

# 36 String Gothic Harp



## Musicmaker's Kits

P.O. Box 2117  
Stillwater MN 55082

(651) 439 9120

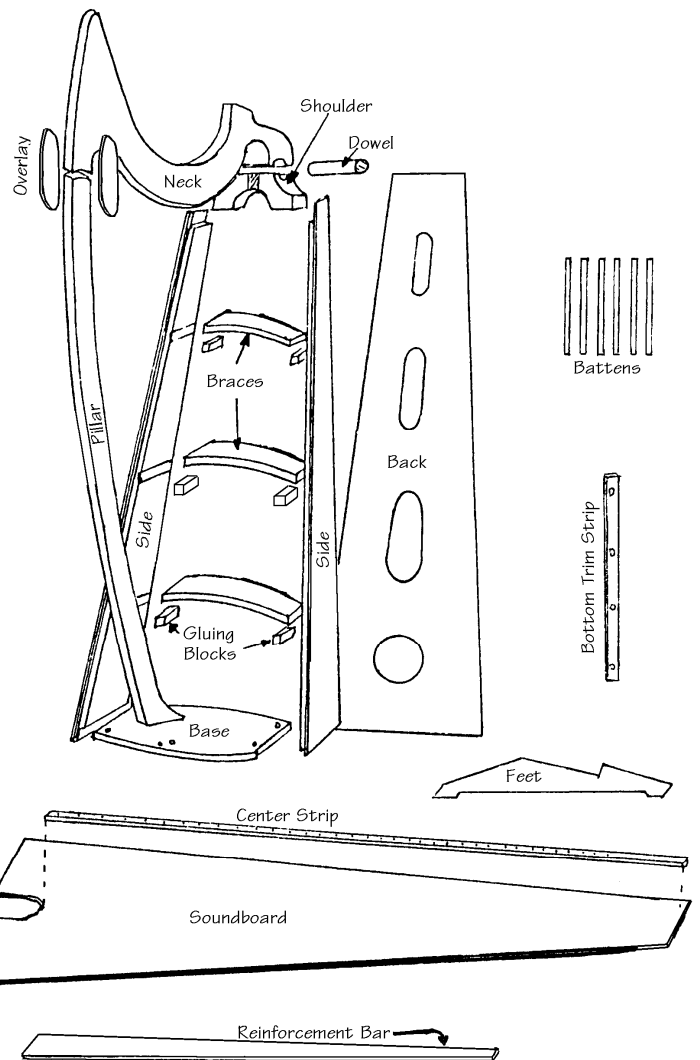
[info@harpkit.com](mailto:info@harpkit.com)

# Gothic 36 Harp

## 1 set assembly instructions

### WOOD PARTS:

- ♦ 1 soundboard, laminated spruce/birch
- ♦ 1 back panel, laminated cherry/walnut
- ♦ 2 sides, solid cherry or walnut
- ♦ 1 pre-drilled neck, laminated maple/cherry or walnut
- ♦ 1 pillar, laminated maple/cherry or walnut
- ♦ 1 shoulder, laminated maple
- ♦ 2 feet, solid cherry or walnut
- ♦ 3 inner braces, laminated maple
- ♦ 1 base, laminated maple
- ♦ 6 short canted gluing blocks
- ♦ 1 center strip (cherry or walnut)
- ♦ 1 Reinforcement Bar
- ♦ 1 walnut dowel, 1" dia
- ♦ 2 overlay pieces (for neck/pillar)
- ♦ 1 bottom trim strip
- ♦ 6 stiffener battens (for back)
- ♦ 9 ft decorative inlay banding
- ♦ 12 ft of iron-on veneer tape
- ♦ 1 small dowel pin, 1/4 X 2"
- ♦ 4 wood plugs to match trim (3/8")



### HARDWARE:

- 36 threaded tuning pins
- 1 Brass driver for tuning pins
- Tuning wrench
- 36 threaded guide pins
- 31 brass eyelets, medium
- 5 brass eyelets, large
- 2 oz wire nails, 3/4" X 18
- 2 wood screws, 3" drywall
- 4 wood screws, 2" drywall
- 4 wood screws, 1-5/8" drywall
- 4 wood screws, 1" drywall
- 1 set of 36 harp strings (with 25 plastic beads)
- 1 drill bit, 1/8"
- 1 drill bit, 5/32"

### **BEFORE YOU BEGIN**

Please take the time to check over the parts of our kit now, to make sure everything is there. If you discover a problem, call us right away so we can rectify it quickly without causing you much delay in your project. We also suggest skimming through the entire directions before beginning, just to get an overview of the project. You may decide that you need to gather more tools or purchase a few optional decorations or accessories to enhance the finished instrument. Now is a good time to decide so you can avoid delays when you reach those steps of construction.

### A NOTE ABOUT GLUE

**DO NOT ASSEMBLE THIS PROJECT WITH EPOXY OR SUPERGLUE OR HOT MELT GLUE!**

Find a good woodworking glue. Many luthiers (guitar & violin makers) still use the natural hide glues that have been around for centuries, carrying on a fine old tradition, but that does not mean that you must do the same. WE BUILD THIS INSTRUMENT WITH MODERN WOODWORKING ADHESIVES (SUCH AS ELMER'S CARPENTER'S WOOD GLUE OR TITEBOND) because they hold the parts even more securely than the old hide glues. The few advantages that some people claim with hide glue are more than offset by the strength, durability, ease of application, and availability of the modern woodworking adhesives.

When gluing parts together, be sure to put enough glue on the joint to wet the entire surfaces to be joined. A good sign of proper gluing is that a little excess will squeeze out around the joint when clamping pressure is applied. Too little glue may cause the parts to separate later, whereas too much glue makes things messy. We always keep a damp rag handy for quick cleanup, as necessary. It is especially helpful to keep your fingers clean while gluing, because gluey fingerprints have the embarrassing tendency to appear on the finished product in places you never expected. Most woodworking adhesives "set" sufficiently after 30 minutes of clamping to allow you to proceed. Check your dispenser for recommended drying times.

## THE SOUNDCHAMBER FRAME

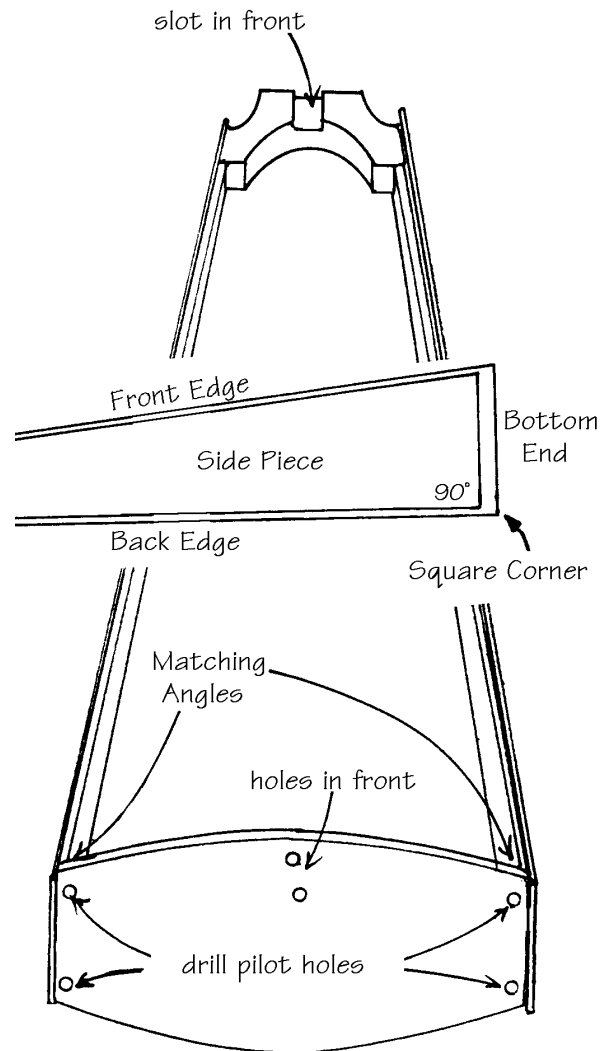
\_\_\_ 1. Check all parts of your kit against the parts list, lightly labeling them in pencil if desired.

\_\_\_ 2. Find the two SIDES, the BASE, and the SHOULDER for the soundchamber frame. Hold them together dry to check the fit of each joint.

### IMPORTANT

*Be certain that you understand which is the front and which is the back of each piece. The front of the SHOULDER has a slot cut in to allow for more vibration of the soundboard. The front of the BASE has two holes pre-drilled in the center for attaching the pillar. The front edge of the SIDES is *not square* with the BASE.*

\_\_\_ 3. Drill pilot holes for wood screws at each end of the BASE, as follows: Hold the BASE in position in the notch of the SIDE piece with all edges flush and tight. Drill through the BASE into the SIDE piece with a 7/64" bit. Repeat for the other SIDE



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Find the following items for the next step:

Carpenter's glue

4 wood screws, 1-5/8"

Phillips head screwdriver

Woodworkers clamp or large C-clamp

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4. Clean all surfaces of the SIDES, BASE and SHOULDER. Apply glue to the joints at the BASE first, holding the pieces together while you insert the 1-5/8" screws to draw the SIDES up tight to the BASE.

5. Apply glue to the edges of the SHOULDER and to the notch at the top of each SIDE piece. Place the parts together and clamp them, making sure all edges are flush. (Note: it is very important that the front of each part faces the same direction.)

6. Turn the frame (if necessary) so the front faces down on your work surface.

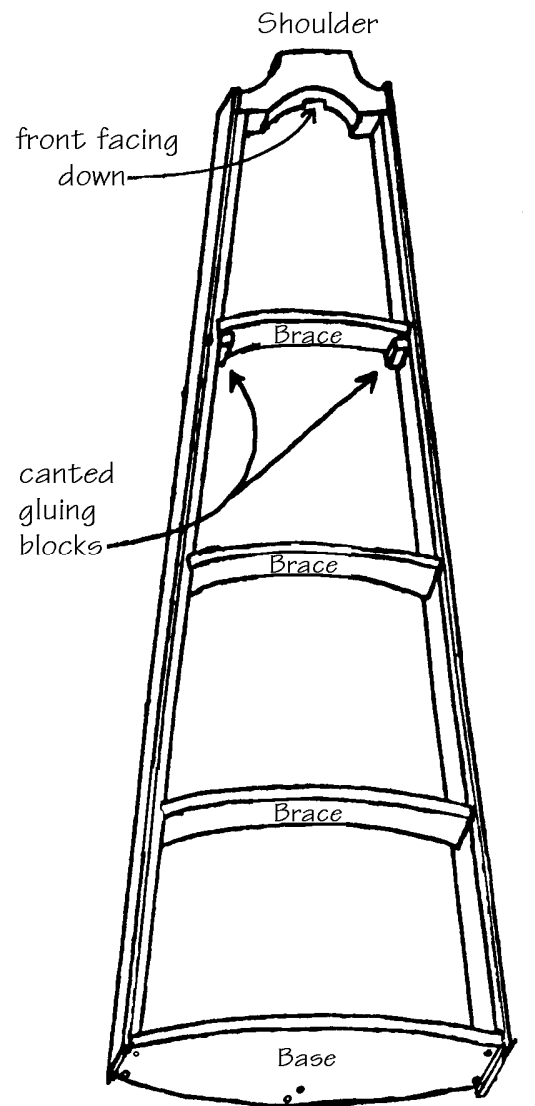
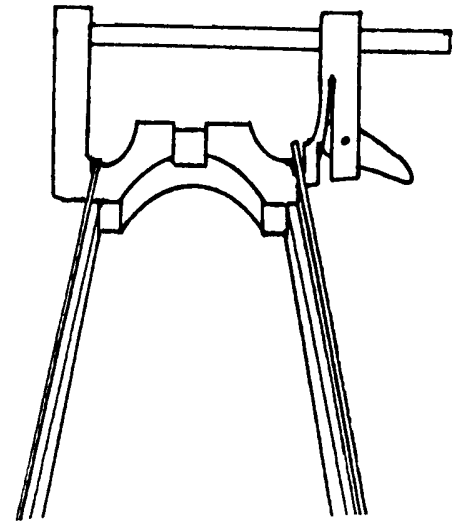
Find and check the fit of BRACES #1, #2, and #3. They should fit between the SIDES at the positions of the shallow notches.

BE SURE THE CONVEX CURVE (HUMP) OF EACH BRACE FACES UP, AND THAT YOU PLACE THESE BRACES RIGHT UP TO THE BACK EDGE OF THE SIDE PIECES, SO THE CURVE MATCHES THE LEDGE CUT ALONG THE SIDE PIECE. They will help form the curvature of the BACK.

