

Hammered Dulcimer kit



Musicmaker's Kits

(Hwy 36 behind Joseph's Restaurant)

P.O. Box 2117

Stillwater MN 55082

(651) 439 9120

info@musikit.com

PERFORMANCE SIZE HAMMERED DULCIMER KIT

Parts List:

- a) 1 back (1/4" plywood)
- b) 1 soundboard/top (redwood)
- c) 2 pinblocks (laminated maple)
- d) 1 long front rail (laminated maple)
- e) 1 shorter back rail (laminated maple)
- f) 2 inner braces (hardwood)
- g) 2 bridges (maple)
- h) 1 tone bar (hardwood)
- i) 1 bridge support

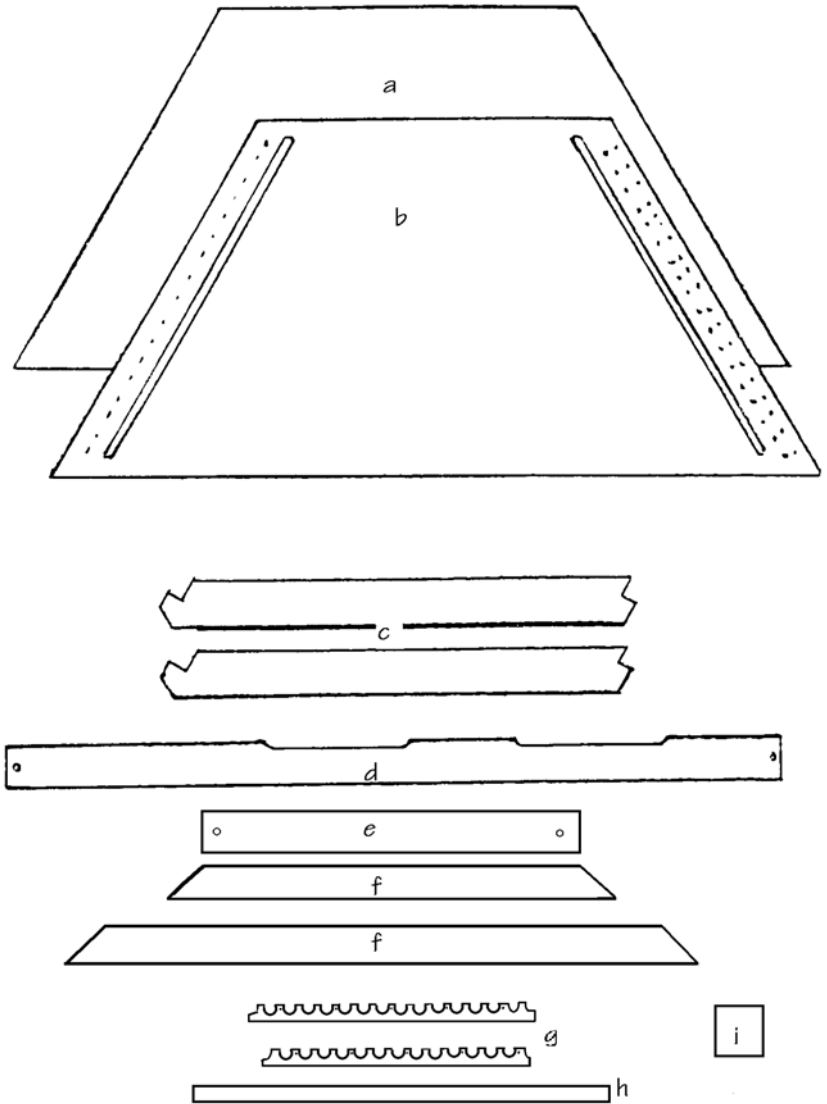
Hardware:

- 2 black delrin rods (21" each)
- 2 brass tubes, 3/8" dia (21" each)
- 58 tuning pins
- 29 round head wood screws (hitch pins)

Music wire

- ◆ 50 ft of .018" diameter
- ◆ 50 ft of .020" "
- ◆ 100 ft of .022" "

- 1 tuning wrench
- 4 wood screws (1-1/4" Phillips head)
- 4 maple plugs (3/8" dia)
- 1 drill bit (3/16" dia)
- 1 pair playing hammers
- assembly instructions & tuning chart



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.

