use a lighter weight than the one that comes with the loom, and for dense heavy warps you may have to add some weight to the arm. You can order half-size weights from AVL Looms. This can be used by itself for very light tension or can be used with the existing weight if more tension is needed.

For sectional beam tension device see figure 24 in assembly instructions page 80.

5. After making these adjustments, at times the warp will be wound too far forward. To wind it back on the warp beam, release the tension at the front of the loom and then go around to the back of the loom and lift the tension arm, then turn the crank so that the warp beam turns backwards. Always check to see that the tension cord has not become crossed over itself after this operation. Then wind the warp forward again with the front ratchet handle until the tension arm rises to horizontal.



TENSION DEVICE

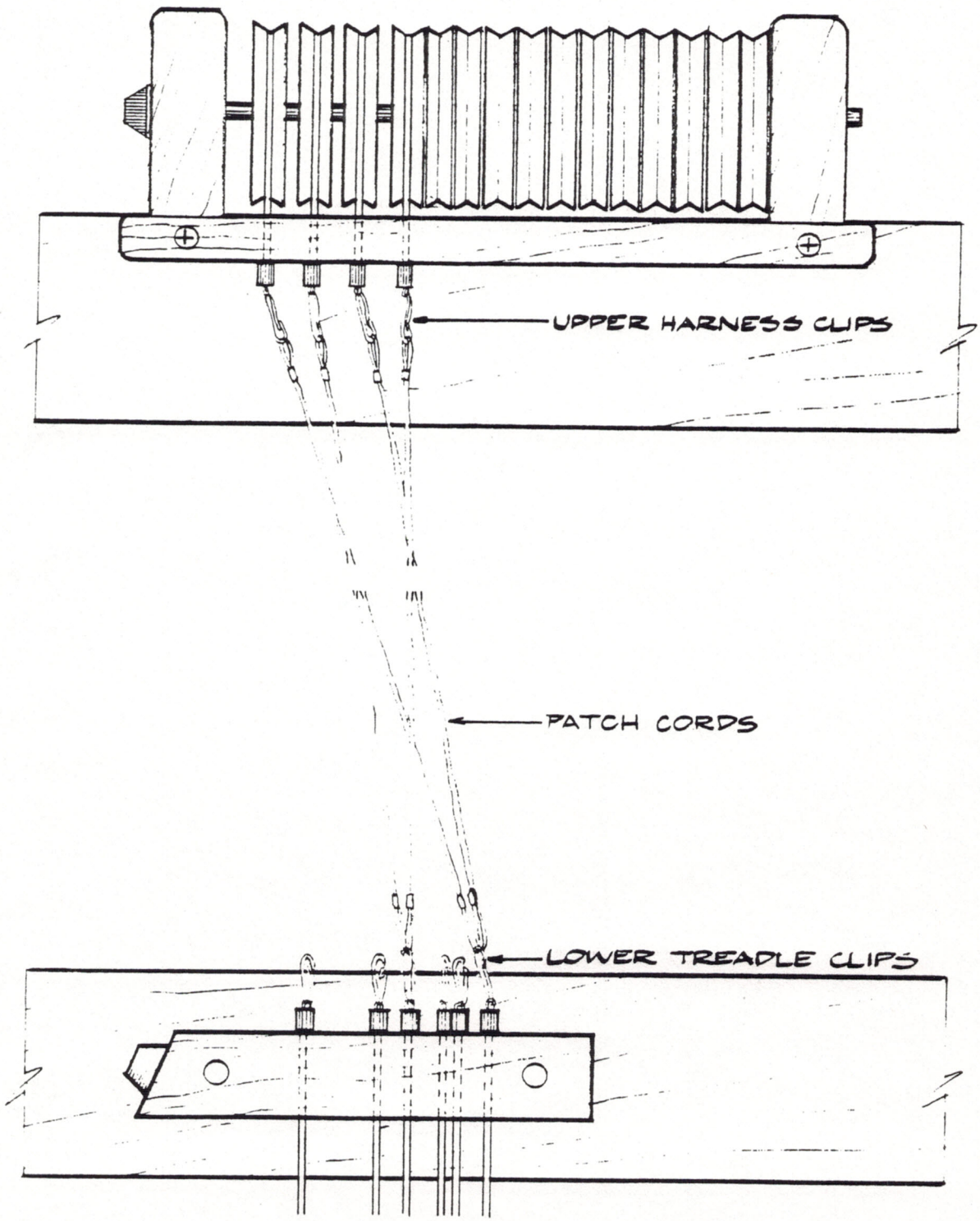
FIG. 7

USING THE MODULAR LOOM

With an AVL modular loom all treadle to harness tie-ups are accomplished at the side of the loom by connecting tie-up 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 you will notice that there are two sets of clips - a lower set of treadle clips and an upper set of harness clips. See diagram next page. 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 tabby weave, as tabby weave will always be used for the first couple of inches of each new warp as a heading. 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 the two patch cords to each of two adjacent treadle clips, then connect the two patch cords from one treadle clip to the clips for harnesses 1 and 3. Next, connect the two patch cords from the other treadle clip to the clips for harnesses 2 and 4 as shown in the diagram on the next page.

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.



MODULAR LOOM TIE-UP FIG. 8

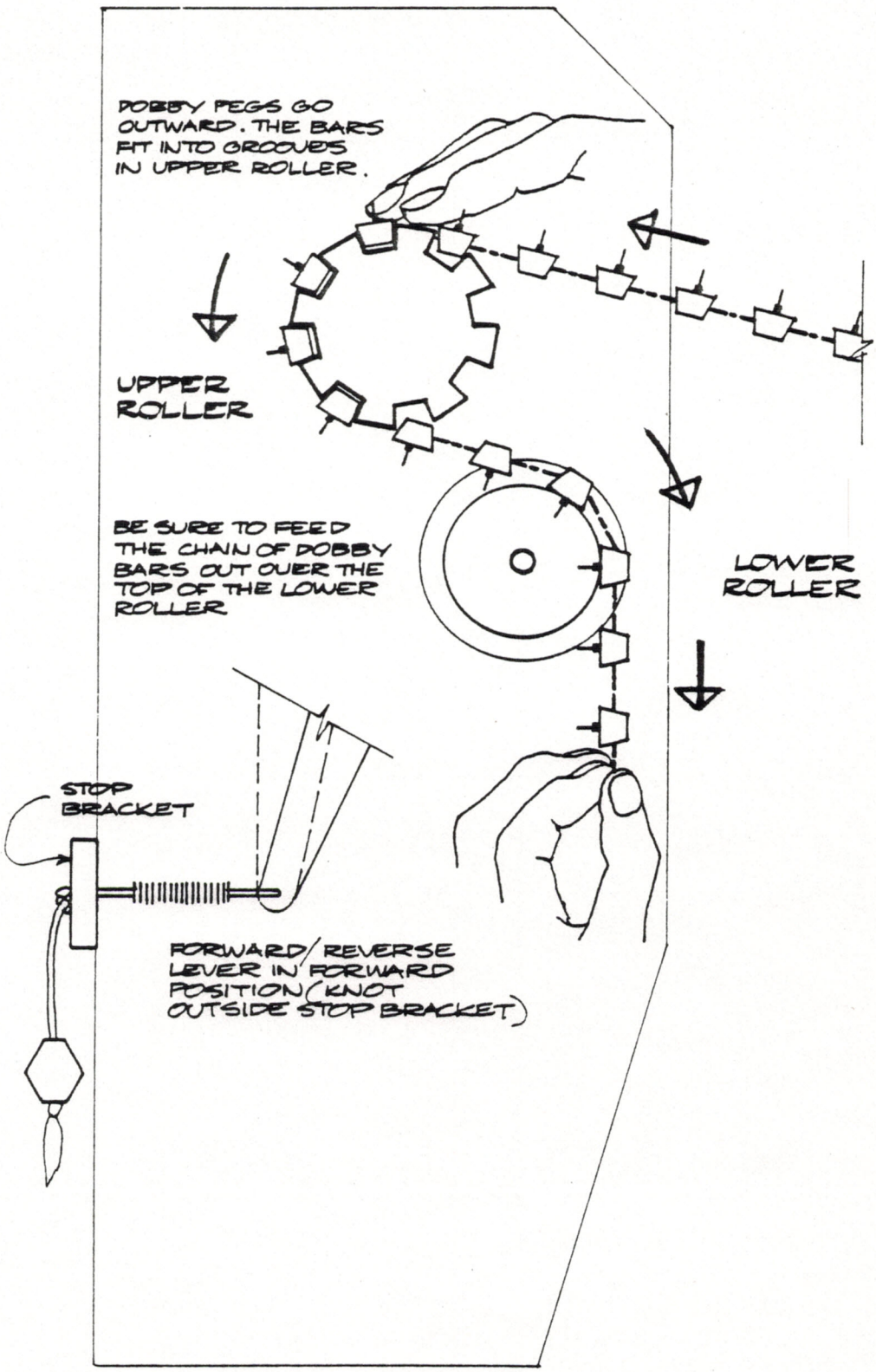
3. If your modular loom does not have the optional cloth storage roller, you will have to be aware of the amount of cloth build-up on the cloth beam and plan your projects so that they can be taken off the cloth beam in sections. (An easy method for doing this is described in Section 7 on page 50.) If the woven material builds up too high on the cloth beam, it will distort the shed geometry and affect the tension in the weaving. Since different materials will build up quicker than others, here are some guidelines to follow for the amount of yardage to have wound on the cloth beam: up to 40 yards for a very fine fabric, up to 30 yards for a medium fine fabric, up to 20 yards for a medium heavy fabric, and up to 10 yards for a heavy fabric. You will get your own feel for this with a little experience.