**NOTE**

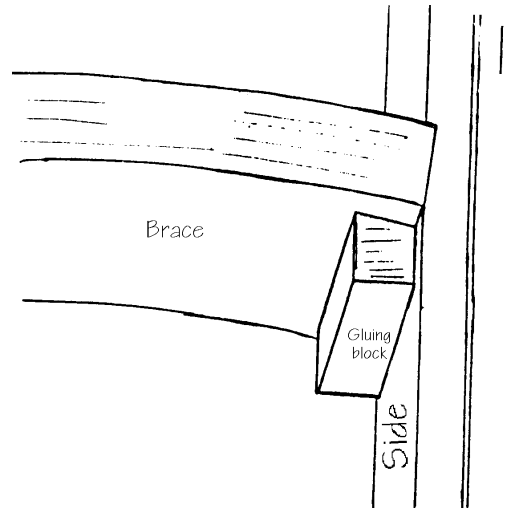
Sometimes the BRACES do not fit perfectly between the SIDES. This could be caused by sloppy cutting on our part, or it might be that the SIDES have bowed a little on their own. We recommend checking the SIDES with a straight-edge and fitting the BRACES so as to push or pull the SIDES into alignment. If a BRACE is too short, you may shim it with a scrap of veneer tape. If too long, use a disk sander to remove a small amount of material without changing the angle or rounding the end.

When satisfied with the fit of each BRACE, glue them in place and apply pressure (clamps or tape) to hold until dry.

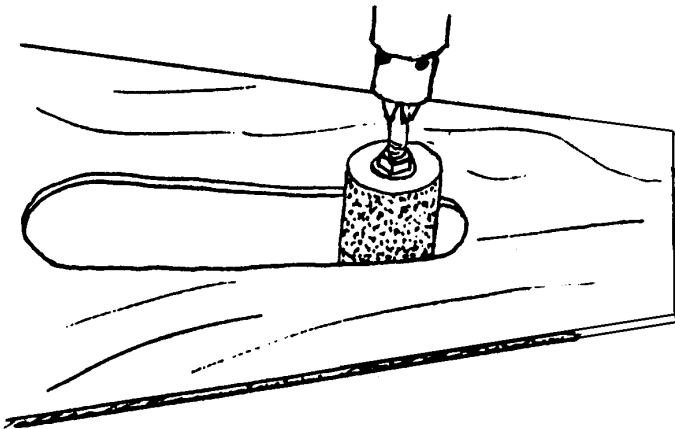


\_\_\_7. Find the 6 short **CANTED GLUING BLOCKS** and glue them into the corners beneath each brace for added strength. Use clamps if possible.

**HINT:** Chip away any glue blobs that might be in the corners preventing the blocks from seating tightly.



## THE BACK



**POINT OF INTEREST**  
 The **BACK** of your harp is a custom-laminated material with Cherry on one face and Walnut on the other. You can decide which face you prefer to show outward on the finished instrument.

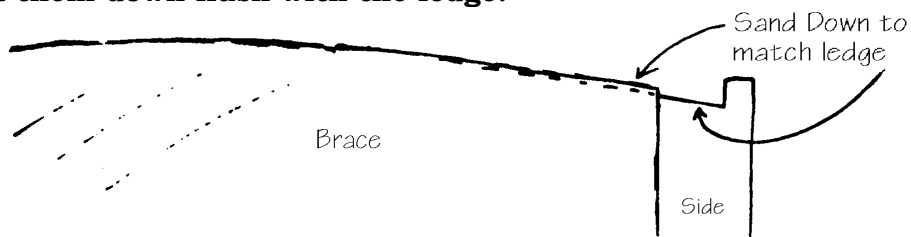
\_\_\_8. Use a fine-tooth blade on your jig saw or saber saw to cut the access holes as they are marked on the wood. (Drill one 3/8" hole in each space for inserting the saw blade.) We recommend cutting *inside the line*, in case the wood chips. Then you can sand to the line.

**HINT:** Use a drum-sanding attachment to your drill for sanding these curved edges to the line. Then use fine sandpaper by hand to smooth out the edges of the holes.

### POINT OF INTEREST

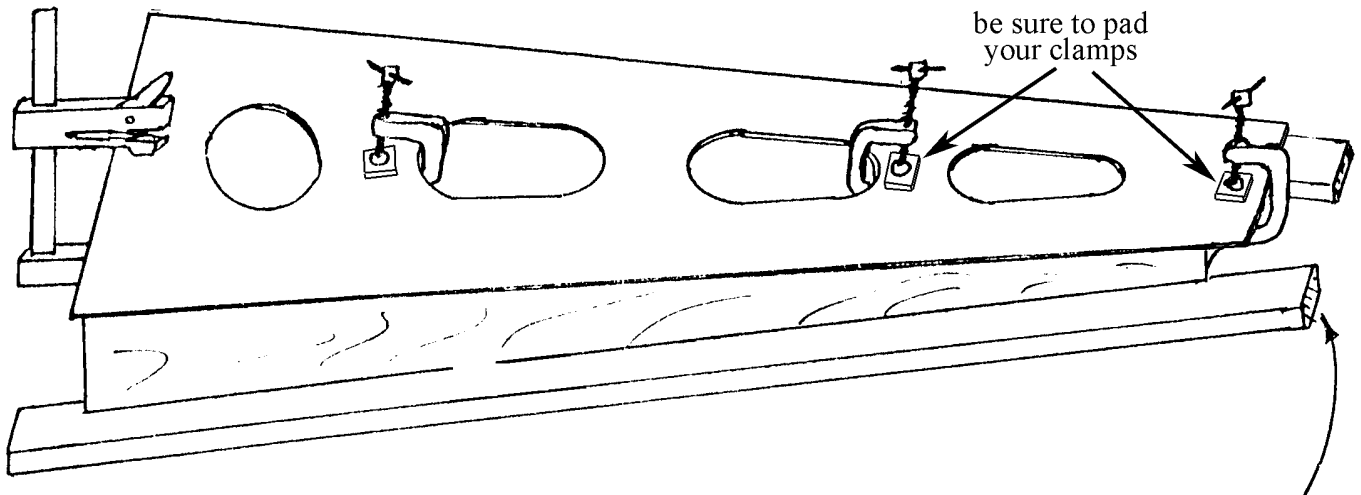
The holes in the back of the harp are meant primarily for access to the strings. They have very little, if any, affect on the sound of the instrument. You may alter the shape of these holes if you like, to make them more ornate. Some people cut heart shapes, cloverleaf patterns, or a leafy vine. We would caution you, however, not to locate a hole where a **BRACE** crosses the frame. We also suggest that you make the holes large enough to permit easy stringing. You need not necessarily be able to reach your entire hand through the holes, but you must at least be able to get a finger or two inside so as to fish out the end of a harp string that is being pushed through from the front of the **SOUNDBOARD**.

\_\_\_9. Check over the back edges of the harp frame. If any of the **BRACES** stand taller than the **SIDES**, sand them down flush with the ledge.



\_\_\_10. Test fit the BACK panel to the convex (humped) side of the frame. With a little effort, it should bend to fit the curve of the BRACES and seat into the ledges of each SIDE. You may have excess plywood extending beyond the SHOULDER and BASE of the frame which can be trimmed off later.

It is not uncommon for the BACK to need sanding or planing along the edges to make it a little narrower. Our parts are often generously sized. Use a hand plane to shave the edges of the BACK to fit. Don't be concerned about a perfect fit, however. Slight gaps will be covered over later on when you add veneer tape.



**HINT:** Find two scrap boards (bed slats or old 2 X 4's work fine) to place under the sides of the frame before beginning to tack the back in place. This will keep the frame from rocking from side to side as you pound the nails in. It may also help to place a thick blanket or towel under the harp for padding.

Find the following items for this step:

hammer

a few C-clamps

glue

bag of small nails included in this kit.

a friend to help with this step (four hands and two hammers make this easier)

\_\_\_11. Clean off all sawdust from the frame and the back panel.

#### HELPFUL HINT

Before gluing the **SOUNDBOARD** or **BACK** into place, get two clean rags wet, and have them readily available for cleaning up excess glue that squeezes out of the joints. Keep your fingers clean too. The second rag should be used for final "scrubbing" any affected area, just to make sure all glue residue is removed. This will help save you lots of time toward the end of this project when you are preparing to apply the finish.

Before you begin gluing, locate and start several nails along the sides of the panel, so they are going in but not through the panel. This will make installation considerably faster after gluing.

Apply a thick bead of glue to the backside of the entire frame where it contacts the BACK panel, including the BRACES, SHOULDER, and BASE.

Immediately place the BACK in position with one clamp at the BASE and another at the top of the SHOULDER. Make sure the panel will bend down to fit into the ledges at each side.

Install a few more C-clamps at each BRACE, using the large holes for easy access.

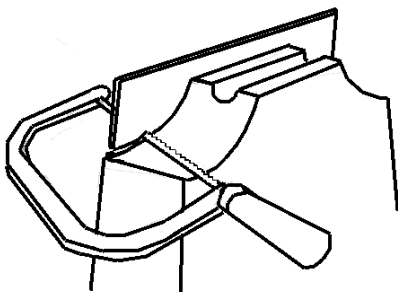
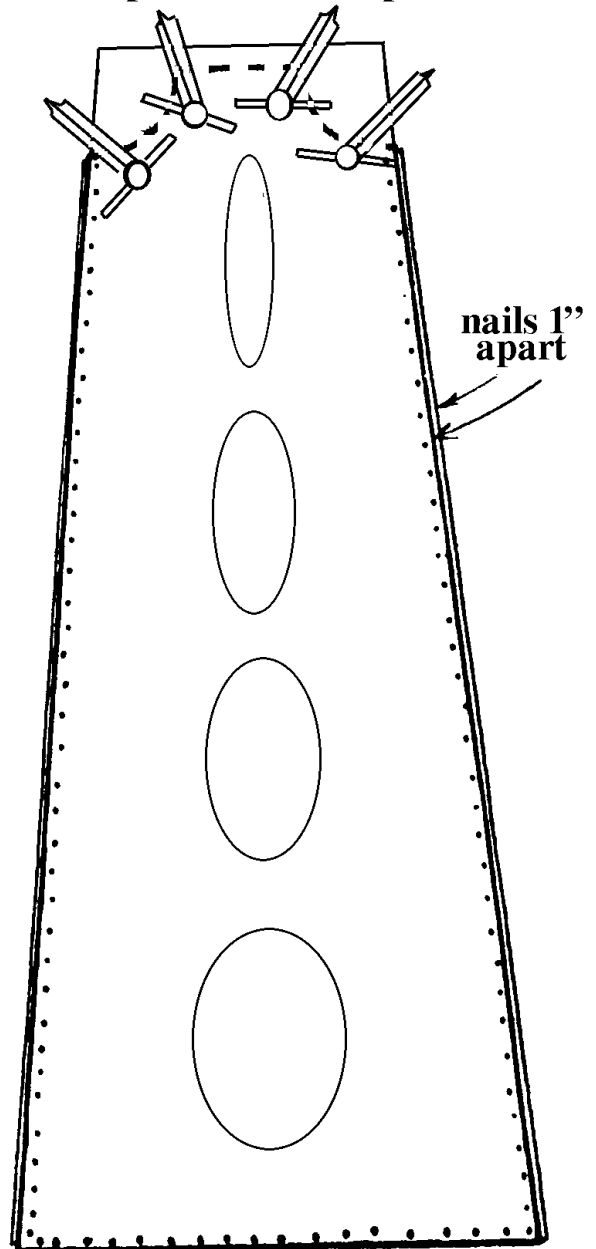
Begin tacking the plywood to the frame. Start by tacking across the bottom so the BACK is held firmly to the BASE. Place the nails 1" apart and centered on the frame below.

You might want to start tacking in every other nail, working your way up each side to the SHOULDER to get the plywood attached, then go back and put in the rest of the nails.

**DO NOT PLACE TACKS ACROSS THE TOP OF THE SHOULDER OR ACROSS THE CENTER OF THE BRACES.**

Try to work quickly, before the glue becomes too thick. When the nailing is complete, check over all the seams to see if you need to add or adjust clamps. Check especially at the top of the SHOULDER where the seams will show on the finished harp. Clean off excess glue with your damp rags right away, making a thorough job of it.

clamps across the top

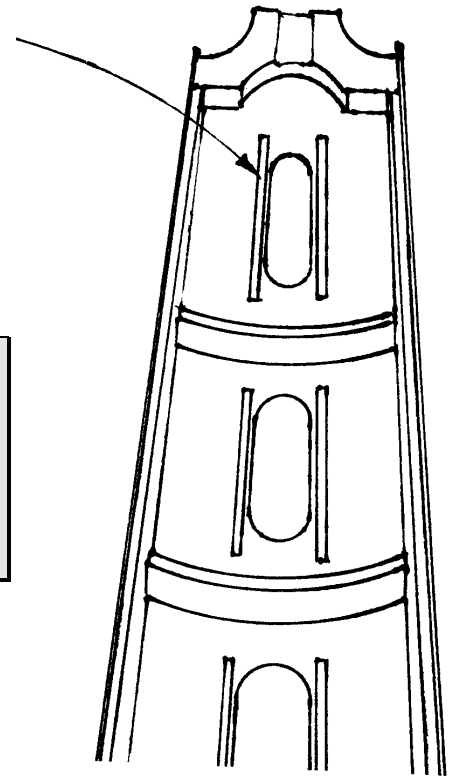


**POINT OF INTEREST**

We use nails here because it is difficult to put clamps on these curved surfaces. The nails do a nice job of holding the parts together until the glue dries. We provide wood veneer tape to cover them later so they won't be noticed by nosy friends or critical relatives.