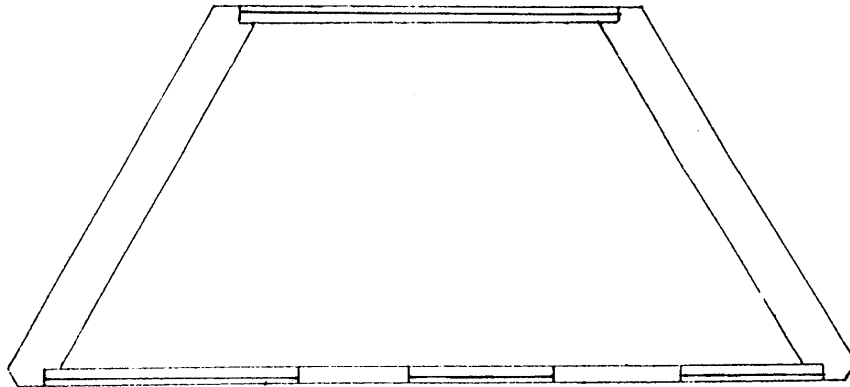
ASSEMBLY INSTRUCTIONS

PRELIMINARY CAUTION

BE VERY CAREFUL WHEN HANDLING THE REDWOOD SOUNDBOARD IN THIS KIT. IT IS VERY SOFT AND SUSCEPTIBLE TO DENTS AND SCRATCHES. STORE IT IN A SAFE PLACE UNTIL YOU ARE READY TO GLUE IT IN PLACE.

THE FRAME

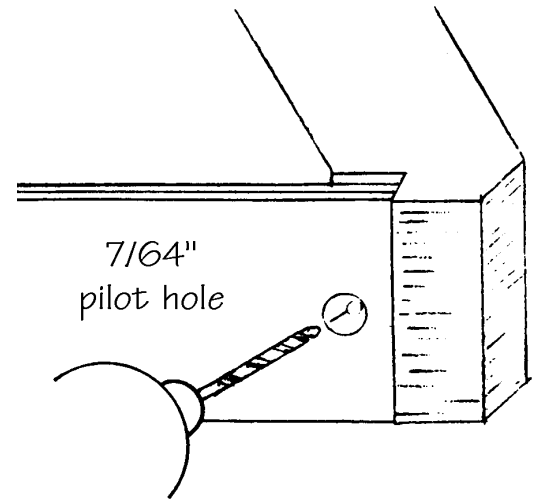
1. Test fit the four frame parts together (two pinblocks and long and short rails) without glue to see how they fit. The two rails should be pre-drilled with a 3/8" countersink for the wood screws. Make sure these countersunk holes face outward.



Position the frame pieces on top of the Back panel and check to see that the corner joints fit tightly. Make minor adjustments to the ends of the rail pieces if necessary.

___2. Use a 7/64" drill bit (not provided) to drill a pilot hole into each end of the pinblocks to make it easier to screw the rails to the pinblocks. Drill through the holes already located in the RAILS, making sure the parts are perfectly aligned as you drill. Note the slight angle of the holes -- that will help pull the joints tightly together.

___3. It is also a good idea to open up the holes in the RAILS so the screws slip through easily. Use a 3/16" bit to make the holes larger in the RAILS only, not the pilot holes you just drilled in the PINBLOCKS.



When pilot holes are drilled, and you are satisfied with the fit of the parts, go ahead and assemble them permanently with glue and screws. The screws serve as clamps to draw the parts together, but the real strength lies in the glue joint. Use enough glue so that some of it squeezes out of the joint when the parts are drawn together (put wax paper under each corner so as to avoid gluing the frame to your work table).