PEGGING THE DOBBY UNIT

The dobby loom provides the means for quickly and easily raising any number of harnesses in any combination by the alternate use of only two treadles. This is accomplished by the use of a chain of wooden bars which are placed in the dobby mechanism, or "head", in which short metal pegs can be easily inserted. Each wooden bar has a row of 16 holes in it. The first hole on the left corresponds to the first harness, the second hole to the second harness, and so on. Each wooden dobby bar controls one shed and when a peg is inserted into a hole in a bar it causes the corresponding harness to raise when that bar comes around into position by pressing on the treadles.

1. The first pattern you need to peg up on the dobby bars is a tabby weave. Tabby weave should always be used for the first inch of each new warp as a heading. Take one of the chains of 30 dobby bars and lay it flat on a table with the holes up. In the first bar (start at the top of the chain and work downward) place pegs in holes 1,3,5,7,9,11,13, and 15 using the special wrench provided. First place the smooth end of the peg in the wrench. Then holding the wrench handle, screw the peg into its hole firmly but not too tightly. (Use the wrench again when removing pegs.) In the second bar place pegs in holes 2,4,6,8,10,12,14, and 16. Continue repeating these two sequences until all the bars are pegged.

2. Now place the pegged up chain in the dobby unit. Note that in the dobby unit are two rollers - a large grooved upper roller and a smaller lower roller with a metal rod. Next find the forward-reverse cord. It is on the side of the box facing the front of the loom. There is a wooden pull hanging from the end of a cord. Pull this gently until the knot on the rope is caught on the outside of the wooden stop bracket. The large grooved roller will now turn in a counterclockwise direction (assuming you are at the front of the loom).



FEEDING DOBBY CHAIN INTO DOBBY HEAD

FIG. 9

Take your tabby chain and place the top few bars in the grooves in the top roller of the dobby box. Turn the roller toward the top of the loom so that the chain moves over the top of the roller and into the dobby box. Place your fingers in the box under the top roller and guide the chain so that it comes out over the top of the smaller roller which is underneath. This is very important because the dobby chain will jam in the box if it does not come out over the top of the smaller roller. When enough chain is available fasten the chain together to form a continuous circle using the white dobby chain ties. To use the dobby chain ties (the little white plastic tapes with an eye in one end) simply pull one end through the eye until it's tight, then clip the excess.

3. Next you will probably want to peg up another chain with a more complex weave structure (a 16 harness point twill is an easy one to try first). The first step is to draw up a "peg plan" which is a graph that shows the order in which the pegs are inserted into the dobby bars. The peg plan takes the place of the tie-up and treadling plans used with conventional treadle type looms. Use the following procedure for determining your peg plan:

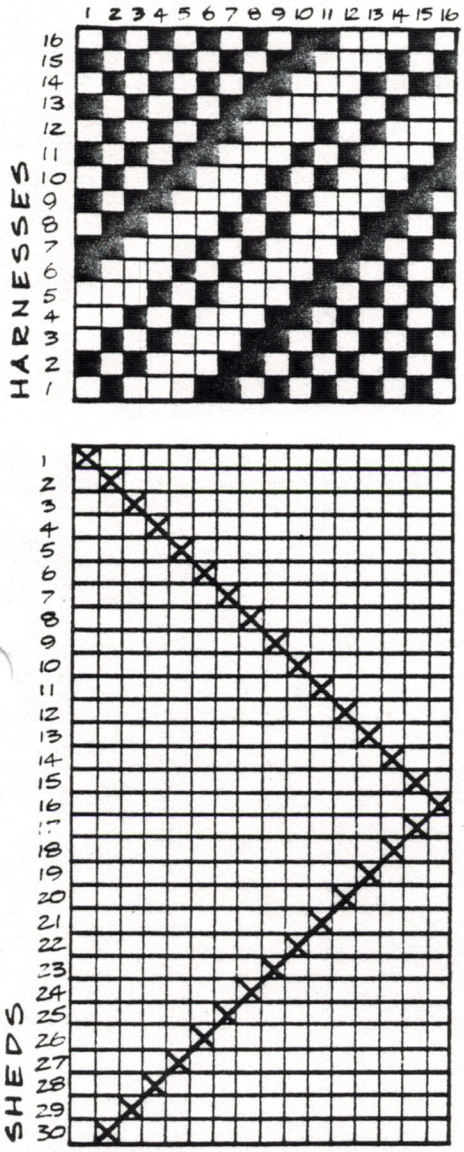
    a. First determine the tie-up and treadling plan for the weave structure you will be using as you would for a conventional treadle loom. Diagram (a) on page 40 is an example showing a typical pattern with its tie-up on top, and its treadling plan below; the threading plan (a 16 harness point threading) is not shown. In the tie-up each vertical column represents one treadle (numbered 1-16 from left to right), and each horizontal row represents a harness (numbered 1-16 from bottom to top). Squares are filled in showing which harnesses are to be tied to each treadle. Please note that the filled in squares represent <u>raised</u> harnesses.

In the treadling plan below, each horizontal row represents one shed and they are numbered from top to bottom in the order they will be used when weaving. At each shed an X is placed in a vertical column representing the treadle which is to be used. Make sure your treadling plan represents one complete repeat of all the sheds needed to weave your pattern.

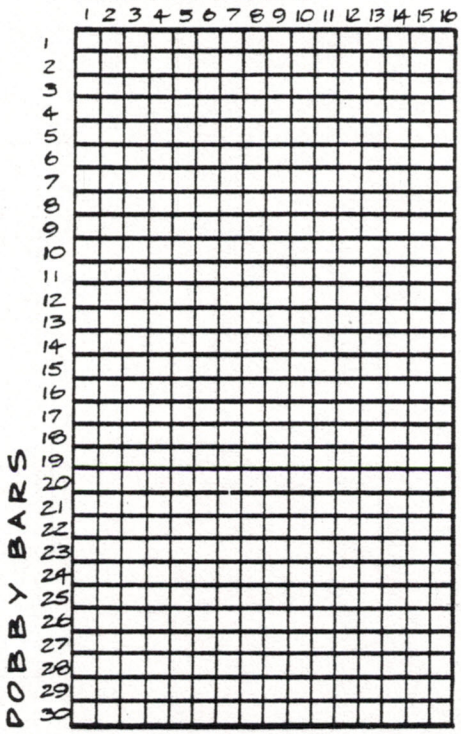
b. Now on graph paper you will construct a peg plan. In your peg plan each horizontal row will represent one dobby bar and they will be ordered from top to bottom to correspond to the way the dobby chain feeds into the dobby head; and each vertical column represents the holes in the dobby bars and their corresponding harnesses. If you are using all 16 harnesses on the loom there will be 16 vertical columns numbered from left to right. The number of horizontal rows (or dobby bars) needed will be the same as the number of sheds in the treadling plan. Refer to sample peg plan (b) and notice that there are 30 horizontal rows since there are 30 sheds in treadling plan (a).

c. Now you are ready to start filling in squares in your peg plan. First look at the first shed (1) in your treadling plan. Then look above to its corresponding vertical column in the tie-up and note which harnesses are to be raised. In diagram (a) that would be harnesses 2,6,7,9,11,13, and 15. Now fill in the squares that correspond to the harnesses in the first horizontal row of your peg plan as we have done in diagram (c). This represents the holes which will be pegged in the first dobby bar, and thus which harnesses will be raised by it. Notice how <u>horizontal</u> rows of the peg plan correspond to <u>vertical</u> columns of the tie-up.