**12. Use a coping saw to trim off excess overhang of BACK, flush with the edges of the SHOULDER.**

\_\_\_13. We find it helpful to add **STIFFENER BATTENS** along each side of the top three access holes in the **BACK**, just to reinforce this thin laminate. Glue and clamp these **BATTENS** to the **BACK** near the holes, as shown.

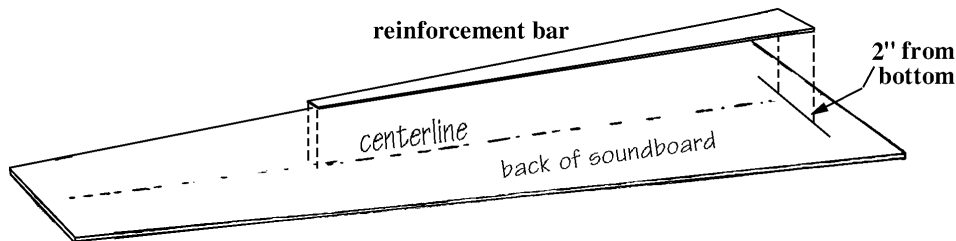


## THE SOUNDBOARD

### POINT OF INTEREST

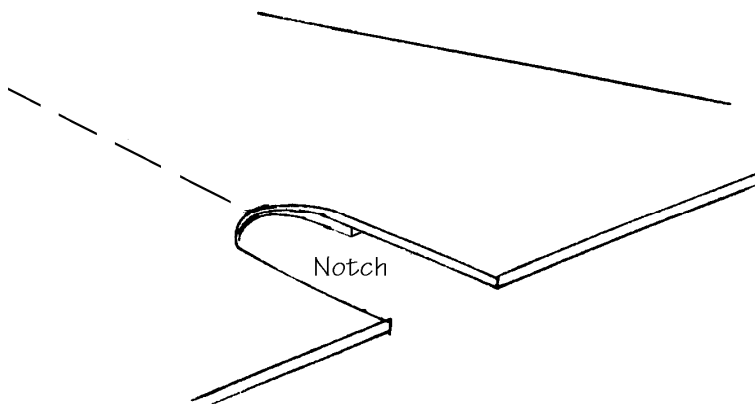
Many people ask why we use *laminated* wood instead of solid. The reason for this is that we get much more strength from laminated material than from solid, and much less trouble with cracking. This superior strength allows us to use a thinner soundboard than if we were to use solid wood, so you get remarkable sound with minimal risk of breakage.

\_\_\_14. Draw a **centerline** down the length of the **SOUNDBOARD**, on the front and back sides. Then draw a pencil line 2" from the bottom on the *back side only*.



\_\_\_15. The **REINFORCEMENT BAR** is to be glued to the backside of the **SOUNDBOARD**, starting at that line. It does not reach all the way to the top of the instrument because we want the **SOUNDBOARD** to be thinner at the top. You may taper the thickness of the top 6 inches of this **REINFORCEMENT BAR** to make it gradually blend into the **SOUNDBOARD**. Then glue and clamp it in place, as shown.

\_\_\_16. The front face of the **SOUNDBOARD** has the notch drawn on it.



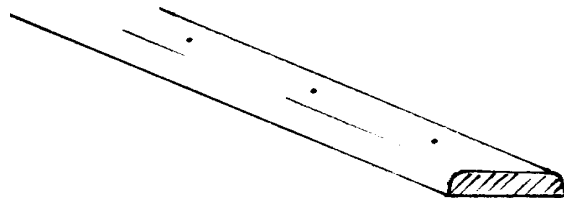
Cut out the notch marked at the bottom, using the same technique as you used to cut the access holes in the **BACK**

**NOTE: SAVE THE SCRAP** of wood from this cut-out. You will replace a portion of it later on.



\_\_\_17. Find the CENTER STRIP for the SOUNDBOARD. It is a long narrow piece of walnut or cherry with punch marks in it.

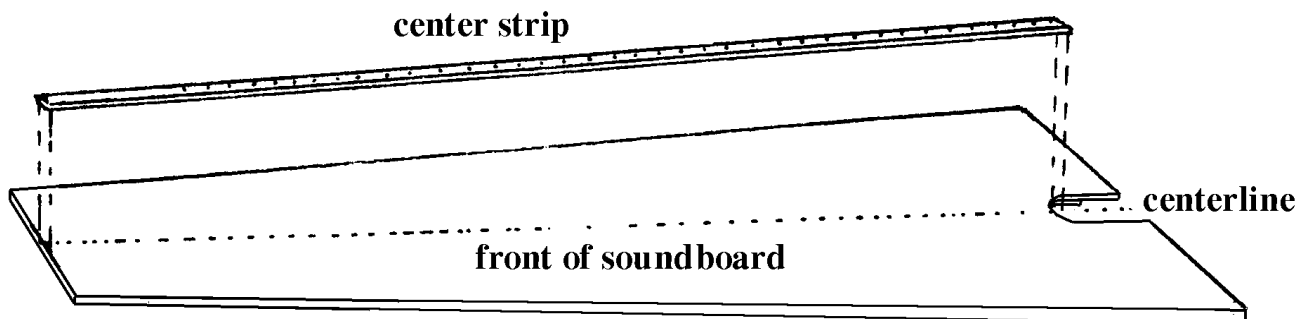
Sand off the sharp corners of this strip as shown.



\_\_\_17a. Glue the CENTER STRIP to the SOUNDBOARD as follows:

A) *Be sure the top and bottom are properly oriented.* The punch marks are closer to the bottom end than to the top.

B) Place the bottom of the CENTER STRIP right next to the notch. The upper end may extend beyond the top of the SOUNDBOARD, or you may cut it shorter and taper the top end just beyond the last punch-mark.



C) Draw the outline of the strip in its proper position so you can be sure to keep it properly centered when clamping.

**HINT:** If the CENTER STRIP is not straight, hold a straight-edge against it to force it into place, and use masking tape to hold it straight before applying clamps or weights.

D) Make certain string hole markings are facing up.

E) Apply only a small ribbon of glue to the underside of the CENTER STRIP so you don't get too much squeeze-out that will need to be cleaned up.

F) Use weights or clamps (in an emergency, look for heavy sacks of flour, sugar, sand, or fertilizer to use as weights) to hold it until dry.

**CUSTOMER SUGGESTION:** One customer who has built several of these harps suggests *tacking* the CENTER STRIP in place with the tiny nails in the kit, instead of using clamps. Place the nails at the punch-marks, but be careful not to pound them all the way in -- leave the heads sticking up so you can pull the nails out later. We think this is a great idea!

G) Check it again for straightness, if possible. This little strip can easily slide around under the pressure of your clamps.

This would be a good time to sign and date your harp, on the inside of the **SOUNDBOARD**, where it can be seen through one of the access holes in the **BACK**.

### POINT OF INTEREST

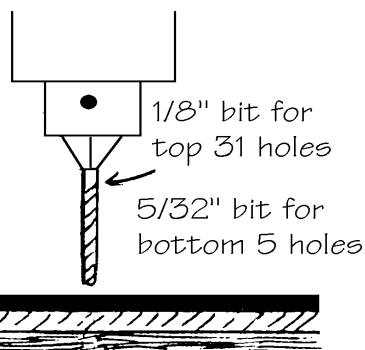
Some people ask about finishing the inside of the soundchamber. We do not recommend trying it. Guitars and violins are never finished on the inside, so this instrument need not be sealed on the inside either. We understand people's concern about the effects of humidity on the wood, but that is only important for solid wood that warps because it is not firmly fastened around the edges. This instrument box is glued firmly all around, so there is no chance of warping from humidity.

\_\_\_18. Turn the **SOUNDBOARD** over and note the punch marks along the **CENTER STRIP**. Use a 1/8" drill bit to bore these 36 holes through all the layers of wood in the **SOUNDBOARD** assembly.

\_\_\_19. Switch to a 5/32" drill bit and re-drill the bottom five holes for larger strings (nearest the notch).

Note: These holes should be vertical (perpendicular to the soundboard)

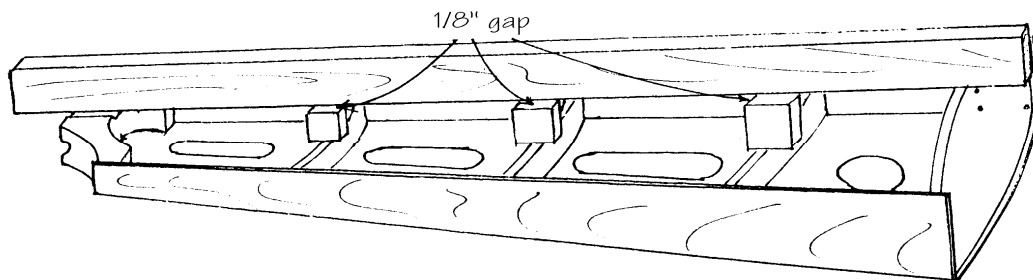
center strip  
soundboard  
reinforcement bar



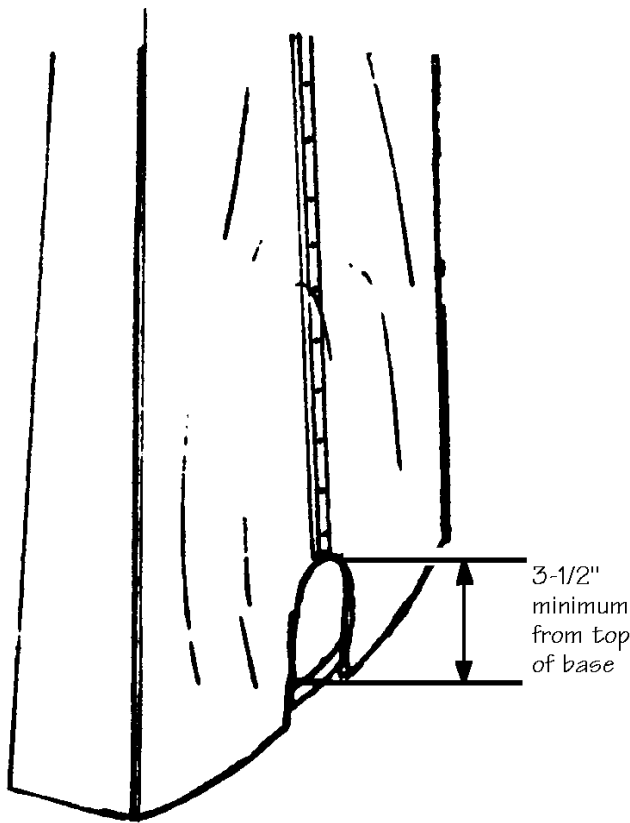
### INSTALLING THE SOUNDBOARD

\_\_\_20. Lay a straight-edge across the frame, from **BASE** to **SHOULDER**, and measure the gaps between the straight-edge and the center of each **BRACE**.

\_\_\_21. Subtract 1/8" from each measurement and cut a small scrap of wood to fill each gap, so it reaches up within 1/8" of the straight-edge. Tape the scraps to the corresponding **BRACES**, so the **sounboard REINFORCEMENT BAR** will rest on the scraps when you install the **SOUNDBOARD**. (Don't worry, you will remove the scraps later!)



**HINT: Just as for the BACK, use bed slats or other supports along the sides of the harp, underneath the protective padding, to hold it steady while pounding the nails into the frame.**



\_\_\_ 22. Test fit the **SOUNDBOARD** to the front of the frame. You want it to have the same kind of curve that the **BACK** has, along the entire length. And you want the top of the "notch" to be at least 3-1/2" from the top of the **BASE**. The scraps that you just taped to the **BRACES** will help you achieve the proper curve to the **SOUNDBOARD**. These scraps can be left in place until you install the strings. The string tension will pull the **SOUNDBOARD** away from the **BRACES**, allowing the scraps to fall free.

You may have to push pretty hard to test fit the **SOUNDBOARD** all the way along its entire length.

Make sure the **SOUNDBOARD** fully covers the **SHOULDER** and the **BASE**. Again, you may need to shave a little off each side to make this piece narrower. We often use a hand plane to remove small amounts of wood from each side in order to slide the **SOUNDBOARD** higher into the frame. Don't be concerned about a

perfect fit along the **SIDES**. Slight gaps will be covered over later when you add decorative trim.