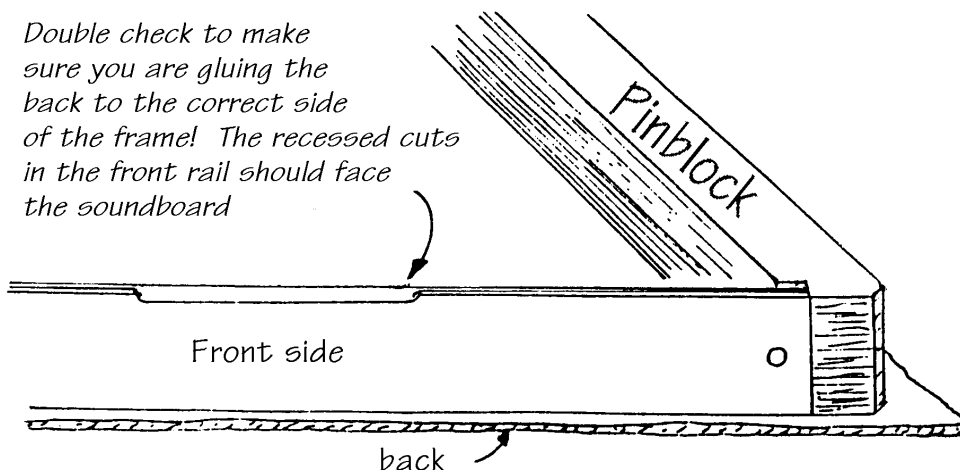
IMPORTANT: HOLD THE FRAME OVER THE BACK PANEL TO MAKE SURE THE FRAME IS NOT CANTED ONE DIRECTION OR THE OTHER. IT IS POSSIBLE TO GLUE THE FRAME SLIGHTLY OUT OF SYMMETRY, AND THAT COULD CAUSE PROBLEMS WITH THE FIT OF THE SOUNDBOARD. FORCE THE JOINTS INTO ALIGNMENT WITH THE BACK, IF NECESSARY, BEFORE THE GLUE DRIES!

THE BACK

___4. Find yourself a good collection of c-clamps or heavy weights (cement blocks or bricks). It pays to be prepared for this gluing step, as the strength of your hammered dulcimer depends on how firmly you glue it together! The back forms a critical part of the structure of this instrument, so take care to clamp it well all the way around the frame.

NOTE: look carefully at all the joints of the dulcimer frame, and clean up any glue blobs that would interfere with a good fit of the back. Also smooth out any unevenness of wood at the joints.

Double check to make sure you are gluing the back to the correct side of the frame! The recessed cuts in the front rail should face the soundboard

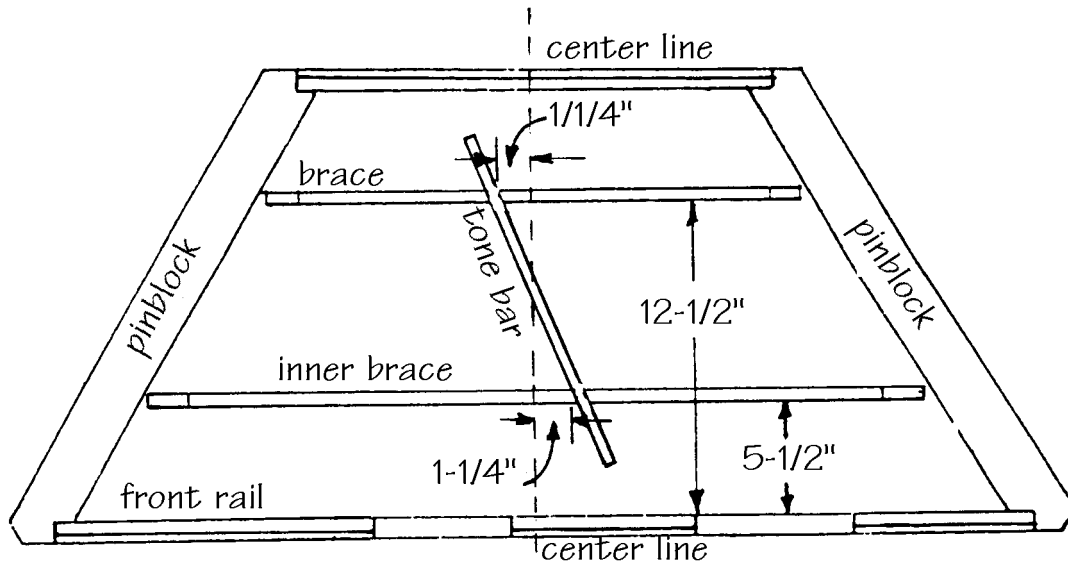


CAUTION
The BACK piece has a good face and a bad one. We have punched little marks into the bad face when trimming the wood to match our pattern. You'll want to have that face on the inside of the instrument so you won't see those punch marks on the finished instrument.

When you are satisfied with the fit, go ahead and glue the back to the frame, using plenty of clamps and/or weights to hold the parts together.