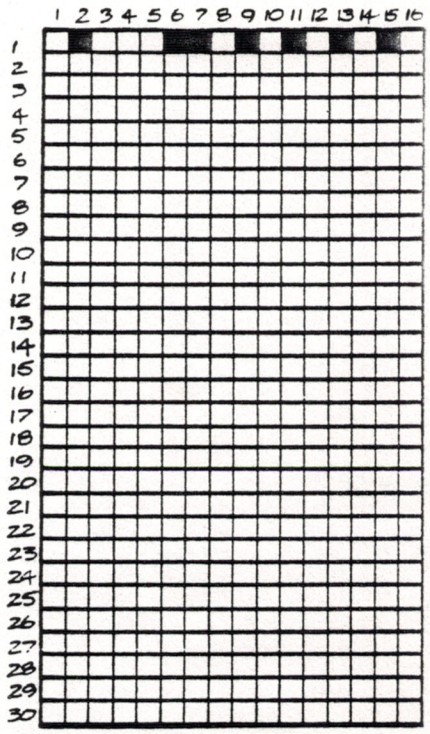
a. TIE-UP & TREADLING PLAN



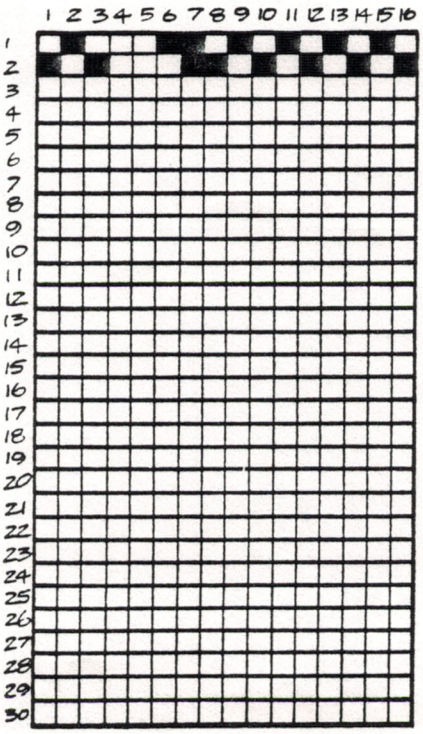
b. PEG PLAN



c. PEG PLAN



d. PEG PLAN



e. PEG PLAN

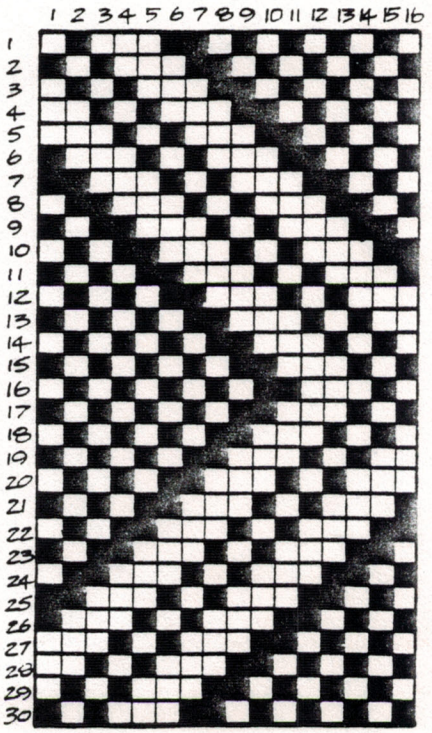
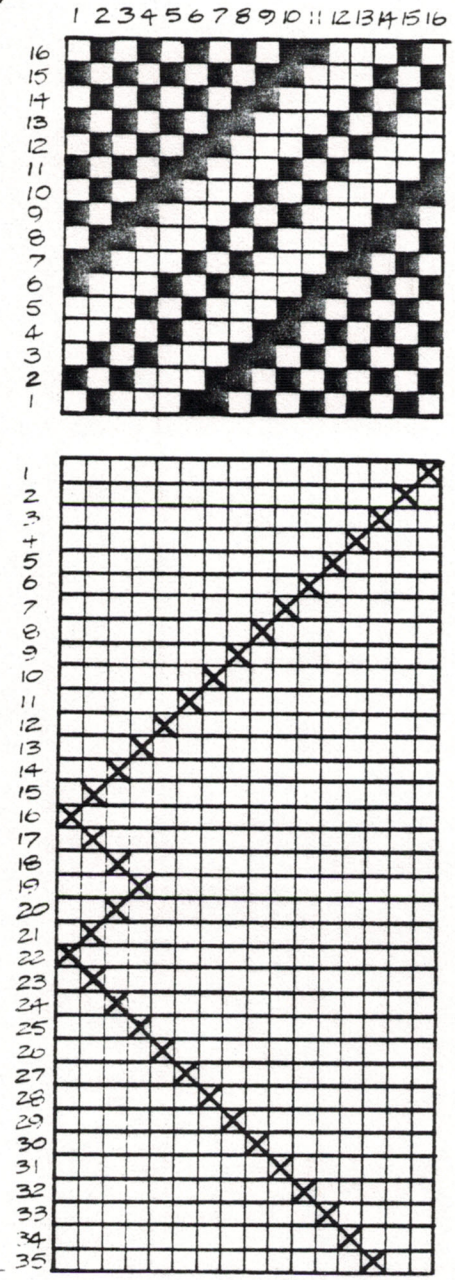
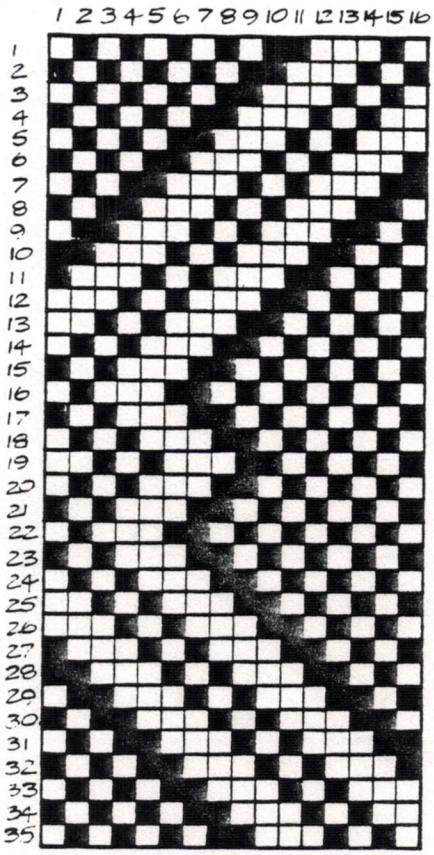


FIG. 10

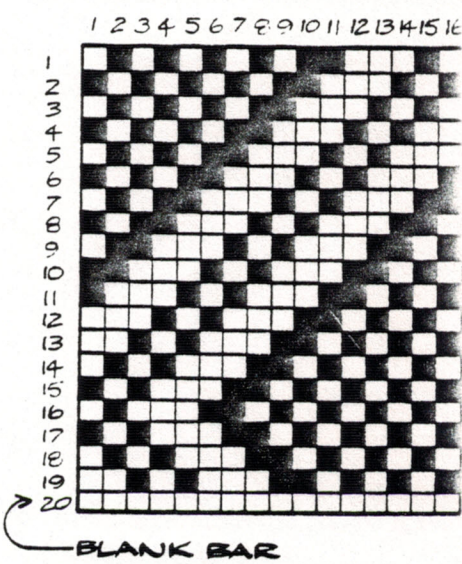
f. TIE-UP & TREADLING PLAN



PEG PLAN



g. PEG PLAN USING REV-ERSING TECHNIQUE



IF THE DOBBY UNIT IS REVERSED AT THE BLANK BAR, THE PATTERN WILL BE WOVEN EXACTLY LIKE THE ONE REPRESENTED IN DIAGRAM f.

FIG. 11

d. Next look at the second shed (2) of your treadling plan and note which harnesses will be raised. In diagram (a) that would be harnesses 1,3,7,8,10,12,14, and 16. Then proceed to the second horizontal row of your peg plan and fill in the squares corresponding to these harnesses as we have done in diagram (d).

e. Continue in this same manner until all the sheds of your treadling plan have been recorded on the peg plan as we have done in diagram (e). Diagram (f) on page 41 shows the same tie-up as in diagram (a) with a different treadling plan and its corresponding peg plan.

4. Here are some additional points to keep in mind when making up your peg plan:

a. At least <u>twenty dobby bars</u> should be used at once in order for the dobby unit to function properly, less than 20 bars will tend to jam in the dobby head. If the number of dobby bars or sheds in the treadling plan is fewer than twenty, they should be repeated several times. As an example, for a tabby weave which has only two sheds, repeat the pegging at least ten times, so that you will be using twenty bars. Fewer than 20 bars can be used if the chain of bars is weighted down to prevent jamming. The easiest way we have found to do this is to place a short length of 3/4" steel pipe, about 8" long, in the bottom loop of the dobby chain. It is possible, however, to create and use an 8-bar chain, which exactly fits in the slots in the dobby cylinder with no slack at all.

b. When the dobby chain is placed in the dobby unit it will form a continuous loop, so visualize your peg plan as circular. Check your peg plan to see that if the first shed follows the last shed the weaving pattern will turn out correctly. If you make the mistake of making the first shed and the last shed the same, two identical sheds will follow each other.

c. There are times when you will find it helpful to use blank dobby bars to mark your place in your pattern. For instance, if you need to know where the beginning of a pattern is, leave a blank bar just before the dobby bar corresponding to the first shed of the pattern. When you are weaving and come to this blank bar, no harnesses will raise.

d. Keep in mind that the direction the chain moves can be reversed at any time. This feature can save pegging time and dobby chain. One example of its use is with a pattern where the second half is a mirror image of the first half. Only the first half of the pattern need be pegged, then by reversing the dobby unit the second half or mirror image is automatically produced. When using this technique you may want to leave a blank bar as a signal at the point at which the dobby is to be reversed. See diagram (g) on page 41 for an example of a peg plan using this technique. This feature can also be used where long lengths of tabby are to be woven between pattern borders. Simply peg-up part of the tabby and by repeatedly reversing, as much tabby can be woven as necessary. Here again use blank bars between the tabby part of the chain and the pattern part.

e. When using two shuttle weaves where there is a tabby shed in between each pattern shed, the tabby sheds are often not included on conventional treadle plans. Don't forget that on the peg plan for such a weave, a tabby shed must be filled in between every pattern shed.

f. Remember that with a dobby loom the number of combinations of raised harnesses is limited only by how many dobby bars you wish to use. On treadle type looms the number of combinations available is limited by how many treadles the loom has. As you gain more experience working with peg plans, try designing right on the peg plan itself, adding raised harnesses wherever it suits the needs of your design.

5. Now peg your pattern up on dobby bars. The number of bars needed is determined by the number of rows in your peg plan. If you need to take off bars from the chain, unfasten the metal connecting loops with a long nosed plier. If you need to add bars to the chain use a long nosed plier to reconnect the metal loops; it is easiest, however, to fasten them together with dobby chain ties or plastic tie tapes.

   Before starting to put pegs in the bars, it is a good idea to mark the left end of the top bar with an X since it will be placed toward the front of the loom when placed in the dobby unit. Otherwise it is easy to get the chain turned around which would make your weaving pattern turn out all wrong. Keep this pegged up chain aside until it is time to place it in the dobby box.

6. When pegging up the dobby head, one thing that you should remember is that if over 100 to 150 bars are used, the weight of this chain of bars may cause the dobby head to skip a bar as it is advanced. If you are using a long length of dobby chain and you experience this skipping, you'll need to suspend an auxiliary roller (a rolling pin would work) so that it will support some of the weight of the bars.