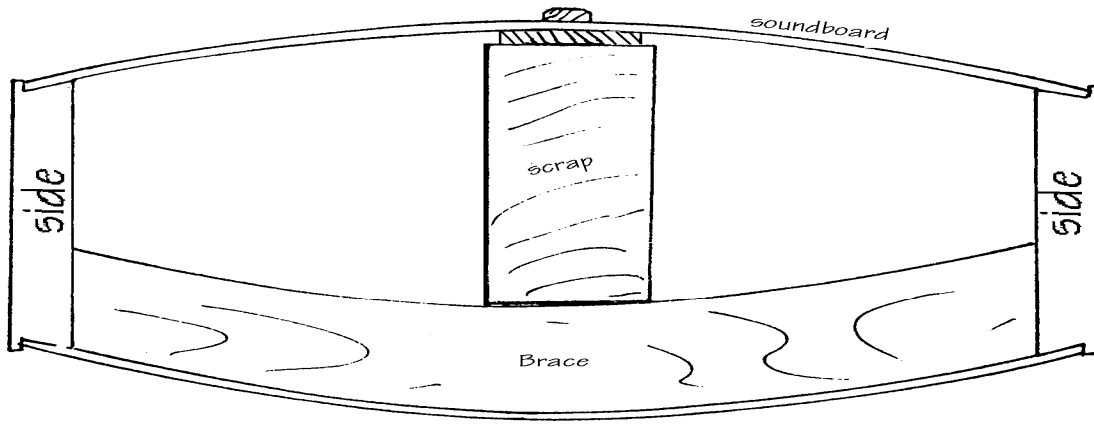
\_\_\_ 23. When you are satisfied with the fit, make some pencil marks on each edge so you know where to position the assembly quickly after applying the glue.

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Gather the following tools and supplies ready for quick use:

- hammer(s)
  - glue
  - bag of small nails
  - padding to protect the back of the harp
  - two damp rags for clean-up
  - a friend to help you with this step (just as with the **BACK**)
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\_\_\_ 24. Remove the **SOUNDBOARD** and start several nails along the edges, as on the back, to make installation faster, and then apply a thick bead of glue around the four edges of the frame that will contact the soundboard.

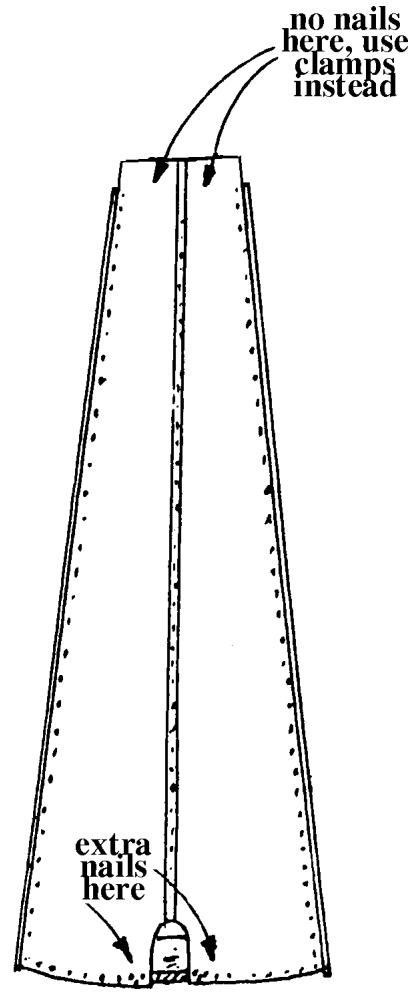
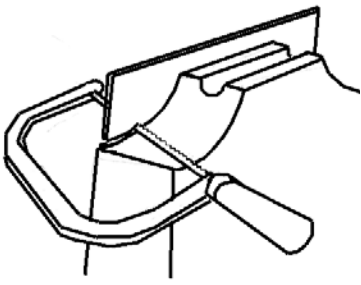


\_\_\_ 25. Quickly replace the **SOUNDBOARD** in the position you had it during the test fitting. Nail it in place along the bottom and sides, just as you did the **BACK** panel, and clamp the top to the **SHOULDER**, checking for tight seams.

\_\_\_ 26. Add extra nails near the notch because it is a major stress point.

\_\_\_ 27. Clean off excess glue with your damp rags right away, making a thorough job of it.

\_\_\_ 28. When the glue is dry, trim off all excess wood that hangs over the top of the **SHOULDER** and the bottom of the **BASE**. Take the time to do a nice job with this. A drum sanding attachment to your electric drill will help for the curved parts of the **SHOULDER**. This is the most visible portion of the finished instrument, so it shouts your woodworking skills to the world.



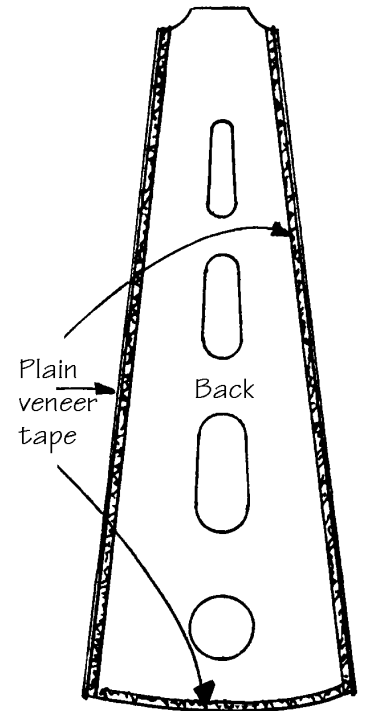
## ADDING DECORATIVE TRIM

\_\_\_ 29. Check to see if any nail heads along the **SOUNDBOARD** or **BACK** panel are raised up above the surface of the wood. If so, tap them deeper with the nail set and hammer.

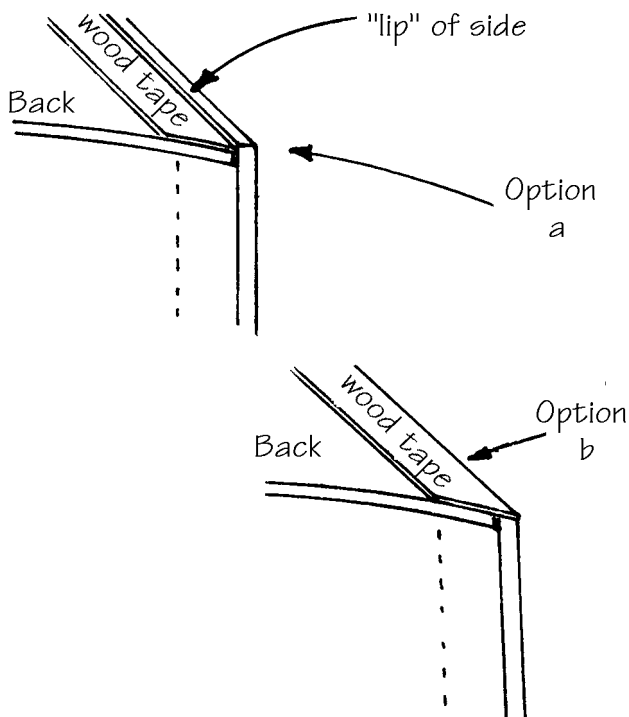
\_\_\_ 30. Use a sharp knife or chisel to remove any clumps of glue or slivers of wood along the edges of the soundboard and back that might interfere with the decorative trim.

Gather the following items for the next steps:

- Wood veneer tape
- Decorative inlay banding
- Sanding block or electric sander
- Electric iron
- Glue
- Sharp knife or chisel
- Hammer
- Nail set or large nail



\_\_\_ 31. Begin with the back of the instrument. Cut two pieces of wood veneer tape long enough to cover the full length of the soundchamber, from **SHOULDER** to **BASE**, along the side edges. Test the way you want these to fit, making sure they cover all the nails. You have two options:



- a) lay the **VENEER TAPE** against the "lip" of the **SIDE** that sticks up higher than the **BACK**, or
- b) Sand that "lip" flush with the **BACK** and lay the **VENEER TAPE** over the seam.

We think the second option looks better on the **BACK** (but not on the **SOUNDBOARD**), but it requires a little more work. If you decide on this second option, be careful when sanding down the "lip" to avoid sanding through the thin outer layer of the **BACK**.

\_\_\_ 32. This **VENEER TAPE** is pre-glued. If there is a cellophane protective paper over the glue, peel that off first. Then lay the tape in place, covering the nails and the small gaps along the sides.

\_\_\_ 33. Preheat the iron to 300 degrees (medium setting) *without steam*.

\_\_\_ 34. Iron the two **WOOD VENEER** strips to make them adhere permanently.

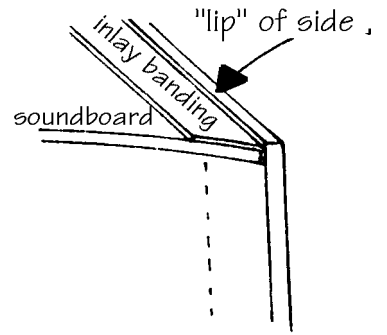
**NOTE:** The veneer tape can be moved slightly while it is still hot, so if the tape slides out of position a bit, just heat it up again and push it back into place. Follow behind your iron with a block of wood, pressing the VENEER into place as it cools.

35. Cut a piece of VENEER TAPE to fit across the bottom of the BACK panel, between the other two strips. Iron that in place to cover the nails at the bottom. Save any leftover scraps of VENEER TAPE for later. They sometimes come in handy for shims and fillers.

36. Turn the harp over and prepare the decorative INLAY BANDING for covering the nails in the SOUNDBOARD.

This decorative trim should be installed beside the “lip” of the SIDES, as shown, so it covers the nails and hides the crack between the SOUNDBOARD and each SIDE.

**NOTE:** There are two possible methods of installing this INLAY BANDING. Some customers prefer to simply spread glue on one side of the INLAY and hold it down with lots of masking tape until dry, and others prefer the iron-on method, which is a little tidier but takes a little more time. Both methods are acceptable. Here is how to do the iron-on method:

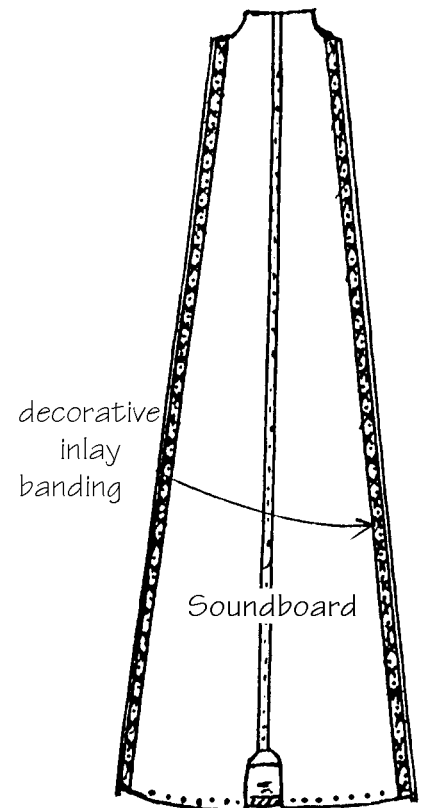


a) Spread a smooth coating of carpenter's glue on one side of the INLAY BANDING. Set aside to dry thoroughly.

b) Spread a 1/2" wide band of the same glue (Elmer's works well) along each side of the soundboard where the INLAY is to be installed, Allow to dry thoroughly. **HINT:** use a scrap of wood that is slightly less than 1/2" wide for spreading this glue, so you don't inadvertently smear glue out onto the SOUNDBOARD where it will have to be cleaned off later.

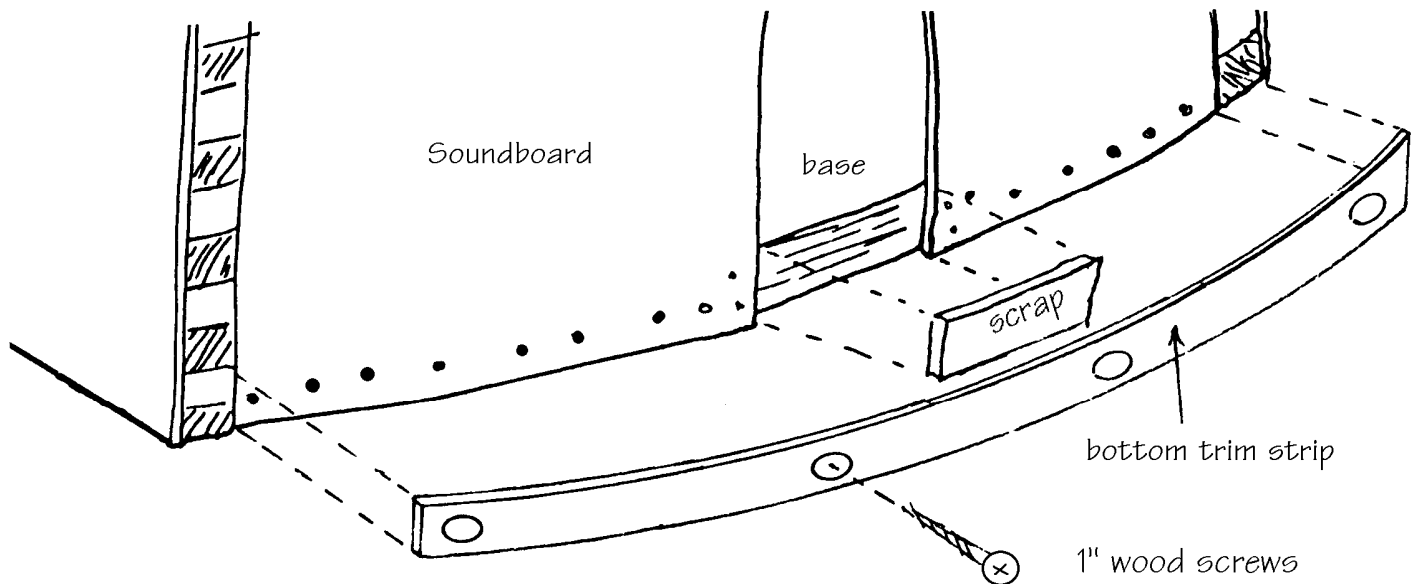
c) When both surfaces are dry to the touch, you can iron the banding onto the SOUNDBOARD just as you did with the veneer tape.