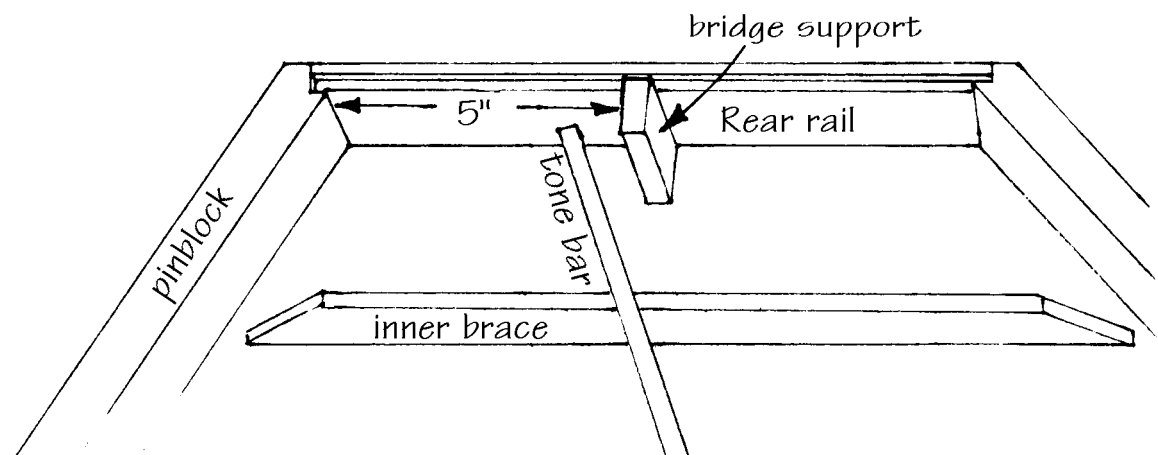
INNER BRACING

___ 5. The two **INNER BRACES** are cut with a slope at each end. The function of these braces is simply to support the **TONE BAR**, which, in turn, supports the middle of the **SOUNDBOARD**. These **BRACES** do not need to touch the **PINBLOCKS**. Measure the distance shown from the long **FRONT RAIL** to determine the proper placement, then glue them to the **BACK**, using heavy weights and/or clamps until dry.



___ 6. When the **INNER BRACES** are dry, position the **TONE BAR** on top of them. Orient it at an angle to the centerline of the instrument, as shown. The **TONE BAR** should overhang the two **BRACES** equally. Mark its position on the **BRACES** so you can glue it down accurately with weights or clamps holding it until dry.

___ 7. One more **BRIDGE SUPPORT** is needed for the internal bracing. This block should be glued to the **BACK** and the **REAR RAIL**, as shown, so it stands the same height as the **PINBLOCKS**.



THE SOUNDBOARD

7. While waiting for the frame to dry, you can work on the soundboard, taking care not to dent or scratch it.

If you do dent the top of the soundboard, you can restore the surface by steaming the wood to swell the fibers back into place. Drip some water onto the dent, and then use a household iron and a damp cloth to steam the damaged portion. Allow the wood to dry before sanding the area.

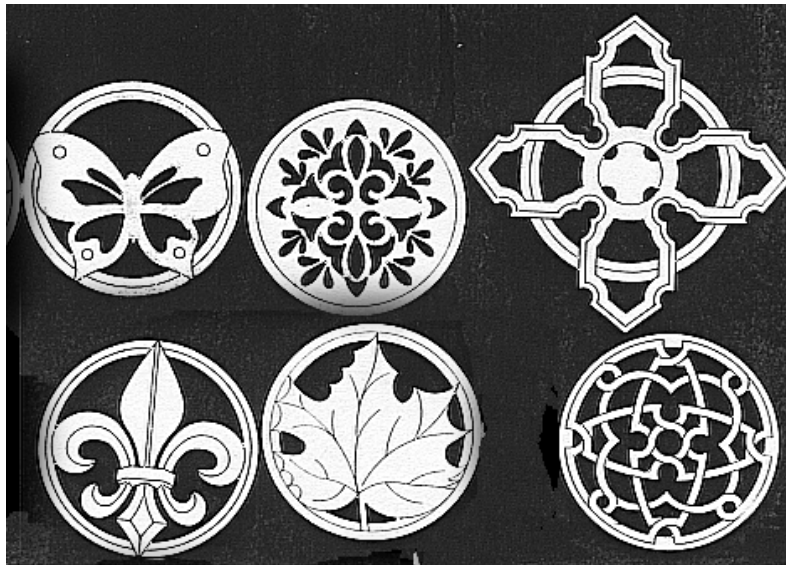
POINT OF INTEREST

Many people ask why we use redwood for the SOUNDBOARD instead of spruce. Although we also like the sound of spruce, we choose redwood for several reasons:

- ◆ We like the bright sound of redwood (spruce has a darker, more mellow sound)
- ◆ The strings are a little easier to see against a dark wood than a light wood
- ◆ Redwood does less swelling and shrinking with humidity changes than most other woods
- ◆ Redwood has been readily available when we need it

If you are building your own instrument from scratch, you may wish to try a different wood for the top. The most common choices are redwood, spruce, Honduran mahogany, and cedar. Each has a slightly different "color" of sound, but all are very good options.

There are two punch marks in the middle of the SOUNDBOARD that show the correct location for the center of the soundholes (they are centered between the bridges). The size and shape may vary to suit your design ideas, but please do not make holes that are larger than 3" in any direction, as that will weaken the soundboard too much.



Our MUSICMAKER'S catalog shows a number of decorative laser-cut rosettes that look nice on a hammered dulcimer. We usually cut holes of 2-1/8" diameter, and then glue a medium size rosette (2-3/8" dia) over the top of the hole. No need to inlay them flush with the soundboard - the rosettes will not interfere with the strings.

If you have a large (2" diameter or more) forstner drill bit or a hole saw, you can bore very nice soundholes with that, as long as it is sharp, but do not attempt to drill with a spade bit or anything that is not perfectly sharp, as this redwood will crumble and split when abused.

CUSTOM SOUNDHOLES

If you would rather design your own soundholes, this is a good place to be creative, making your instrument unique. We have tried a number of different sizes and shapes of holes, and they all work fine.

Draw out your ideas on paper first, then cut them out and try positioning them on the soundboard to see how they would look. Transfer the design to the wood with carbon paper, and use a FINE TOOTH jigsaw blade when cutting the wood. Further decoration can be done with wood overlay of a contrasting color, or with decorative binding around the edges of the hole, or hand painting, stenciling, etc.

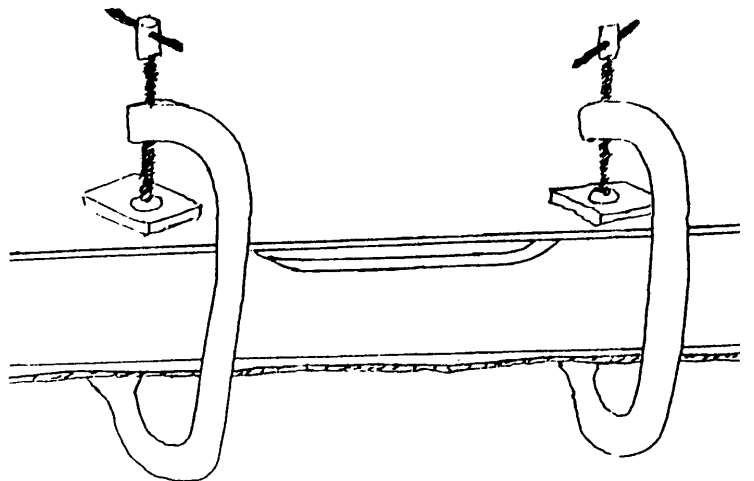
8. When the soundholes are done, and the dulcimer box is dry, you can test fit the two together. Please note that the **SOUNDBOARD**, like the **BACK**, is cut slightly oversize, just to make sure it covers the entire frame. Try to position it evenly, however, because the locations of the tuning pins and hitch pins are already marked on the wood for you. The goal is to have equal overhang all around the frame.

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 even the best varnish or lacquer does not hermetically seal the wood. It blocks spilled milk from soaking in, but it does not prevent the wood from "breathing" moisture vapor from the surrounding air.