7. Here are some tips for handling your dobby chains. First of all, keep one length of chain pegged with tabby weave in a handy location. This way you can quickly do tabby weave whenever necessary without having to repeg it each time. As you develop a repertoire of weaving patterns which you will be using over again, keep a notebook of their peg plans as

well as other weaving information and give each weaving pattern a name. If you have lots of dobby chain, you can just leave the chain pegged-up ready to be used at any time. Each chain will be easy to identify if you write its name on the top of the first dobby bar. If you do not have a lot of extra chain, here is a little trick that saves time if you are going to be repegging a pattern over again. Cut cardboard strips about the same length and width of the dobby bars. Make a guide by punching 16 holes in one strip, so that when that strip is held over a dobby bar the holes in the strip are aligned with the holes in the dobby bar. Use the guide to punch holes in the other strips corresponding to the way the dobby bars are pegged. Use them to quickly and easily repeg the dobby bars.

ADJUSTING THE BEATER AND SPRING LEVERS

1. In preparation for weaving, all AVL beaters should be adjusted in height so that the bottom half of the shed is just touching the shuttle race in the open shed position. So open a shed (to open a shed on the dobby loom, press downward on the right treadle. When closing the shed on the dobby, make sure the left treadle goes all the way down) and raise or lower the beater by using the adjusting wing nut screws which are near the bottom of the beater legs for floor mounted beaters, or near the top of the hanging arm for overhead beaters.

   Floor mounted beaters can also be placed in one of three positions depending on your personal preference and/or how hard the fabric will be beaten. For a very heavy beat, the beater should be placed in its rearmost position. For a very light beat it will be placed in its front most position. Place the beater in one of the three positions <u>before</u> adjusting for height as above.

2. The springs of the spring lever return system should also be adjusted for positive harness return, i.e. the harnesses stay all the way down in the depressed position, and require the least amount of effort for lifting. 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 very little spring tension to assure positive harness return. Heavier, denser, tighter tensioned, and wider warps will need more spring tension. To tell if the harnesses are returning all the way, open several sheds by working the treadles. Watch the unlifted harnesses and if the tops of their heddles become loose and tend to move around, then spring tension should be increased, but 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. 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, in some cases the back spring levers might have to be adjusted shorter to give the same tension as the front ones. 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 tensioned warps, you will find that a lot of adjusting will not be necessary. The loom comes with sixteen chains and sixteen springs. If extra springs are needed you can use 16" screen door springs which can be purchased in almost any hardware store. You can also get extra chain there.

WEAVING PROCEDURES... Now the Fun Begins!

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. On the modular loom simply press down on the treadles in the sequence determined by the pattern of your weaving. On the dobby loom start by pushing downward on the right treadle so that a shed is open and throw the shuttle. Catch the shuttle with the opposite hand then pull the beater forward with a quick wrist movement while closing the shed by pressing downward on the left treadle. The left treadle not only closes the shed but advances the bars in the dobby unit. Even though it seems as if the left treadle goes down almost on its own, it is very important to press it all the way down with the left foot, otherwise the next dobby bar may not advance completely in the dobby box and this will cause errors.

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 front of the beater in order not to have to wind it backwards (see Section 5 - SETTING THE TENSION DEVICE if this occurs). This easy, rapid method of advancing the cloth makes it practical to advance the cloth 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. The position of the forward-reverse cord determines the direction in which the dobby chain will move. When the cord is in its most extended position with the knot caught on the outside of the hole in the wooden stop bracket, the chain moves in a counterclockwise direction. To reverse the direction in which the chain moves, gently pull and snap the cord so that the knot goes through the hole and rests on the other side

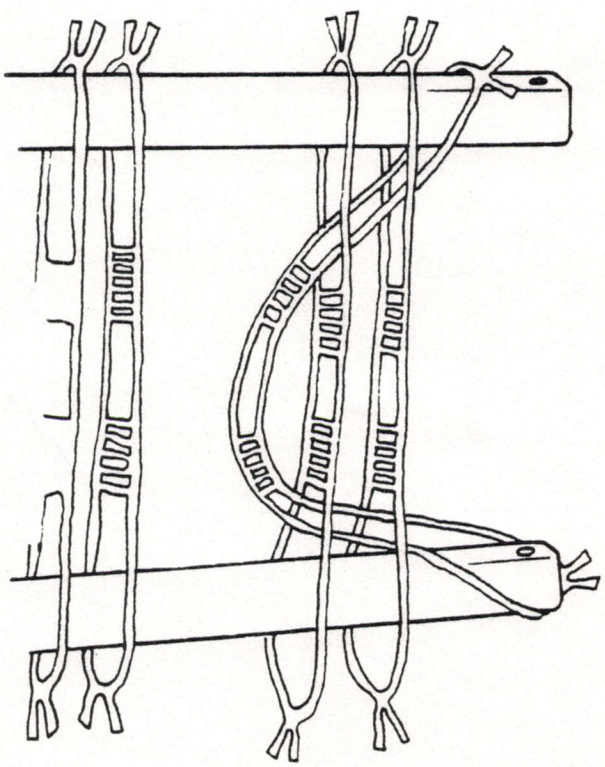
of the stop. Be careful not to pull the cord too hard, or you will pull the spring out of shape.

4. In case of threading error, use the following method for insertion of a new polyester heddle:

   a. Remove the harness wire at the end of the harness.

   b. 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.

   c. Take the bottom loop of the new heddle through the bottom loop of all the heddles, around the bottom harness stick, and back through the bottom loops of all the heddles until it reaches its place.



INSERTION OF NEW HEDDLE

FIG. 12

5. At the onset of weaving, first weave in one inch of a strong, medium weight weft with a 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. Then 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. Now change the dobby chain, or modular loom tie-up if so desired, and proceed with your planned weaving.

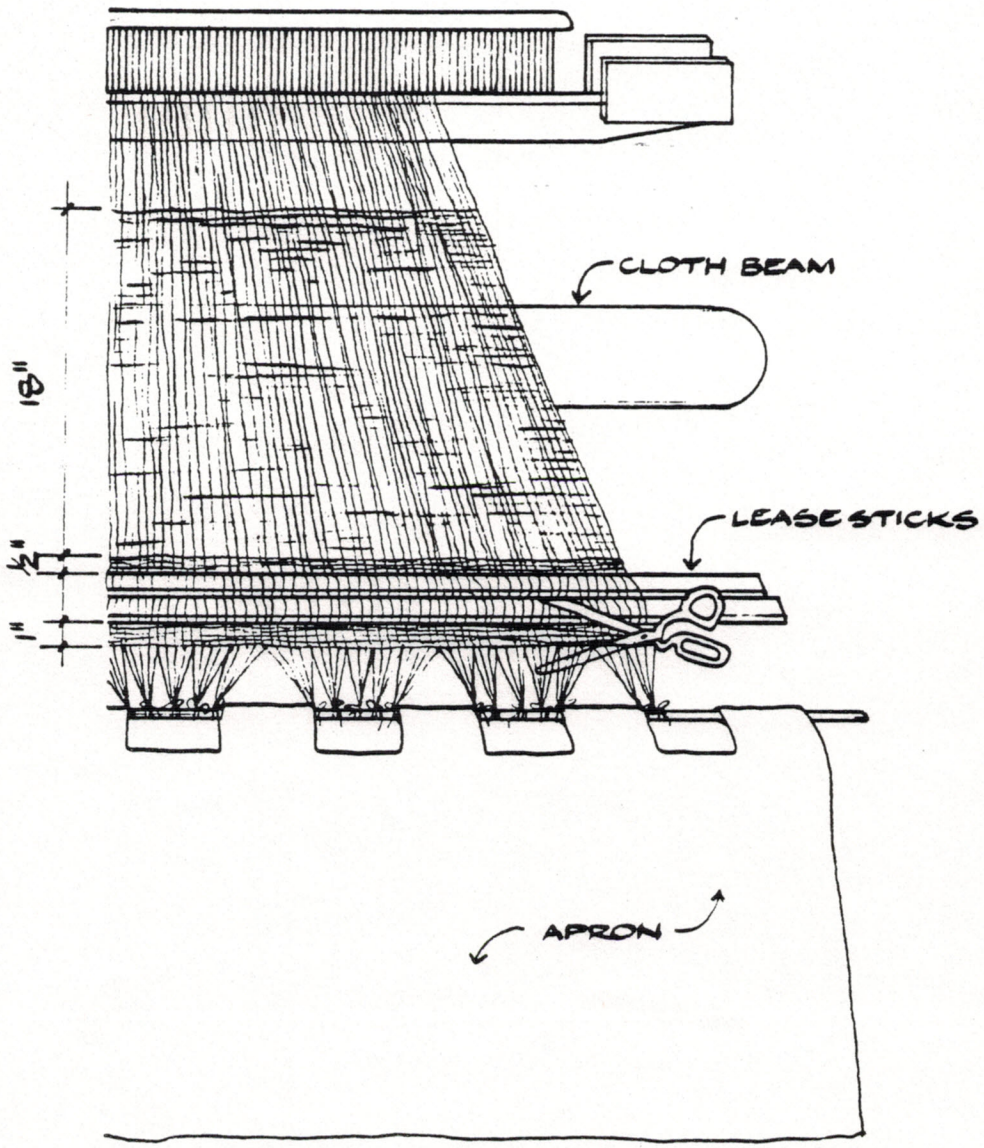
6. If you are using an apron and wish to remove it (to create a smoother tighter build-up on the front roller) stop weaving when the woven in lease sticks have wound around the roller 1 1/4 times, i.e. until the woven cloth overlaps the lease sticks on the roller. Now release the ratchet on the cloth beam and unwind the weaving back to the beginning. Unwind the weaving and apron from the front roll. Remove the apron by cutting off the knots which tied the warp to the metal bar, but do <u>NOT</u> cut off the tabby hem or the woven-in lease sticks from the end of the warp (see diagram next page).