You will need to make a nice clean splice with a sharp chisel at the point where you join two pieces of banding together to reach the full length of the harp. Try to do this at a point in the pattern that where the joint will be less noticeable.



*No, there is not enough decorative inlay to reach across the bottom of the soundboard. We provide a sturdier BOTTOM TRIM piece for this place.*

\_\_\_37. But before installing that last bit of trim across the bottom of the **SOUNDBOARD**, find the scrap of 1/8" plywood that you saved from the notch and cut a small piece of it to fit in the gap across the bottom. Glue and nail it in place.



\_\_\_38. Then find the **BOTTOM TRIM** piece (pre-drilled with four holes) and four short wood screws. Glue and screw this strip firmly to the **SOUNDBOARD**. You may need to drill pilot holes (7/64) for the screws.

**NOTE:** The **BOTTOM TRIM** piece is longer than necessary. You may trim it to cover over the **INLAY BANDING** or to fit between the **INLAYS**, whichever you prefer.

\_\_\_39. Cover the screw heads by gluing the **WOOD PLUGS** over them and sanding the plugs flush with the trim piece.

## **SANDING THE SOUNDCHAMBER**

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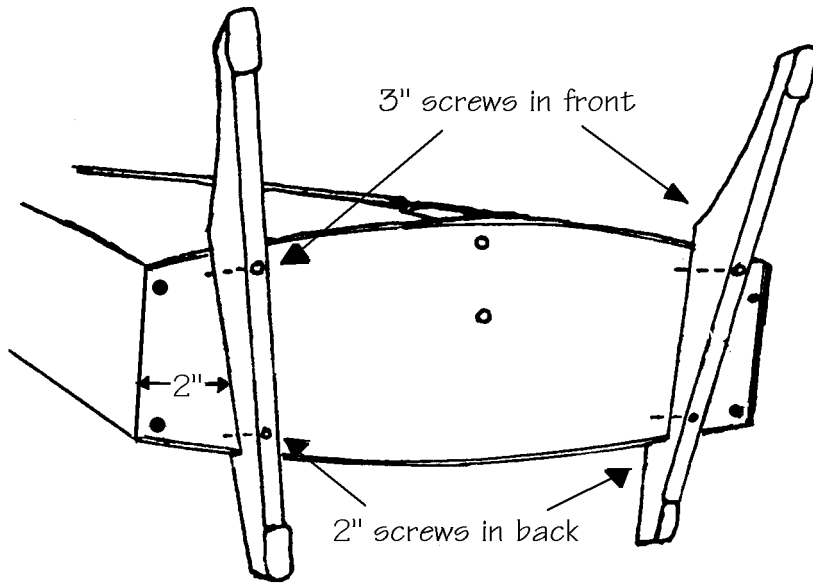
\_\_\_40. Start with a coarse (#80) sandpaper wrapped around a block of wood. Use it to round over the sharp edges of the soundchamber sides and reduce the "lip" of the sides down so they are flush with the decorative **INLAY BANDING** on the front.

You want the decorative **INLAY BANDING** to appear as though it is inlaid at the **SIDE**.

Remember that your fore-arms will make frequent contact with these corners of the soundchamber as you play, so make them feel comfortable. A sure sign of amateur woodworking is sharp corners. Don't hesitate to round them *generously*, as shown. Then your harp will look and feel like the professionally built instruments.

\_\_\_41. Switch to a medium grit (120) sandpaper to smooth off the scratches made by the coarse paper. This time, be sure to sand with the grain of the wood so you don't add more scratches.

## INSTALLING THE FEET



\_\_\_ 42. Place the soundchamber on a table with the bottom end hanging over the edge at any easy working height. Place the FEET in position approximately 2" from each SIDE so that the angled ledge of each FOOT contacts the BACK of the instrument.

We like the FEET to point slightly outward at the front rather than being "pigeon toed".

Insert the appropriate length screws into the holes in the

FEET, and tap them with a hammer to punch-mark the location for drilling pilot holes into the BASE.

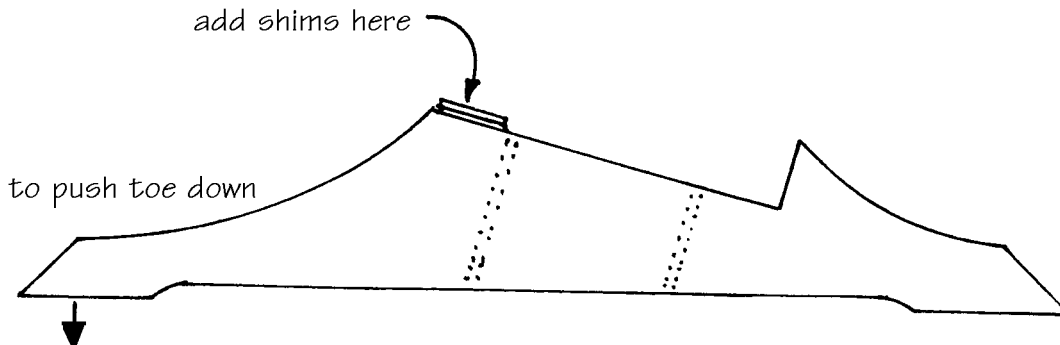
\_\_\_ 43. Drill pilot holes into the base with a 7/64" bit so the screws will go in easily

Attach the FEET to the BASE with screws only - no need for glue. Now the soundchamber will stand up on its own two FEET!

Check to see if the FEET make contact with the floor at all four points. If the harp rocks on two points, then you can adjust them as follows:

a) Look carefully at which points do not touch the floor (e.g., the "left toe" and the "right heel", or vice versa).

b) Remove the FEET and shim them with short pieces of WOOD VENEER TAPE, as shown. (If, for example, the "left toe" needs to be lower, add shims near the front screw that holds that foot in place.)



***You are doing great - more than half done!***



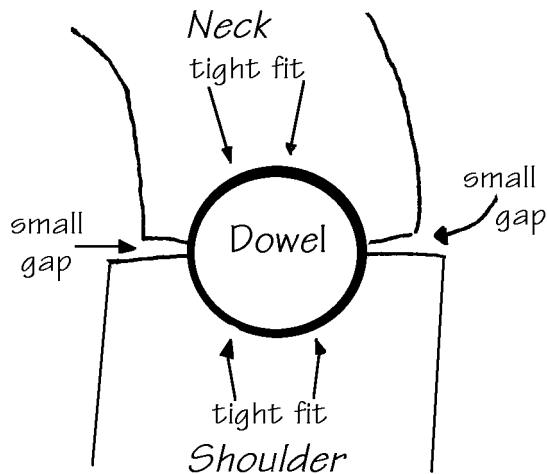
### Point of Interest

Many people ask why we use laminated maple for the NECK of this harp instead of solid hardwood. The reason is that the strings exert over 1,000 pounds of tension trying to break the wood. With such a deeply curved shape to the NECK, there is bound to be at least one weak point where the grain would be quite short, and that is where it would break if the wood were solid (straight grain). So the modern solution to this dilemma is to laminate thin layers of hardwood together, having each layer with the grain going a different direction. That way there are always some strong layers of wood in any given section of the NECK, regardless of the curves. You can rest assured that this harp is nearly indestructible with this laminated maple material.

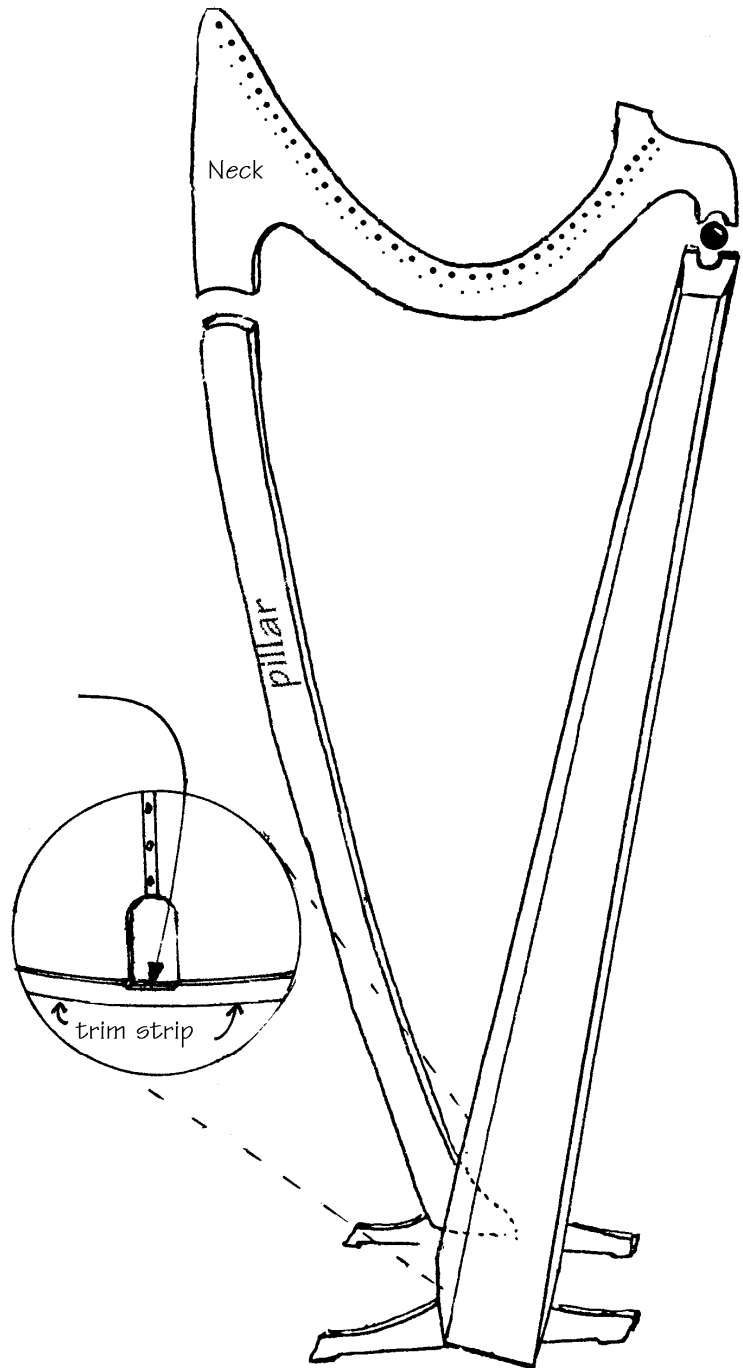
## PREPARING THE NECK

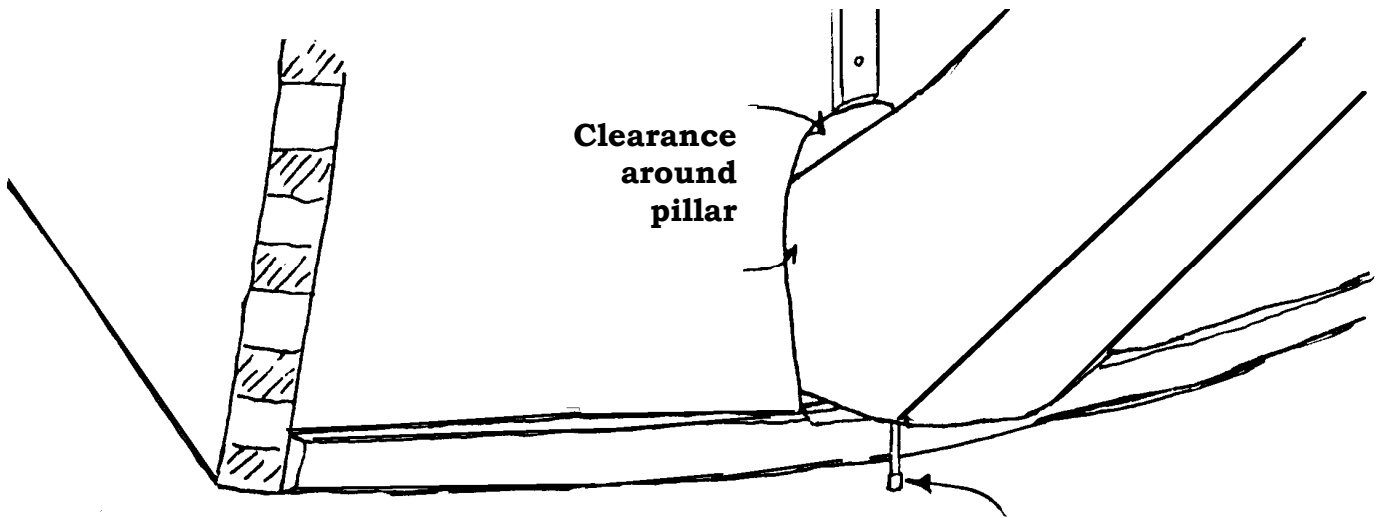
\_\_\_44. The **BOTTOM TRIM** strip may require filing at the center so it is level with the surface of the **BASE**. Otherwise it would interfere with the **PILLAR**. Use a coarse file to accomplish this.