Now is a good time to sign your name to your instrument. Put your signature, date, location, and any message you have for posterity(!) on the inside of the back where it can be seen through a soundhole

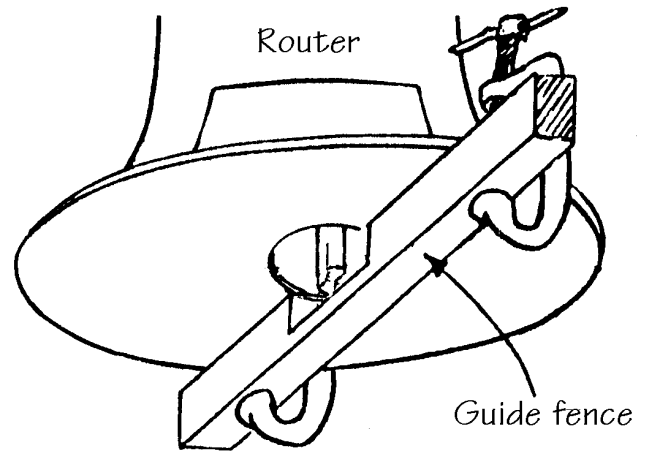
Check for dried glue blobs or uneven surfaces that might interfere with a good fit of the **SOUNDBOARD** on the dulcimer frame. When satisfied with the fit, glue the **SOUNDBOARD** to the frame and the **TONE BAR**, using plenty of clamps and weights to ensure complete contact all the way around the instrument. Look for glue squeezing out as a sign of good contact.



TRIMMING & SANDING

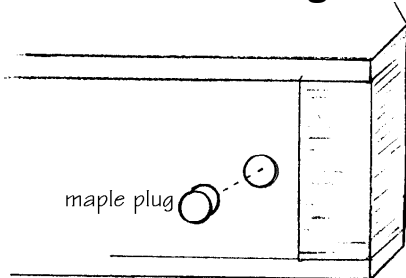
___ 9. Once the box is dry, you need to trim away the excess wood from the **SOUNDBOARD** and the **BACK**. One easy way to accomplish this is with a belt sander. This tool will also even out the corners of the **PINBLOCKS** that may protrude slightly beyond the **RAILS**.

If you use a router for this trimming operation, use a very sharp carbide bit and move the router fairly slowly to avoid problems. We usually work the router in the reverse direction than normal, i.e. in the same direction as the spin of the bit. That helps prevent tear-out. We have seen redwood **SOUNDBOARDS** get chipped by cutting too quickly. Also, take care to avoid letting the bit "fall" into the open slots in the **FRONT RAIL**. A good way to prevent this is to clamp a small guide fence to the router base, as shown.



CAUTION: CHECK YOUR ROUTER BASE AND WORK TABLE FOR ANY FOREIGN MATTER THAT MIGHT SCRATCH UP YOUR HANDIWORK. WE RECOMMEND COVERING YOUR WORK TABLE WITH AN OLD TOWEL OR A CARPET SCRAP FOR PADDING. THEN YOU CAN MOVE THE DULCIMER AROUND WITHOUT WORRYING.

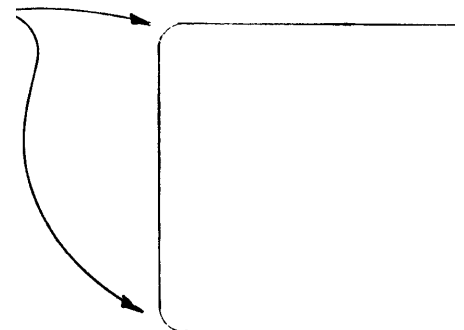
Those who are unmotorized can achieve good safe results by hand with coarse sandpaper wrapped around a scrap of 2 X 4 wood, although it will take a considerable amount of "elbow grease".



___ 10. Fill the countersunk screw holes in the front and rear **RAILS** by gluing the four maple plugs into the holes.

___ 11. Sand the wood plugs flush with the surface of the **RAILS** so that you remove all ridges and all glue residue that is showing.

___ 12. Round over all sharp edges so they feel smooth to your hand. Again, a router with a 1/4" rounding over bit makes this job simple, but you can do the job well with a sanding block, working by hand. Follow up with a medium sandpaper to remove the scratches left by the coarse block.