   Place the two thin woven-in lease sticks flat on the front cloth beam making sure they are centered and parallel to the roller. 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 weighted tension lever rises to the horizontal position and continue weaving. Now that you have a smooth cloth roll in front, you will not have to be weaving over any knots or bumps and an even tension will be maintained in the weaving.

7. For sample weaving, if you wish to remove part of the weaving from the loom before the entire warp is woven off, use the following procedure:

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



REMOVING THE APRON

FIG. 13

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

c. Start new weaving and weave until the lease sticks are wound 1 1/4 times around the front cloth beam (or about 18")

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

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

Wind the weaving back on the cloth beam holding the lease sticks in place until the weaving winds back over itself and holds itself in place. Take up the tension by using the ratchet handle until the weight of tension lever rises to the horizontal position and continue weaving.

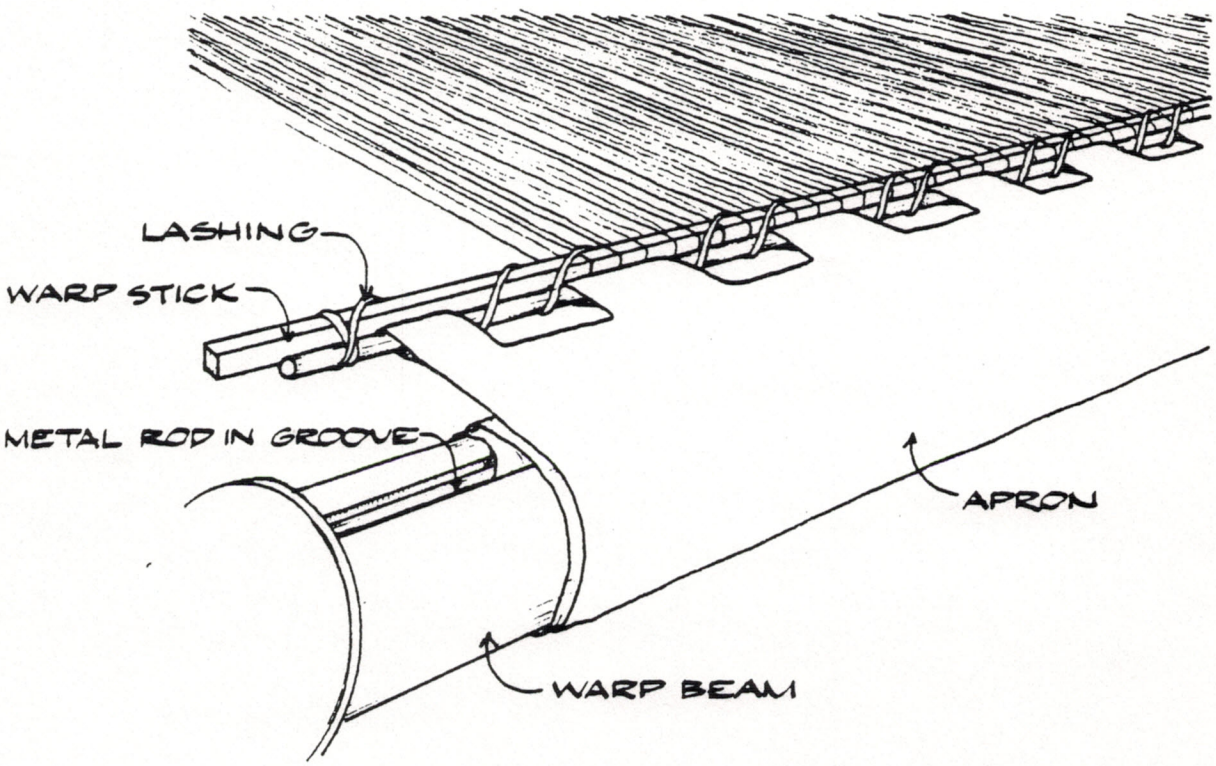
f. **Important Note:**

You may find that for a lot of fabrics, it is not necessary to weave in the two lease sticks and the tabby. Simply cut off one piece of fabric when there is 18" of the next piece woven. Wrap the new piece of fabric around the front beam so that it overlaps itself. Take up tension, and continue weaving.

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

8. 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. 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 with a metal rod in place (in the hemmed end with the openings) and insert a second metal rod in the plain hem at the opposite end. Place this second metal rod enclosed in the apron hem into the groove in the warp beam and wrap the apron around the beam, 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. 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 tension arm rises and continue weaving until the warp end is just behind the harnesses.



EXTENDING END OF WARP

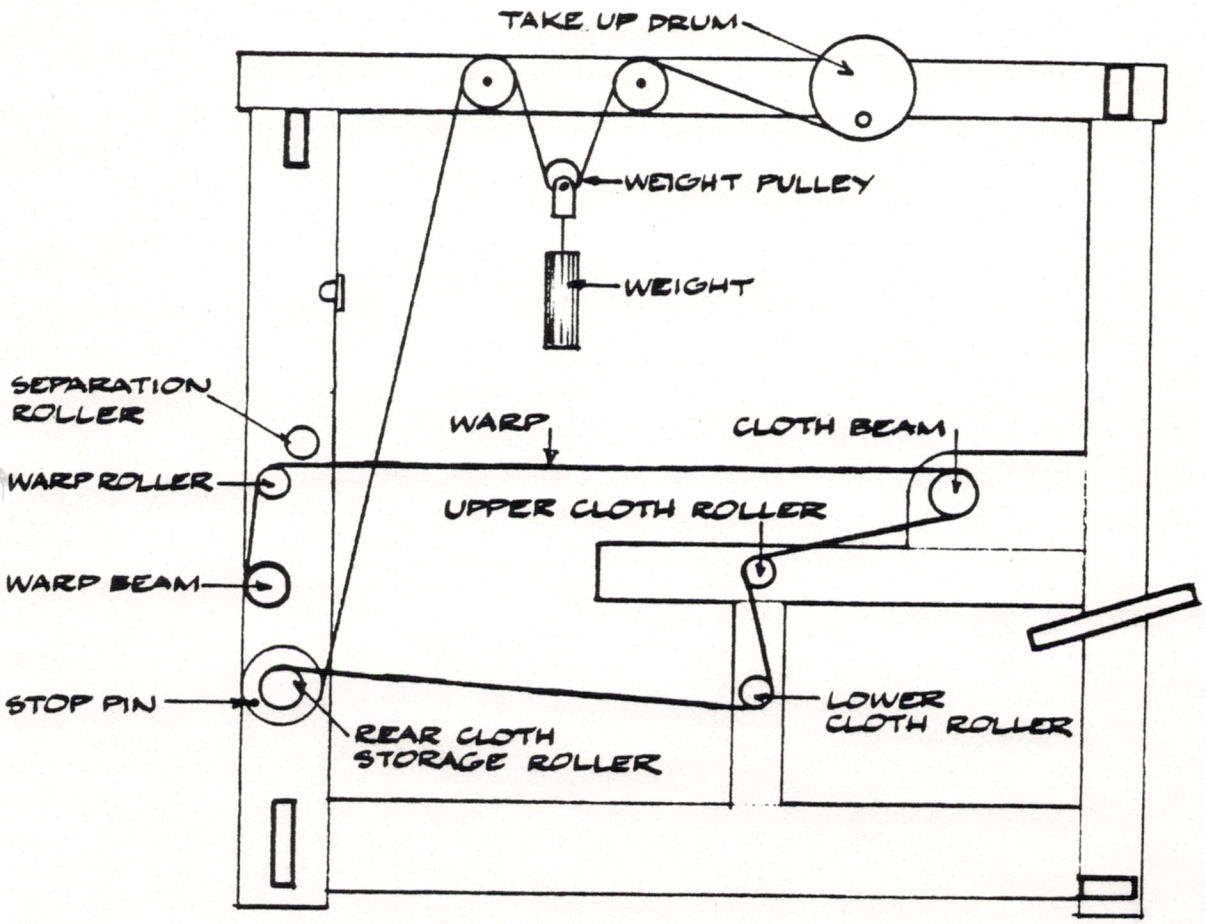
FIG. 14

USING THE CLOTH STORAGE ROLLER

When weaving long lengths of fabric, the material is taken around the front cloth beam and passed to the back of the loom to the cloth storage roller which can accomodate a roll up to 16" in diameter. The cloth storage system, consisting of cord, pulleys, rollers, and a weight is designed to automatically wind the woven cloth onto the storage roller as the cloth is advanced. A looser tension is maintained on the storage roller than on the weaving. This eliminates any strain on the fabric, while the special abrasive surface of the cloth beam holds the proper tension on the weaving being done. 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 cloth beam.

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

2. The stop pin should be in its place in the rear cloth take-up drum and the cloth take-up weight should be in its topmost position. Remove the lease sticks from the end of the fabric so that the fabric will wind on smoothly. Then place the fabric on the roller, making sure it is centered and parallel. Fasten it on using 2" pieces of masking tape placed vertically at 6" intervals. You will next remove the stop pin and allow the fabric to turn onto the roller until tight. <u>You'll need to use some caution here because as soon as the stop pin is removed the weight may start falling very quickly and the roller will wind up very quickly if uncontrolled</u>. To avoid this, firmly grip the roller and let the roller turn slowly inside your hands. When finished wind the weight back up to its topmost position by turning the take-up drum on the upper right hand side of the loom.



SECTION THRU LOOM SHOWING ROUTING TO REAR ROLLER

FIG. 15

3. Now readjust the weaving tension by using the ratchet handle on the front cloth beam until the weighted tension lever rises and continue weaving. As the weaving proceeds and the cloth is wound forward the weight on the pulley will gradually descend. Before the weight hits bottom, wind it back up to the top using the take-up drum. This will happen about every 1 1/2 to 2 yards.