\_\_\_45. Test fit the **NECK** and **PILLAR** to the soundchamber. Place the 1" diameter **WALNUT DOWEL** across the top of the **SHOULDER**, rest the back of the **NECK** on top of the **DOWEL**, and stand the **PILLAR** up from the notch in the **SOUNDBOARD** up to the front of the **NECK**.



These parts should stay together by gravity. Make sure the **PILLAR** rests flat on the **BASE**. You want plenty of clearance around the **PILLAR** at the notch. The sound of the harp will be dampened if the **SOUNDBOARD** touches the **PILLAR**.





**HELPFUL HINT:** You may need to pull the bottom of the PILLAR out away from the SOUNDBOARD to achieve the proper fit. Draw a pencil line under the PILLAR where it meets the BOTTOM TRIM. Then take the PILLAR out and pound a finishing nail part way into the PILLAR at that pencil line, to prevent the PILLAR from sliding too far into the notch as you assemble these parts together.

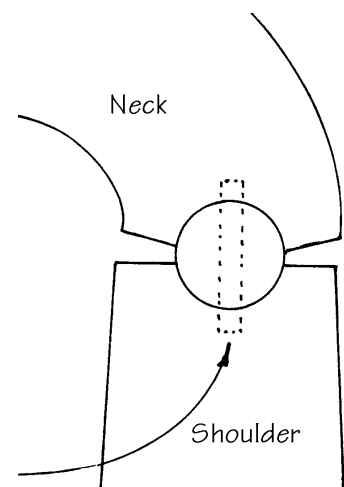
Look carefully at each joint. The SHOULDER and NECK should fit nicely on the DOWEL but should not touch each other (you can sand away some of the wood to make a small gap in front of and behind the DOWEL, so there is some room for the NECK to pivot on the DOWEL). Don't worry if this joint is a little loose now. The string tension will draw these parts together firmly.

**POINT OF INTEREST**

The joint at the back of the NECK is meant to be a kind of *knuckle joint* that allows for some movement in the future. If we were to attempt to glue a permanent joint here, the string tension would eventually cause a crack to open as the harp frame flexes in response to the strings. So we simply create a joint that allows for slight movement. Another benefit of this type of joint is that you will always have the option of taking your harp apart for future repair or refinishing. Just remove the strings and the NECK/PILLAR assembly can be taken off the harp.

**46. OPTIONAL STEP:** We have included one SMALL DOWEL (1/4") that can be used to "pin" this knuckle joint, if you wish to install it. We recommend it if you think you will ever ship the instrument somewhere. Occasionally, we have seen the NECK shift to one side of the SHOULDER during shipment, just because of the constant vibration of transporting it on its side for hundreds of miles.

This pin need not fit tightly, so we use a slightly oversize drill bit (17/64") to drill a hole through the center of the WALNUT DOWEL, and just 1/2" into the SHOULDER and the NECK so the pin will be hidden inside the knuckle joint, as shown. Yes, this is a bit tricky to fit, but it can be a loose fit. We often enlarge the holes a little by wobbling the drill back and forth to make sure the holes line up enough to allow the pin to fit into all three parts.



*Point of Interest*

Many people ask why we don't have dowels in the NECK/PILLAR joint. Doweling this joint would not hurt anything, but it is a difficult and unnecessary step. We have designed this instrument so that the string tension actually holds the parts together. The only force to worry about is the torque from the strings all pulling on one side of the NECK. They want to tip it over. Adding dowels would do little to prevent this motion, so we use decorative wood OVERLAYS on the outside of the NECK/PILLAR joint. They give a kind of "I-beam" strength to this joint. When properly glued in place, they are much more effective than dowels embedded on the inside. If you dislike our decorative shapes for these OVERLAYS, you may make your own customized shape. Just take care to make them out of sturdy wood -- no pressed wood, thin veneers, or soft wood here. Make sure also to aim the direction of the grain vertically, so it crosses the NECK/PILLAR joint.

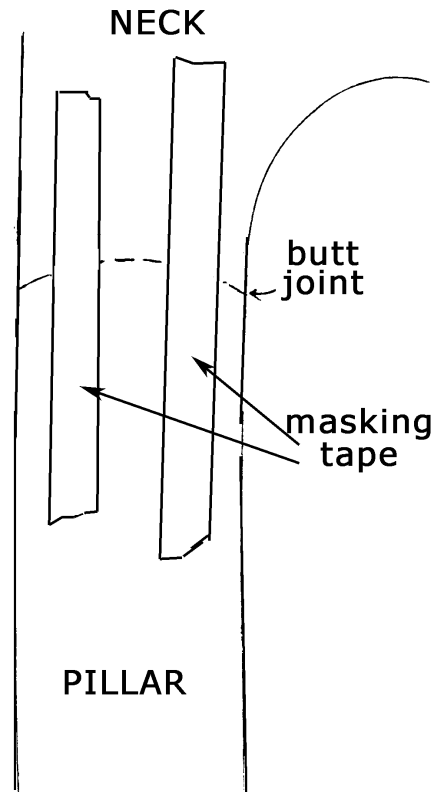
47. Look carefully at the joint at the front of the NECK where it rests on the PILLAR. It should be nice and tight, no wide gaps, when the bottom of the PILLAR is in correct position in the notch. Some adjustment can be made by sanding the top of the PILLAR, if necessary. But don't worry if the joint is not absolutely airtight. You may add a little filler paste here later. We usually do.

**STOP!**

Many customers have glued the NECK and PILLAR together without following these directions and have had trouble as a result.

**PLEASE PROCEED ONLY AS DIRECTED!**

You must glue the NECK and PILLAR together as they are standing in position on the harp. Otherwise you cannot be certain they will fit back into place again.



Gather the following tools and supplies for the next gluing operation:

- Several C-clamps
- Masking tape
- Glue
- Two damp rags
- Some scraps of wood for clamping pads

48. Apply glue to the butt joint of the PILLAR and NECK first, keeping the parts standing in place on the harp. Use masking tape to hold the parts together as tightly as possible until the glue dries, about 3 hours.

Once dry, round the edges around this area. It will be easier to do now, without the overlay in the way. Make sure the surface is flush, so your overlay rests nicely on the joint.

\_\_\_49. Sand the OVERLAY pieces before installing them. It is much easier to smooth off the edges now than it will be after gluing them to the harp.

\_\_\_50. Test fit the OVERLAY pieces to the NECK/PILLAR joint, centering the length over the joint. Lightly mark their outlines on each side of the PILLAR and NECK, so they will be positioned opposite one another.

**CUSTOMER SUGGESTION:** One customer suggests burying four tiny nails in the NECK and PILLAR to help hold the OVERLAY PIECES from sliding out of place when clamped. Clip off the nail heads, and drill 1/16" pilot holes into the NECK and PILLAR near the top and bottom of the pencil outline so the nails will show just enough to poke into the OVERLAYS when you clamp them in place. Great idea!

\_\_\_51. Apply glue to one of the OVERLAY pieces and tape it into position (where you drew the outline earlier).

Tape some clamping pads to your clamps, so they don't dent the harp when tightened.

Clamp one OVERLAY, watching to be sure the part stays in correct position and is held securely.

Use damp rags to clean up all glue as it squeezes out. This is very important! You will kick yourself every time you look at the finished harp if you leave glue residue around these decorative pieces.

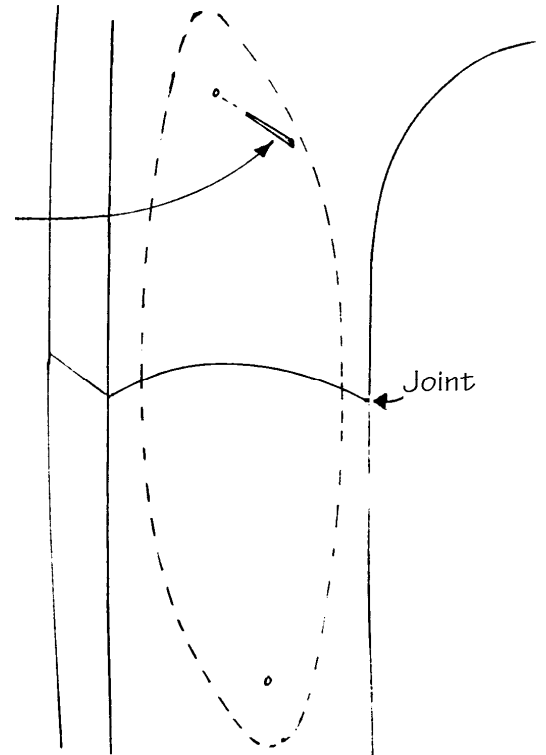
Allow the first side to set for a few minutes, then glue the second OVERLAY, clamping both sides at the same time. Again, clean up any glue that squeezes out, to avoid glue marks on your finished harp. Keep the clamps on for about 3 hours, giving it ample time to dry.

\_\_\_52. When dry, you may remove the NECK/PILLAR assembly from the frame of the harp. This is the best time to do final sanding and shaping of these pieces. Here are some guidelines:

Sand all the edges to remove machining marks, scratches, and glue residue. A medium sandpaper (150 grit) should suffice for this. Hold the parts in different lighting to check for scratches and glue spots. They can be elusive! (One customer recommends wiping the instrument with naphtha to find the glue spots – it works well.)

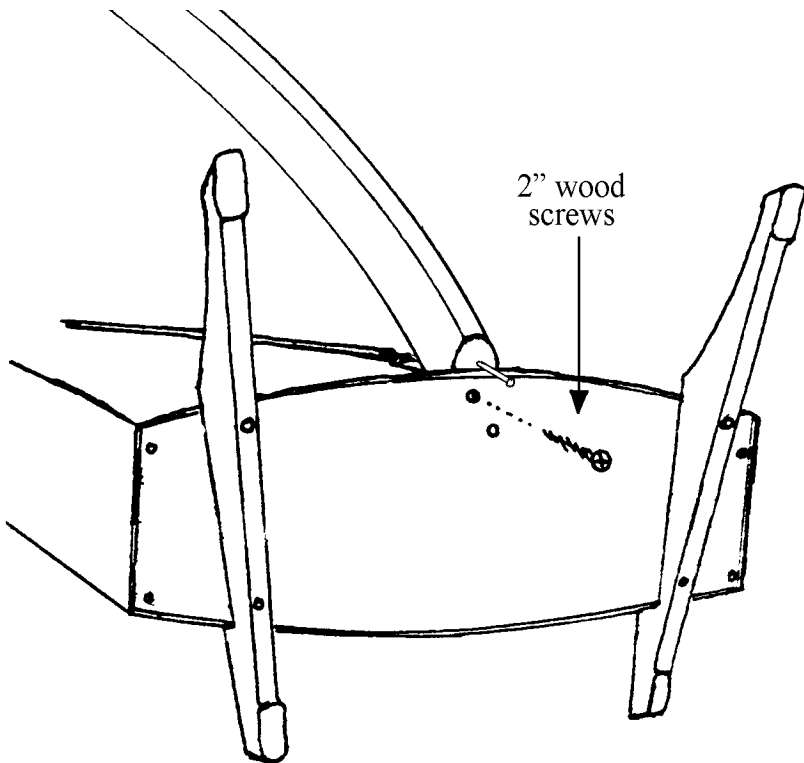
**Note that we have rounded over all edges of the NECK *except one*. This lower edge should be left square so you have room for mounting sharpening levers later on.**

Any minor cracks can be filled with your favorite wood putty. If you have nothing on hand that will match this wood, make up a paste of wood sanding dust and Elmer's glue mixed to a consistency of putty (thin it with a few drops of water). You might also find scraps of the WOOD VENEER TAPE handy for filling narrow openings.