DRILLING FOR HARDWARE

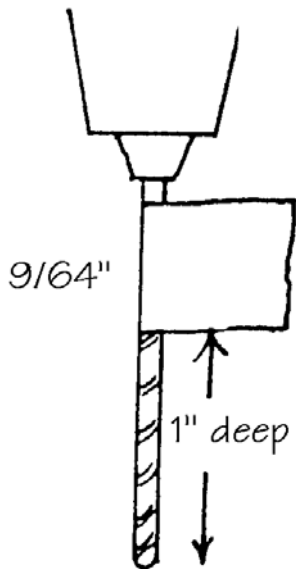
13. Now you can drill the holes for the tuning pins and hitch pins. A drill press would be helpful on this step, but not absolutely necessary. You can achieve good results with a hand electric drill. Just try your best to hold the drill straight (vertical) as you work. Wrap a piece of masking tape around the drill bit to mark the correct depth.

POINT OF INTEREST

Some people ask about using different HITCH PINS than the round-head screws provided with this kit. You can make that exchange if you wish, but here are the reasons we like the screws:

- a) You can drill straight (vertical) holes for the screws -- no need for tilting your drill;
- b) Some people find stringing to be particularly frustrating. When handling the continuous music wire, the head of the screw is very handy for keeping the wire from jumping off the pin as you string the instrument;
- c) If you happen to chip the redwood a little with your drill bit, the head of the screw helps hide your boo-boo.

If you decide you'd rather have straight HITCH PINS, then check the pin diameter before selecting the drill bit, and make sure to tilt your drill about 10-15 degrees away from the center of the instrument so the strings won't slide off the tops of the pins.

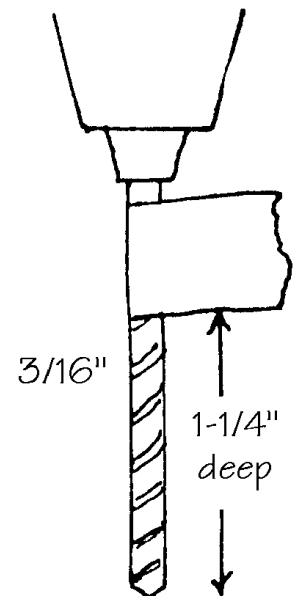


HITCH PIN HOLES:

Drill the 29 hitch pin holes along the left side of the top using a 9/64" drill bit, boring ONE INCH deep.

TUNING PIN HOLES:

Drill the 58 tuning pin holes along the right side of the top using a new 3/16" drill bit provided in this kit, boring ONE AND A QUARTER INCHES deep. (you do not want the tuning pin to reach the bottom of the hole).



IF YOU PURCHASED OUR PARTIALLY ASSEMBLED KIT

Breathe a sigh of relief for the work you've avoided, and check over the hardware parts of your kit now, to make sure everything is included. 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 to purchase a few optional decorations or accessories to enhance the finished instrument. Now is a good time to order so you can avoid delays when you reach those steps of construction.

Hardware

2 black delrin rods (21" each)	1 tuning wrench
2 brass tubes, 3/8" dia (21" each)	1 pair playing hammers
58 tuning pins	assembly instructions & tuning chart
29 round head wood screws (hitch pins)	
Music wire: 50 ft of .018" dia, 50 ft of .020" dia, 100 ft of .022"	

PRELIMINARY CAUTION

BE VERY CAREFUL WHEN HANDLING THE REDWOOD TOP (SOUNDBOARD) ON THIS KIT. IT IS VERY SOFT AND SUSCEPTIBLE TO DENTS AND SCRATCHES. WE RECOMMEND PLACING A TOWEL OR CARPET SCRAP ON YOUR WORK TABLE FOR PADDING. THEN YOU WON'T NEED TO WORRY WHEN YOU TURN THE BOX UPSIDE DOWN OR SLIDE IT AROUND ON ITS TOP.

OPTIONAL DECORATING

We offer several designs of decorative laser-cut rosettes that can be glued directly over the soundholes on your instrument for that added touch of class. Check our MUSICMAKER'S CATALOG for designs and sizes. It will be easiest to glue these in place before finishing, using standard woodworking glue. If you try to attach them later, you'll need to use an adhesive such as epoxy or superglue that will stick to a finished surface.

SANDING & FINISHING

___ 1. Sand the entire box to smooth out the surfaces and round over the edges so they feel good to your hand. Use a medium (150 grit) sandpaper, working with the grain so you don't scratch the surface.