4. If you are weaving a very thick fabric or rug which would build up quickly on the front roller you may want to connect the warp directly to the cloth storage roller. You will need a long apron for this purpose. With the weight at the top and the stop pin in place, use masking tape to secure the plain edge of the apron to the cloth storage roller. Then wind the apron once around itself so that it holds itself in place. Then simply route the apron around the lower cloth roller, the upper cloth roller and up over the cloth beam following the diagram on page 56. 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.

5. After you've completed your weaving 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. 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, 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 clockwise 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 cotter pin hole. (The drum rewind handle is a cylindrical wooden handle, round on one end, with a pin at the other end.)

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

USING THE FLYSHUTTLE BEATER AND AVL SHUTTLES

The AVL Loom's flyshuttle beater is designed to increase weaving speed. It has a light and easy action and little physical exertion is needed to operate it. Weaving can be done for hours without tiring the weaver. With a properly wound bobbin and a little practice of the throwing technique, selvage edges turn out smooth and even.

1. To change the reed on the flyshuttle beater, remove the beater top and then remove the seven bolts from the reed support. Then lift off the reed support and remove the reed. Now it's just a matter of reversing your steps for installing the new reed. This isn't as convenient as simply slipping the reed in and out of a groove as on a standard beater, but on a flyshuttle beater it is essential that the reed stays in perfect alignment with the shuttle race, or else you'll have flyshuttles flying across the room.

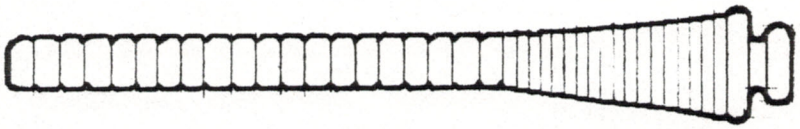
2. A properly wound bobbin is essential to the correct operation of the flyshuttle. If the weft thread does not come smoothly off the bobbin, if the shuttle jerks and pulls the selvage edge too tightly, or if the shuttle fails to move lightly across the shuttle race, look to an improperly wound bobbin as the cause of your troubles. If a bobbin is not working properly, do not waste time fooling with it, place it aside and use another bobbin.

   The AVL Loom's shuttles use stationary, open-end bobbins. The advantage of using this type of bobbin over the conventional spinning bobbin is that as soon as the shuttle is caught, thread stops coming off the bobbin, whereas the spinning bobbin tends to keep spinning and unwinding thread even after the shuttle is caught. The stationary bobbin allows the weaver to more easily obtain a clean selvage edge. The AVL shuttle also has a built-in adjustable tension device that puts the proper tension on the thread as it comes off the bobbin. This eliminates the need to lay in each weft shot and thus greatly speeds up the weaving process.

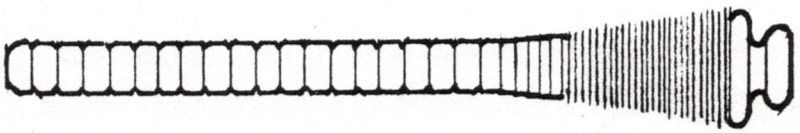
Stationary bobbins are wound quite differently than spinning bobbins. They are not wound back and forth from one end of the bobbin to the other, so please practice the following technique until you get it right.

Use a standard size bobbin winder. A hand winder will work but an electric one is better, and some sort of tensioning device is ideal since the thread should be wound very tightly. (Wearing a heavy leather work glove will help you to pull the thread tighter.) Make a few winds of the thread over itself at the far end of the bobbin (the end near the large coned shaped part) and then place it on the winder. To start, wind a thin layer going back and forth in one area, about 2" long at this far end. It should cover three quarters of the cone shaped part of the bobbin. Consider this the first layer of thread. Then move down one fourth of an inch and start a new layer which will overlap one and three quarter inches of the last layer. For each layer wind the thread tightly and quickly back and forth covering a two inch area until that layer is complete, then move down one fourth of an inch and start a new layer which will overlap one and three quarter inches of the last layer. Keep repeating these tapered overlapping two inch layers until there is one half inch left at the end of the bobbin. You will soon learn when each layer is complete. If the layers are too fat the bobbin won't fit into the shuttle, if they are too thin you won't get as much thread on the bobbin and it will have to be changed sooner. Wind many bobbins at once so it won't be necessary to stop and wind bobbins while weaving.

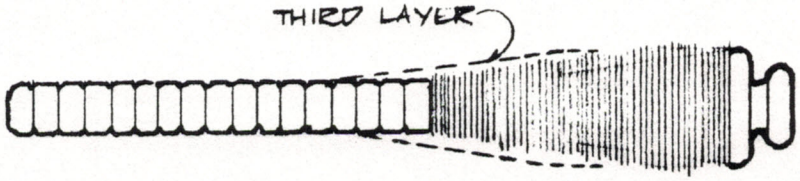
Now, pull up the metal rod in the middle of the shuttle and slip the large end of the bobbin onto it (it might be a little stiff at first) and then push the bobbin all the way down to the end of the rod so that the groove in the end of the bobbin straddles the retaining pin in the bottom of the shuttle. Uncoil some thread from the front end of the bobbin and push it down between the two metal plates of the tensioning device. Slip it down the groove that runs toward the point of the shuttle and out the hole in the side.



EMPTY BOBBIN



FIRST LAYER OF THREAD



SECOND LAYER

FULL BOBBIN

WINDING THE BOBBIN

The tension device on the shuttle can be adjusted by turning the screw inside the hole on the side of the shuttle with the screwdriver provided. For fine yarns which need a tighter tension, turn the screw so that the metal plates are tight against each other. For large yarns, loosen the screw so that the metal plates loosen up. Note: In some cases, adjustment is accomplished with an allen wrench rather than a screwdriver.

Throw a few weft shots with the shuttle and then check your selvages. If the selvages are too loose, increase tension; if tension is too great and the selvages are drawing in, reduce tension. It may take a little experimenting to get it just the way you want it, but when properly adjusted they work beautifully.

3. It's going to take a little practice to learn to throw the flyshuttle. Start out slowly and patiently. In the beginning you should only be concerned with learning the technique described below. Practice each step slowly and carefully. This will form good habits which will become automatic and it is after that that the speed will come.

You should practice at first with an empty bobbin and then with weft thread when it starts to go a little smoother. Push the beater away from you to its rearmost position, place the shuttle on the shuttle race, and slide it into one of the shuttle boxes so that it pushes the picker as far as it will go to the end of the box. The hole in the side of the shuttle through which the weft thread passes should generally be facing the weaver. In some cases, it will be advantageous to turn the shuttle around. Place one hand on the flyshuttle handle and the other hand in the center of the beater and open the shed. To send the shuttle along the shuttle race and into the opposite box with the single box flybeater, make a short quick wrist movement with the handle in the direction the shuttle is to travel. With the double box and four box beaters you pull straight down on the handle. Your body should be erect and relaxed. Move only your hand and wrist. You will soon get a "feel" for the

correct wrist movement. The shuttle should stop just at the end of the shuttle box without bouncing too far back or falling short. If the shuttle bounces too far back, too much weft thread will be let out of the shuttle and a loop will form at the selvage edge. If the shuttle falls short of its goal, it will not be in the correct position for throwing the next pick. If the shuttle falls short, push it to the end with your hand. Next beat the fell of cloth with the hand that is on the beater. Again, keep the body relaxed and do <u>not</u> waste energy by moving your body backwards. Now close the shed. Start the sequence again by opening the shed and throwing the shuttle to the opposite side, but be sure <u>not</u> to change hand positions. To change shuttles on the double box and four box beaters simply lift up and shift the control handle. On the four box there are four settings (you'll "feel" the notches).

Again, remember at first to practice each step distinctly and don't hurry. As you get better at it, the movements should become less distinct and start to flow into each other. Eventually it should all become one smooth flowing movement. The weaver's body stays straight and comfortable with no strain as light movements of the hands, wrists, and feet are used to operate the loom. The weaver's eyes and attention are focused on the fabric being woven, constantly on the lookout for flaws, so that they can be corrected immediately. Here is a good way to progress in learning to use the flyshuttle beater more efficiently.

1. Beater Back
2. Open shed
3. Throw shuttle
4. Shuttle stops
5. Beater forward
6. Close shed

After you feel comfortable with these, move on to the following four step progression:

1. Beater back and open shed at the same time
2. Throw shuttle
3. Shuttle stops
4. Beater forward and shed closed at same time

Next move onto these three steps:

1. Beater back, open shed and throw shuttle in quick succession.
2. Start moving beater forward as shuttle reaches halfway on the shuttle race
3. At the time that shuttle stops, the beater is moving forward and shed closed

Use the above method for weaving loose weaves and moderate-set fabrics. For upholstery and rugs, you will have to use a harder beat and change both sheds while the beater is forward. Try practicing to some lively music - it will help a lot.

When starting a new bobbin there are two methods. One way is to throw the first shot by hand in the conventional manner holding on to the end of the thread but instead of catching the shuttle, send it all the way to the opposite box. The other way is to use the flyshuttle. Before sliding the shuttle into the box, take hold of the end of the thread with the hand that would ordinarily hold the beater.

4. If you are doing a weave that requires two or more shuttles to be thrown in succession, and you have a single box flyshuttle beater you will need to hand throw at least one or more. It does work well however, with a two shuttle weave to use the flyshuttle for one shuttle, and throw the other one by hand -- try it! If you do much of this type of weaving you should probably consider the AVL double box or four box flyshuttle beater. Anyway, if you are doing a weave that requires the hand throwing of shuttles, you can do this with the single box flyshuttle beater simply by unclipping the cords and handle and removing the sliding pickers so that

they don't get in your way. Then use the beater as you would a standard beater. If you are weaving a wide piece in this way you might experience difficulty in getting the shuttle through the shed without interfering with the box sides. If so, just remove the four screws from each front box side and remove them. This will give you plenty of room to work.