## FINAL ASSEMBLY

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**53. Now you can attach the NECK/PILLAR assembly to the soundchamber. It requires only two screws (no glue), as the string tension will help hold the entire instrument tightly together.**

**Lay the harp on its back on a carpeted floor. Fit the NECK/PILLAR assembly in place on the harp and then drill pilot holes through the holes in the BASE, using 7/64" drill bit, making sure the PILLAR is centered in the notch.**

**Insert the screws to hold the parts together. We use no glue in this assembly step because it is unnecessary and because you may wish to be able to disassemble the harp in the future for refinishing, repairing, shipping, etc. That is a handy option.**

## FINISHING

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**Your harp is now assembled. All that remains is to do some final sanding and then apply the finish. Here are some finishing options, along with a few hints from our experiences with finishing materials.**

**STAIN -- STAINS** are coloring agents and should only be used if you dislike the natural color of the wood. We usually do not apply stains to our projects, especially when they are made with naturally beautiful hardwoods such as cherry or walnut. These woods look very nice with just a clear finish. But, if you want to color the wood differently, your staining should be accomplished before applying a surface finish such as oil, varnish, or lacquer. Use a high quality oil-based stain for best results (Minwax is a good brand).

**OIL --** An oil finish will give your wood a low luster appearance, bringing out the natural color of the grain, but it tends to soak into the wood and appear dry and "thirsty" after awhile. The principal advantage of an oil finish is that it can be applied and wiped dry immediately, so you can proceed to installing hardware (and strings) right away. The disadvantage of oil is that it usually does not give much surface protection or sheen, although there are some brands that include waxes and/or varnishes to give more surface build-up and luster.

**VARNISH --** Any regular varnish will work fine on this project, but we recommend our wipe-on polyurethane called MUSICMAKER'S INSTRUMENT FINISH. Our complete finishing kit (code *FINI-20*) includes detailed instructions, sandpaper sheets, tack cloth, foam applicator, and lint-free wiping cloth, along with a pint can of semi-gloss polyurethane varnish. The advantages of this finish are its simple application, durability, and deep, soft luster.

LACQUER -- Many professional instrument makers still use lacquer for their finish. The most readily available lacquer is called Deft Clear Wood Finish. It is best to purchase a can of liquid to brush on as a sealer coat first, and then use an aerosol can of the same product to spray on the final coats. The advantage of this finish is its quick drying time, but the disadvantage is the strong odor of the toxic lacquer fumes.

### OPTIONAL DECORATING

Hand painting or woodburning are fun ways to decorate the **SOUNDBOARD** of the instrument. Light artwork can be applied between coats of varnish or lacquer very nicely and will not harm the sound of the harp. Some people use acrylic paints, and others decorate with colored pencils or pastels. This is your opportunity to customize or personalize your harp.

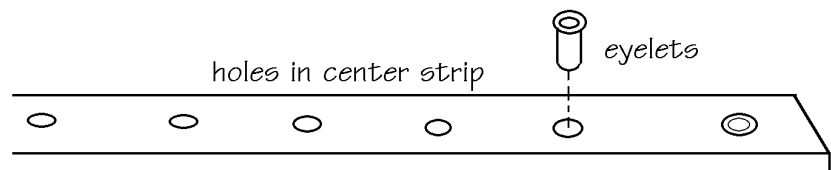
\_\_\_\_ 54. Do your final sanding with about a #220 grit sandpaper, always working with the grain so as not to scratch the wood. Dust the instrument well with a clean damp rag before applying the finish.

\_\_\_\_ 55. Apply the finish of your choice, sanding lightly between coats with very fine sandpaper or steel wool.

**HINT:** You may find it easier to apply the finish if you disassemble the harp. Just be careful to avoid dropping the heavy **NECK/PILLAR** assembly - it will dent easily because of its weight.

### ATTACHING HARDWARE

\_\_\_\_ 56. Find the **BRASS EYELETS** and push them into the holes in the front of the **SOUNDBOARD**. Note that there are two sizes to match the holes you drilled in the **CENTER STRIP** of the harp.



**HINT:** Install the hardware to the NECK when the harp is still disassembled. But be careful to put some cloth padding under it (such as a towel) so you don't scratch or dent the back side as you pound the hardware in.

57. You can install the **THREADED GUIDE PINS** into the lower row of holes drilled in the **NECK**. We like to lubricate the threads with some candle wax so they turn easily. These pins can be pounded partway with a hammer, then turn in with a #1 Phillips screwdriver until the top is about 5/8" above the surface of the wood.

**NOTE:** Our **THREADED GUIDE PINS** are adjustable in depth, allowing you to change the space between the harp string and the wood surface of the neck, using a #1 Phillips screwdriver. This will be important later when you want to install sharpening levers.

58. Turn the **NECK/PILLAR** assembly over so the **GUIDE PINS** are hanging over the edge of your work table, but the **NECK** is still firmly supported. Insert the **BRASS DRIVER** all the way into the chuck of your hand drill, and use the drill to push and turn the 33 **THREADED TUNING PINS** into the upper row of holes in the **NECK**, from the opposite side of the **GUIDE PINS**. Note that these pins have a fine thread. When you push firmly as you turn them, they will drive in quite quickly, and that is good. Don't just rely on the microthreads to seat these pins – that takes too long and it only serves to heat up the pins to extreme temperature. Push and turn them until the square end stands about 5/8" above the wood.

Assemble the harp back together again, tightening the 2 screws securely at the base of the pillar.

## STRINGING & TUNING

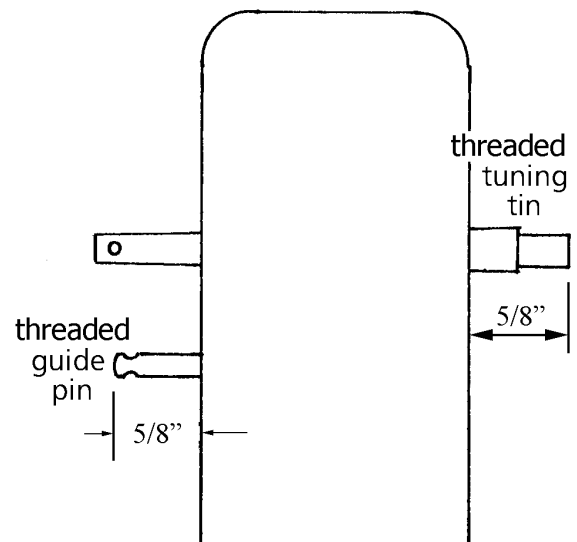
59. Stringing a harp is somewhat of an art. We recommend that you read through these last pages of directions completely before beginning, so you know what to expect. It is not uncommon for people to call us in a panic because their harp either a) won't stay in tune, or b) keeps breaking its strings. Careful installation will do much to eliminate these problems. We string this model harp regularly and tune it up to concert pitch right away with rarely a broken string. But it takes a little patience and concentration.

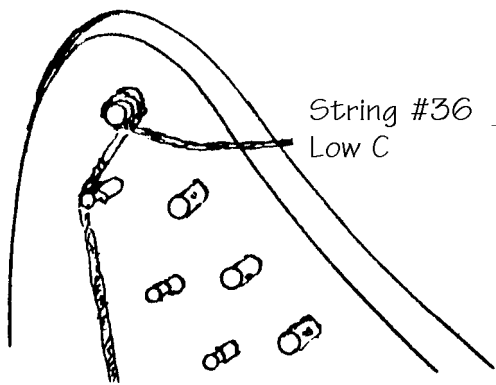
The strings are numbered from 1 (for the smallest) to 36 (for the longest), and they are color-coded to help guide you as you play. "C" strings are all red, and "F" strings are blue.

**NOTE:** If the color on the strings should happen to fade, you can restore it with permanent marker.

Gather the following tools for this operation:

- Set of harp strings with plastic beads
- Wire cutter
- Scissors
- Tube of Superglue or Crazy glue
- Tuning wrench





\_\_\_ 60. Start at the bass (longest) end of the harp with string #36, a long red string that is very thick. Push the plain end of the string through the lowest hole in the **SOUNDBOARD** from back to front. Pull it all the way until the knotted end contacts the **REINFORCEMENT BAR** inside the harp.

\_\_\_ 61. Thread the plain (steel) end of the string through the last **TUNING PIN** near the point of the **NECK**, pulling it through the pin, but leaving enough slack below the pin to allow several windings before coming taut.

\_\_\_ 62. Use the **TUNING WRENCH** to turn the pin *clockwise* (from the viewpoint of the tuning wrench on the backside of the **NECK**) and guide the windings neatly around the pin.

\_\_\_ 63. As the string begins to tighten, place it in the groove of the **GUIDE PIN** as shown:

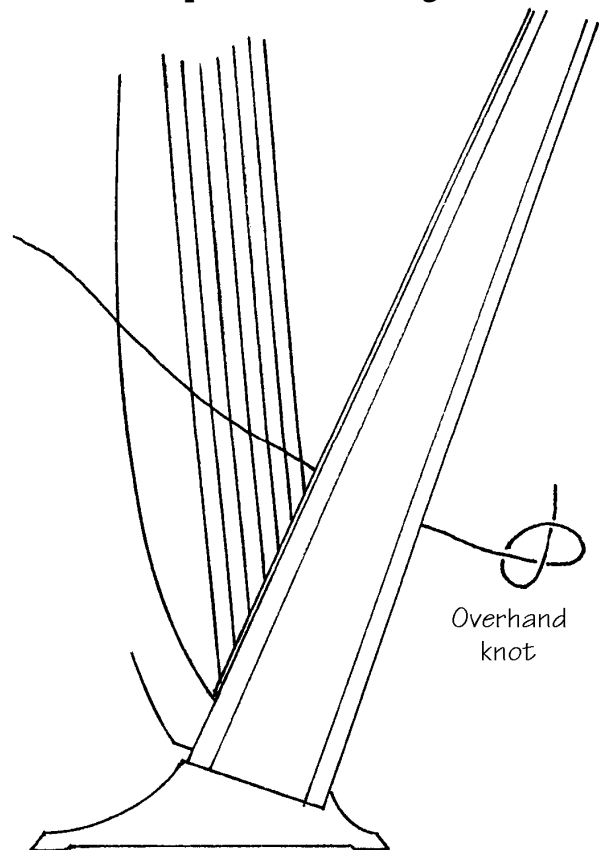
**CAUTION!**

These **WOUND STRINGS** are very fragile and expensive to replace. Some people break the first one they install by over-tightening. They don't expect it to come up to pitch so quickly. Take care to avoid that costly mistake

\_\_\_ 64. Thread the other 6 wound strings in the same way, taking care to keep them in the correct order. When you are satisfied with installation of these strings, use a wire cutter to clip off the excess wire, close to the **TUNING PINS**. These sharp ends are *dangerous!* Cut them short so they won't poke you or catch on your clothing.

\_\_\_ 65. The remaining 29 strings are plain (monofilament) nylon that have no knots tied in them yet. You may insert these strings from the front of the harp, if that is easier, and then reach inside the back to find the end. Tie a simple overhand knot at the end, as shown:

Put a drop of Superglue or Krazy glue on the knot, then pull the knot tightly against the inside of the **SOUNDBOARD** (right away, before the glue has set up). No, we don't want to glue string to the harp, we just want to "freeze" the knot itself, so the slippery nylon doesn't untie itself when the string is tuned up to pitch. We buy gel Superglue - it is not so messy.



**NOTE:** pull straight through the hole, not at an angle, so as to avoid scratching the nylon against the brass eyelet.



Thread the other end of the string through the next TUNING PIN, pulling it through the hole until there is only a little slack in the string below the PIN. How much slack? About 2-4 inches. You'll catch on—too much slack makes for a bulky accumulation of string around the TUNING PIN, and too little means you won't have enough to even wrap once around the PIN. Ideally, you'll have 3 to 5 wraps of string around each TUNING PIN for security.

Turn the PIN clockwise with the tuning wrench as you take up the slack with the other hand, guiding the string as it winds around the pin. As the string begins to tighten, place it in the groove of the GUIDE PIN.

Once the string is satisfactorily installed, you may clip off the excess nylon close to the pin (leave ¼" stub), and tune the string up to its proper pitch (no, it won't stay in tune yet, but it helps to begin stretching it right away).

#### *Helpful Hint*

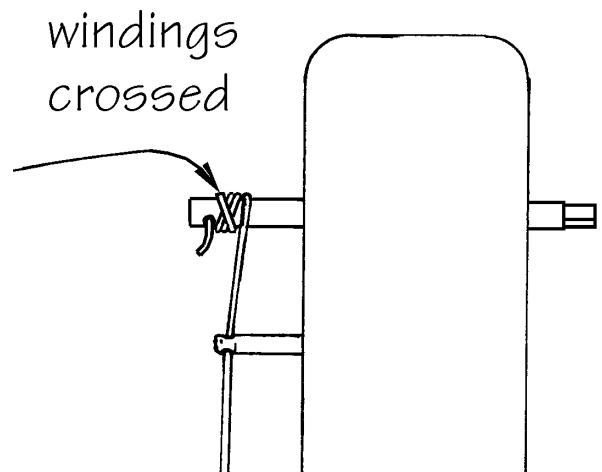
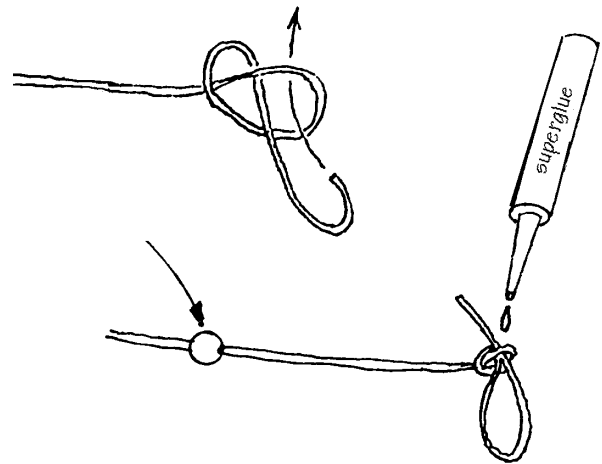
Do not accumulate a lot of windings of string around the TUNING PINS, especially with the thick bass (low) strings. They become bulky and cumbersome. If you have that problem, turn the TUNING PIN backwards to unwind the string, then pull more of the string through the hole and tighten again.

\_\_\_ 66. Install all six of the large (.060") strings this same way, taking care to put the colored ones in the proper positions. We have included one spare clear string in each bundle in case you break one.

\_\_\_ 67. When you come to the mid-range strings (sizes .050" and .040"), thread a small plastic bead onto each string, as shown, and then tie the bottom knot a little differently to give it more bulk. Start with the same overhand knot, but before tightening it, push the loose end part way back into the knot, just to add one more thickness of string to the knot.

**IMPORTANT:** It is necessary to also anchor the tops of these strings (and all the lighter ones) securely to the tuning pins, as follows:

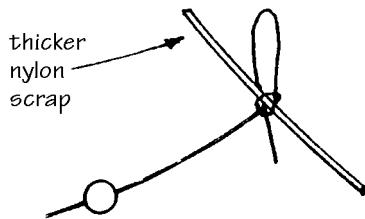
Guide one or two windings of string on the TUNING PIN, then guide the next winding over the others so the string helps "pinch" itself tightly to the PIN as you tune it up to pitch. If you don't do this, you will surely experience string slippage and breakage, especially in the upper half of the instrument.



### FLASH INTERRUPTION

When about half the strings are installed, double check the position of the NECK on top of the soundchamber. Center it nicely now, before the string tension draws the parts together too tightly.

\_\_\_ 68. The next two sizes of strings ( sizes .036" and .032") are thinner and more fragile. Take care to avoid scratching them as you install them, and don't forget the PLASTIC BEADS and the Superglue!



\_\_\_ 69. The last seven strings are the most delicate. Take your time with them. This nylon is so thin that even a double knot will sometimes pull through the hole in the bead. The solution is to insert a short piece of thicker nylon into the knot to make it bulkier, as shown.

When all the strings are installed, make sure the back of the NECK is still centered on the SHOULDER, and tune the entire harp up to pitch so the instrument begins to adjust itself to the tension.

The strings should all be tuned to the natural C major scale (white keys on the piano). All the red strings will be C notes and the blue ones F notes. Middle C is string number 22 from the top. The lowest note is two octaves below middle C.

Many people are not certain if they are tuning their harp strings to the correct octave. Tuning the strings an octave too low will result in flabby harp strings that don't provide much volume. Tuning the strings too high will cause strings to break. To make sure you are tuning your harp strings to the correct octave, you can double-check the pitch on our website with our "online tuner". [www.musikit.com](http://www.musikit.com)

**NOTE:** It will take several tunings before the harp will stay in tune. Be patient! It should get better each day. One technique for accelerating the settling of the nylon strings is to slide your fingers up and down each string while pulling on it. BE CAREFUL! This activity generates heat quickly, so don't burn your fingers with the friction. But a little heat is good, because it helps the nylon stretch out quickly to its final shape. This should hasten the tuning stability at least a little, but be prepared for *MUCHOS* tuning for the first month!

**CONGRATULATIONS!** We hope you have enjoyed building this harp and that you enjoy many years of musical pleasure from playing it. We stock a good number of teaching materials and accessories for your instrument to help you get started playing music. Just call us for more information or for placing an order.

# SHARPING LEVERS

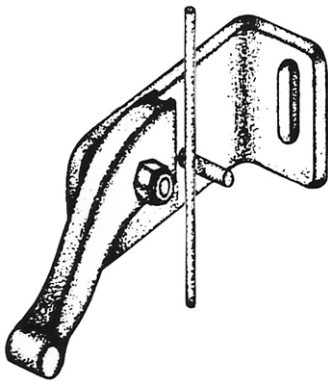
Sharping levers are used on folk harps to facilitate key changes. Installing a lever at a string allows you to raise the pitch of that string one-half step by engaging the handle against the string. Thus an F-string can be raised to F# by a simple flick of the lever. Similarly, a B-string may be tuned to Bb so that the lever will raise it to a B-natural and release it back to a B-flat, as needed.

Most folk harp players set the key signature (sharps or flats) on the harp before starting each piece of music. For the key of G, you would engage the levers on all the F strings to produce the F# needed for that key (making sure all other notes on the harp are natural). If the following piece were then to be played in the key of F, you would then release the levers on all the F strings to produce F-natural, and also release all the B-string levers to produce Bb.

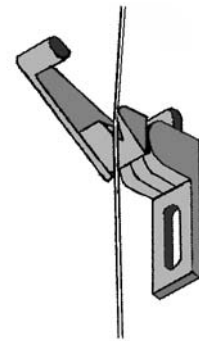
You may install a lever over every string on the harp, or, if you think you won't use all of them, it would be more cost-effective to select which keys you think you are most likely to use, and then install only the levers necessary for those keys.

|            |                                  |
|------------|----------------------------------|
| KEY OF E:  | requires F# and C# and G# and D# |
| KEY OF A:  | requires F# and C# and G#        |
| KEY OF D:  | requires F# and C#               |
| KEY OF G:  | requires F#                      |
| KEY OF C:  | requires no sharps or flats      |
| KEY OF F:  | requires Bb                      |
| KEY OF Bb: | requires Bb and Eb               |
| KEY OF Eb: | requires Bb and Eb and Ab        |

**Loveland Lever**



**Universal Lever**



MUSICMAKER'S KITS, INC.  
PO BOX 2117  
STILLWATER, MN 55082-3117  
(651) 439-9120

[www.harpkits.com](http://www.harpkits.com)

## SOME NOTES ON USE OF YOUR GOTHIC HARP

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**PLAYING POSTURE:** The 36-string Gothic Harp is a very tall instrument. To play it comfortably, you may need to sit on a stool of about 24" height. Lean the harp backwards until it rests lightly on your right shoulder. You should be able to reach the lowest bass strings with your left hand and the highest treble strings with your right hand.

Experienced harpists will also advise you to make sure that your thighs are parallel to the floor as you play. If the stool causes your legs to angle downward, then you should put your feet on a low platform. This will be especially important if you play the instrument for extended time periods. You will become much more tired if your legs are not in the "ergonomically correct" position.

**TUNING TIPS:** It is best to tune the harp with all sharpening levers flipped down (disengaged), so there will be no interference from the levers. Please note that this means you may be tuning some strings to flats instead of natural notes. If you have levers on the B strings, for example, you should tune those strings to B-flat when the lever is flipped down. You will then flip these levers up when playing in the key of C.

**BUZZING STRINGS:** Your harp need not suffer the problem of rattling or buzzing sounds when you play. If you hear such noises, you can correct them. Here are some troubleshooting hints:

If the buzzing sound occurs only when the SHARPING LEVER is flipped up (engaged), then you need to tighten the LEVER more firmly against the NECK of the harp.

If the buzzing occurs when the LEVER is flipped down (disengaged), the string may be vibrating against some part of the SHARPING LEVER itself. If you have Loveland brand levers, look very closely at the position of the string as it passes through the LEVER bracket. It may be rattling against the plastic cam (the part that you flip up & down), or against the small "fretpost" (the part that the cam pinches the string against when engaged.) You can change the position of the string by raising or lowering the THREADED GUIDE PIN on which the string rests above the SHARPING LEVER. (Make sure the string is resting in the groove of that PIN.) Use a #1 size Phillips screwdriver to turn the GUIDE PIN in or out, watching how that moves the string in relation to the SHARPING LEVER.

If the problem is not located around the SHARPING LEVER, you may have a loose end of string that is rattling inside the soundchamber. Put your hand inside the harp and touch the knotted ends while plucking the harp to see where the problem is located. Oftentimes you can solve it by simply trimming off a loose end of string or by twisting the knotted end in a different direction.

**HARP REPAIRS:** If you ever need to repair the wood parts of your harp, you will be glad to know that the NECK/PILLAR assembly can be removed from the soundchamber to facilitate repair work. Simply loosen the strings and unhook them from the TUNING PINS. Then remove two screws at the BASE of the harp to allow the NECK/PILLAR to come free of the harp body.

# 36-STRING GOTHIC HARP

| LGOTHSTRG |        |                 | FULL SET OF 36 STRINGS |       |                  |                     |
|-----------|--------|-----------------|------------------------|-------|------------------|---------------------|
| STRING    | NOTE   | GAUGE           | CODE                   | COLOR | VIBRATING LENGTH | LOVELAND LEVER SIZE |
| 1         | C7     | .025            | NYL025                 | red   | 4-3/8"           | 00                  |
| 2         | B6     | .025            | NYL025                 | clear | 4-7/8            | 00                  |
| 3         | A6     | .025            | NYL025                 | clear | 5-1/4            | 00                  |
| 4         | G6     | .025            | NYL025                 | clear | 5-3/4            | 0                   |
| 5         | F6     | .025            | NYL025                 | blue  | 6-1/4            | 0                   |
| 6         | E6     | .025            | NYL025                 | clear | 6-7/8            | 0                   |
| 7         | D6     | .025            | NYL025                 | clear | 7-1/2            | 0                   |
| 8         | C6     | .032            | NYL032                 | red   | 8-1/8            | 0                   |
| 9         | B5     | .032            | NYL032                 | clear | 8-7/8            | 2                   |
| 10        | A5     | .032            | NYL032                 | clear | 9-5/8            | 2                   |
| 11        | G5     | .032            | NYL032                 | clear | 10-5/8           | 2                   |
| 12        | F5     | .036            | NYL036                 | blue  | 11-5/8           | 4                   |
| 13        | E5     | .036            | NYL036                 | clear | 12-3/4           | 4                   |
| 14        | D5     | .036            | NYL036                 | clear | 13-7/8           | 4                   |
| 15        | C5     | .036            | NYL036                 | red   | 15               | 4                   |
| 16        | B4     | .040            | NYL040                 | clear | 16-1/4           | 5                   |
| 17        | A4     | .040            | NYL040                 | clear | 17-1/2           | 5                   |
| 18        | G4     | .040            | NYL040                 | clear | 18-7/8           | 5                   |
| 19        | F4     | .040            | NYL040                 | blue  | 20-1/4           | 5                   |
| 20        | E4     | .050            | NYL050                 | clear | 21-3/4           | 7                   |
| 21        | D4     | .050            | NYL050                 | clear | 23-1/8           | 7                   |
| 22        | mid C4 | .050            | NYL050                 | red   | 24-3/4           | 7                   |
| 23        | B3     | .050            | NYL050                 | clear | 26-1/2           | 7                   |
| 24        | A3     | .060            | NYL060                 | clear | 28-1/4           | 9                   |
| 25        | G3     | .060            | NYL060                 | clear | 30-1/4           | 9                   |
| 26        | F3     | .060            | NYL060                 | blue  | 32-1/8           | 9                   |
| 27        | E3     | .060            | NYL060                 | clear | 34-3/8           | 9                   |
| 28        | D3     | .060            | NYL060                 | clear | 36-3/4           | 9                   |
| 29        | C3     | .060            | NYL060                 | red   | 39               | 9                   |
| 30        | B2     | .022/6/.014 SFN | STEELB                 | clear | 41-3/8           | 7                   |
| 31        | A2     | .028/6/.016 SFN | STEELA                 | clear | 43-3/4           | 9                   |
| 32        | G2     | .022/2/.008 SFB | STEELG                 | clear | 46-1/8           | 7                   |
| 33        | F2     | .022/4/.010 SFB | STEELF                 | blue  | 48-3/8           | 9                   |
| 34        | E2     | .024/4/.010 SFB | STEELE                 | clear | 50-7/8           | 9                   |
| 35        | D2     | .024/6/.010 SFB | STEELD                 | clear | 53-1/4           | 9                   |
| 36        | C2     | .026/6/.012 SFB | STEELC                 | red   | 55-3/4           | 9                   |

(Set includes one spare clear string of each monofilament nylon size)

**NOTE: 25 small beads added for upper strings**

Musicmaker's Kits, Inc

PO Box 2117  
Stillwater, MN 55082

(651) 439-9120  
[www.harokit.com](http://www.harokit.com)