LOOM MAINTENANCE

Your AVL Loom, like all high quality equipment, must be properly maintained in order to insure many years of consistent, reliable service. Periodic inspections of your loom are imperative. The frequency of these inspections depends upon relative use and humidity, among other things. The loom maintenance schedule suggested below is targeted for a loom located in an area of average humidity, with average use (say, 30 - 50 yards per week). If your loom will be located in an area of above or below average humidity, and your use is less, or exceeds that of the example, adjust your inspections accordingly.

DAILY INSPECTIONS

1. Check that all cables are riding in their assigned pulleys.

WEEKLY INSPECTIONS

1. Check that all pulleys are moving freely.

MONTHLY INSPECTIONS

1. Lubricate all points specified on the Lube Chart corresponding to the loom you have. (We suggest WD-40 in a spray can or one of the new Teflon type lubricants.) Also lubricate all moving metal/wood junctions (i.e. - all pulley rods, the spring lever axle rods, etc.) Don't lubricate the warp or fabric surface of any beams or rollers or the warp beam tension drums.

   Be sure to spray the tops of the dobby fingers where they pivot on the rod. Spray lubricate the metal strips on the Dobby fingers to prevent rust.

2. Check Dobby Arm alignments.

3. Check all bolts for tightness, especially the tension arm anchor bolts and, for Dobby Looms, the two bolts that attach the Dobby Arm to the side frame. If these have come loose, you'll need to realign the Dobby Arm. (Refer to the section titled "Aligning the Dobby Arm", and figure 13.)

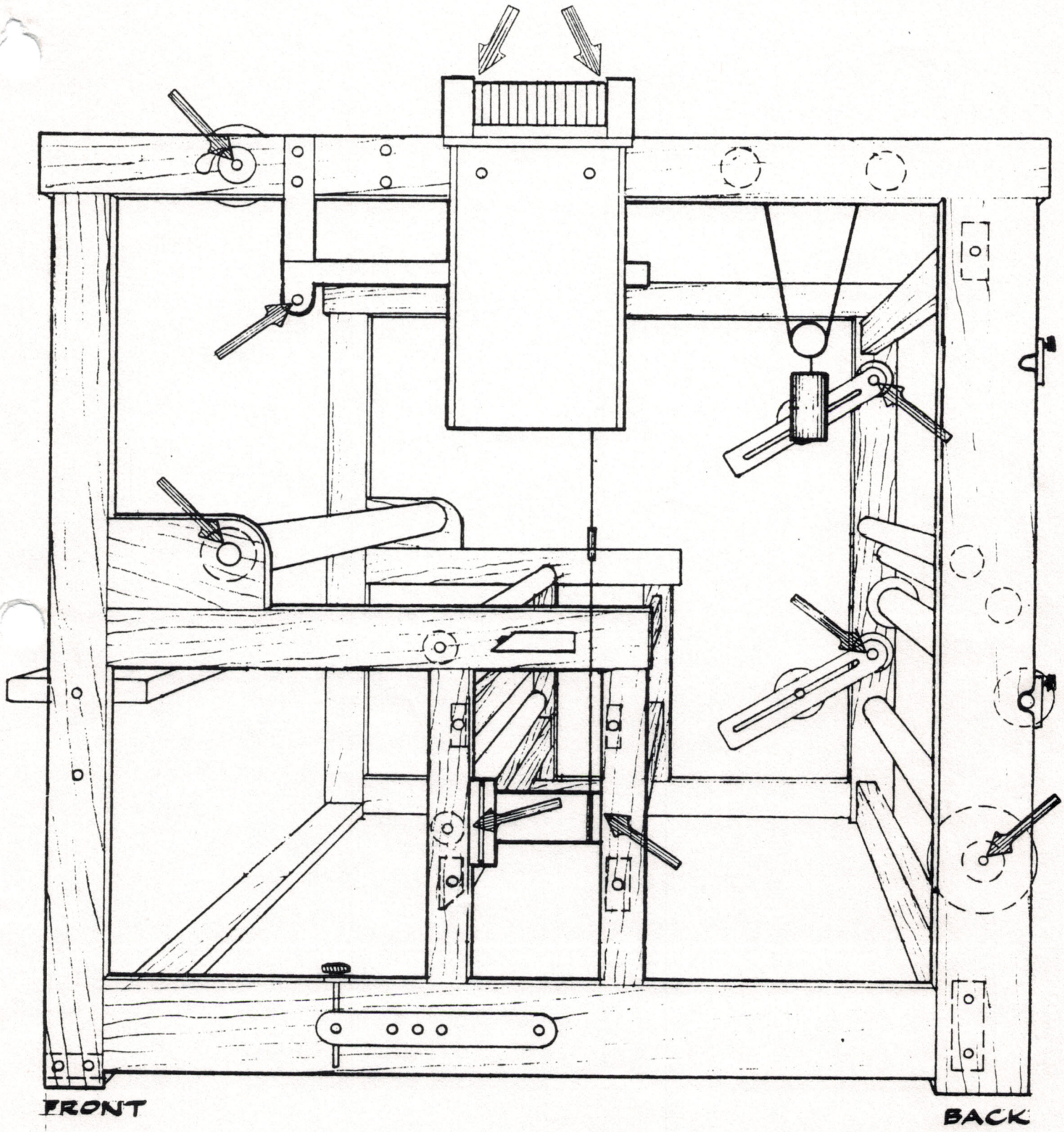
4. Check that all cords are intact and not frayed.

5. Check that the Dobby treadle adjustment is correct. (Refer to section titled "Treadles and Treadle Tie-Up" (Dobby Only) subsection 3.C. See figure 6.)

YEARLY INSPECTION

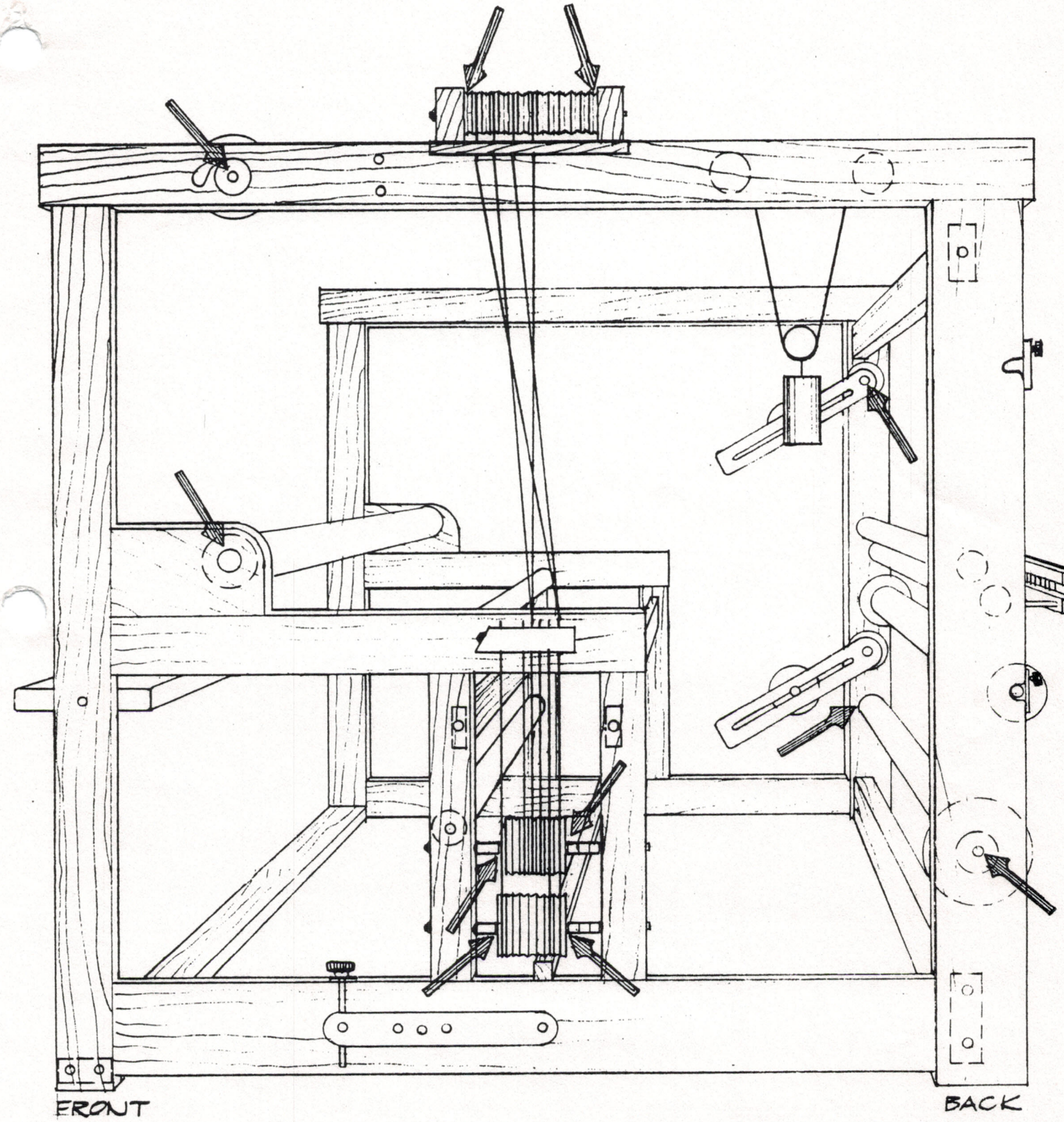
1. Check to see that your loom is properly protected. Your loom was originally finished by two separate processes. For the most part the loom is finished in multiple coats of a sprayed lacquer finish. Some of the parts, such as the harness sticks, spring levers, shuttle race, and many of the turnings were originally finished with Watco Danish Oil (natural color). If, in your yearly inspection, you find the surface of these oiled parts to be dull or dry looking, you can reapply the Watco (or a similar product) with a clean cloth. As for the lacquered parts, small scratches can be touched up by applying a small amount of clear fingernail polish to the damaged area. If you feel the need to refinish a larger area of your loom we suggest that you consult with someone experienced in this field, especially if you have little or no experience in such matters.

That's all there is to setting up and maintaining your AVL Loom. Sit back now, and admire the loom you have put together.



16-HARNESS DOBBY LOOM LUBE POINTS

FIG. 21



MODULAR LOOM LUBE POINTS

FIG. 22

TROUBLE SHOOTING

The Problem	The Cause	The Remedy
Dobby skips	Pressing too hard or too quickly on treadles	Press treadles with a smooth, rhythmical motion
	Too many dobby bars in dobby head	Reduce number of bars or support bars with an auxiliary roller to take some of the weight off the dobby head
	Cable turnbuckle out of adjustment	Adjust according to assembly instructions
One or more harnesses that are supposed to raise, don't	Left treadle isn't being pressed all the way down.	Concentrate on getting both treadles all the way through their travel
	Dobby arm out of adjustment	Realign dobby arm according to assembly instructions
	Dobby cables out of finger slots	Rearrange cables according to assembly instructions
Harnesses don't raise properly	Harness cables have been hooked to wrong harness	Rearrange cables
	Chains from spring levers have been hooked to wrong harnesses	Rearrange chains
	Copper hooks on spring levers have been bent	Straighten hooks with pliers
	A harness cable has slipped off its pulley	Put cable back on pulley
	A treadle cable has slipped off its pulley	Put cable back on pulley
	Dobby arm rubbing on slot in dobby head	Realign dobby arm according to assembly instructions
Dobby head jams	Dobby chain not brought out over the top of the lower roller	Reverse dobby and turn by hand to get dobby chain out

The Problem	The Cause	The Remedy
Small or uneven shed	Dobby cable turnbuckle out of adjustment	Adjust turnbuckle according to assembly instructions
	Beater not adjusted properly	Adjust according to weaving instructions
Harneseses jam up on each other	Heddles not distributed evenly over harness sticks	Redistribute heddles evenly on both sides from the center of the harness sticks
Squeaking noise when harnesses are raised	Probably either in the dobby arm or treadle or harness pulleys	Isolate where the squeak is coming from, then either rub with paraffin or lubricate with WD-40, or a silicone spray
Excessive tension on warp	Too much weight on tension arm	Use a smaller weight on tension arm
	The tension rope has gotten crossed over itself on the warp beam brake drum	Straighten out rope
Flyshuttle hits the box sides	Reed not absolutely flush with shuttle race	Place small shims in back of reed so that it is perfectly even with the rear beater box side
	Picker too loose	Shim box sides so that picker just moves freely without too much play
Dobby arm binds, or rubs, in the slot in right side of dobby head	Extreme changes in weather can cause wood to expand	Check alignment of dobby arm or lightly sand slot in dobby head
Flyshuttle works hard	Change in weather can cause the sliding pickers to stick in their grooves	Place shims in back off front box sides so that pickers just slide freely. Don't over do this
Dobby head jams	Too short of a dobby chain	Increase chain length to 20 bars or so (double pattern)

The Problem	The Cause	The Remedy
Dobby chain does not advance	Detente wheel on dobby head loose	Contact AVL Looms Customer Service for advice on correcting this problem
Harnesses don't raise, or else they fall	Chain pegs not contacting the dobby fingers at proper angle (90 degrees)	Contact AVL
Can't get enough warp tension	Tension arm cord has stretched	Shorten cord by re-tieing the knot at the tension arm end

BOOKLIST

Here are some books that may be of interest to you. If you want to order any of them, write or call Ken Colwell, c/o The Looms at the Brewery, Far End Shake Rag Street, Mineral Point, Wisconsin 53565 (608/987-2277) and ask about their availability and for a current price list.

Books Relating To Loom Preparation And Four Harness Weavers

Black, Mary E. The Key to Weaving, 1980 $27.95
Major work, frequently used as college text. May overwhelm with detail. Thorough explanations of setting up techniques, thread sizes, etc., many recipes, many weaves covered. Hardbound, 700 pages.

Bowen, Kernochan Four Harness Weaving, 1980 $19.50
Covers set-up, techniques, including correcting errors. Beautiful clear photos. Excellent "when you get in trouble" book. Hardcover, 160 pages.

Gilmurray, Susan Weaving Tricks, 1981 $14.95
Good ideas on working with different fibers, drafting and designing, dressing the loom, and finishing. A good addition to your shelf. Hardcover, 160 pages.

Murray, Rosemary Practical Modern Weaving, 1975 $6.95
Simple, practical, beginning book, includes tapestry, and some off-loom techniques. Clear useful photos. Softcover, 112 pages.

Scarlet, James D. How to Weave Fine Cloth, 1981 $8.95
Fine traditional review of warping, weaving, and finishing techniques. The author, a Scottish tartan weaver, orients toward finer fabrics. Softcover, 200 pages.

Sutton, Ann The Structure of Weaving, 1982 $24.95
Intriguing presentation of various structures, mostly four harness. Superb photos. Hardcover, 192 pages.

Sutton, Collingwood, St. Aubyn Hubbard, 1983 $12.95
Covers spinning, dyeing and weaving. Concise information on dressing, weaves, wide variety of techniques, includes Collingwood Macro-gauze. Softcover, 150 pages.

Tovey, John The Technique of Weaving, 1983 $10.50
Just re-published. Well-known English book strong on warping, dressing and other techniques. Covers counterbalance and countermarche harnesses very well. Softcover, 120 pages.

Worst, Edward Weaving with Foot Power Looms, Recent reprint $5.00
Old book. Good material on counterbalance and countermarche including to ten harness. Overshot, Swedish weaves, etc. Good warping, dressing techniques. Softcover, 160 pages.

Books Relating To Complex Weaves And Dobby Looms

ARS Textrina, Volume One $35.00
A collection of papers given at the First Annual Conference on the Creation of Complex Weave Structures. PB, 331 pages.

Barrett, Clotilde Summer and Winter and Beyond $5.00
Includes turned and multiple harness. PB (paperback), 54 pages.

Burnham, Harold B. and Dorothy K. Keep Me Warm One Night $45.00
Focused on early handweaving in Canada, it is the great work on coverlets, including a variety of multiple shaft structures, 388 pages.

Cyrus-Zetterstrom, Ulla Manual of Swedish Handweaving $18.95
A 1984 revision of this well-known book. Good information on draw damask and other complex harness arrangements. 222 pages.

France, Joseph Weavers Complete Guide $5.25
Fascimile of 1814 book, 73 drafts from 2 - 16 shafts, some very interesting, PB, 32 pages.

Holroyd, Ruth N. Jacob Angstadt, His Weavers Patron Book $40.00
One volume a facsimile of original book, second an interpretation of the drafts. From 4 to 32 shafts, primarily 16 and 20. Mostly block drafts but many point twills. A beautiful set. 96 pages in Volume I; 300 pages in Volume II.

Hooper, Luther Hand-loom Weaving $9.95
First ed, 1910. Quite thorough review historically, of handweaving equipment and weaves, not including jacquard and dobby. A classic. May be out of print soon. PB, 344 pages.

Johansson, Lillemor Opphamta och Damast $23.00
In Swedish, but profusely illustrated and diagramed. Many two harness systems, an essential for drawloom weavers. 168 pages.

Keasbey, Doramay Pattern Devices for Handweavers $18.00

Wide variety of weaving systems. Includes double harness, split shed, dobby, etc., PB, 124 pages.

Kirby, Mary Designing on the Loom $8.50

Multi-shaft weaves, chapter on 16 shafts includes dobby. Also jacquard design, a good one. PB, 100 pages.

Oelsner, G.H. A Handbook of Weaves $6.95

Original English edition in 1915. Industry oriented, brief explanations of wide variety of structures for use with dobbies up to 40 shafts, 1875 illustrations, mostly tie-ups for use with straight drafts. Good for dobby users. PB, 400 pages.

Powell, Marian 1000 (+) Patterns $7.95

Shadow weaves only in 4, 6, and 8 harness patterns, many very interesting. PB, 270 pages.

Ryall, Pierre Weaving Techniques for the Multiple-Harness Loom $9.95

Brief explanation of structures, analysis, etc., 5 thru 12 shaft designs. Draft system unusual, but readily clear to the experienced weaver. Translated from French. PB, 384 pages.

Sutton, Ann; Peter Collingwood; Geraldine St. Aubyn Hubbard The Craft of the Weaver $12.95

Practical guide to spinning, dyeing and weaving. Concise general information of high quality including types of equipment, weaving techniques and structures. Has Collingwood shaft switching and macrogauze techniques. PB, 152 pages.

Tovey, John The Technique of Weaving $10.50

A reprint. Good basic information but technically valuable for experienced craftsman. Double harness system explained. PB

Wood, Irene Sixteen Harness Patterns $8.95

Primarily photos of 150 sixteen shaft point twills with straight twill borders, tie-ups given from the Fred Pennington notebooks. Also examples of scaling down to fewer shafts, plus techniques for doing your own. PB, 130 pages.