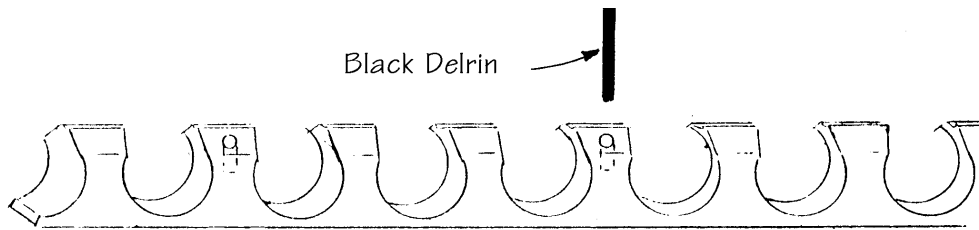
Carefully check all the joints and glue seams to remove any glue residue that might remain visible, as that will show up as ugly smudges under the finish.

___ 2. Sand the maple BRIDGES to remove any burrs or rough spots.

POINT OF INTEREST

The bridges in this kit have been cut by laser beam. This gives us perfect accuracy every time and it avoids the problems of splitting that often occur when using a drill bit on such thin material. The dark area inside each hole is actually charred wood from the laser beam. We like to leave it dark without sanding that area -- it looks very sharp on the finished instrument.

3. Notice that the BRIDGES have a few tiny holes drilled along the tops. These



are for marking dots to help guide you in your playing. You need to fill these holes with black DELRIN (from the excess length

provided in the kit). Push one end of a DELRIN rod into a hole and clip it off as close to the wood as you can with a wire cutter.

Repeat this procedure for each hole, but be careful not to use too much DELRIN from one rod. You must leave the rods long enough to span the entire length of the maple BRIDGES.

Sand these marking dots flush with the surface of the bridges.

4. If the BRASS TUBES are tarnished, use steel wool or a scouring pad to clean and brighten them up.

APPLYING THE FINISH

5. When satisfied with your sanding, apply the finish of your choice. Here are a few suggestions:

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. We like ANILINE DYES for darkening the wood without obscuring the grain. Our 3-color powdered dyes (code *FINI-40*) can be mixed with denatured alcohol to the desired shade. The advantage of these dyes are quick drying time, deep colors, even penetration, and the opportunity to create a "sunburst" shading effect.

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 disadvantages of oil are 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.

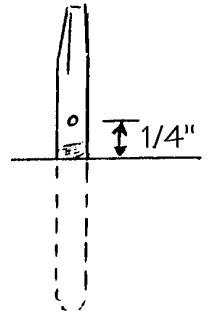
VARNISH -- Any regular varnish will work fine on this project, but we recommend our wipe-on polyurethane called MUSICMAKER'S INSTRUMENT FINISH. Our complete finishing kit (code *FINI-20*) includes detailed instructions, sandpaper sheets, tack cloth, foam applicator, and lint-free wiping cloth, along with a 1/2 pint can of semi-gloss polyurethane varnish. The advantages of finish are its simple application, durability, and deep, soft luster. It also works well for protecting Heat Transfer decorations.

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. CAUTION: Lacquer finish will not work over Heat Transfer decorations -- it dissolves the toner.

___ 6. Don't forget to apply finish to the maple BRIDGES and the playing HAMMERS too! We also like to spray one coat of Deft on the BRASS TUBES to keep them shiny.

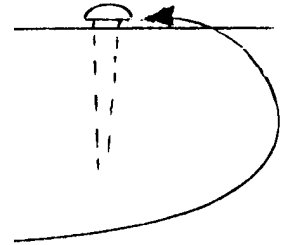
INSTALLING THE HARDWARE & STRINGS

___ 7. Once the finish is dry, you can install the hardware. The 58 holes along the right side of the box are for the TUNING PINS. Insert these pins right-side up (THREADED END FIRST) into the holes using a hammer to tap them until they are about half-way in (the small hole should be about 1/4" above the wood).



HINT: YOU MAY WISH TO PLACE A SCRAP OF WOOD ON THE SURFACE OF YOUR DULCIMER NEAR WHERE YOU ARE POUNDING, SO THAT YOU DON'T ACCIDENTALLY MAR THE REDWOOD TOP BY AIMING INCORRECTLY WITH THE HAMMER -- OUCH!

___ 8. The 29 holes along the left side are for the HITCH PINS (round-head wood screws). You can use a hammer to pound these part way in also, but change to a screwdriver to make final adjustments on the height, so the screw heads are just slightly above the wood surface.

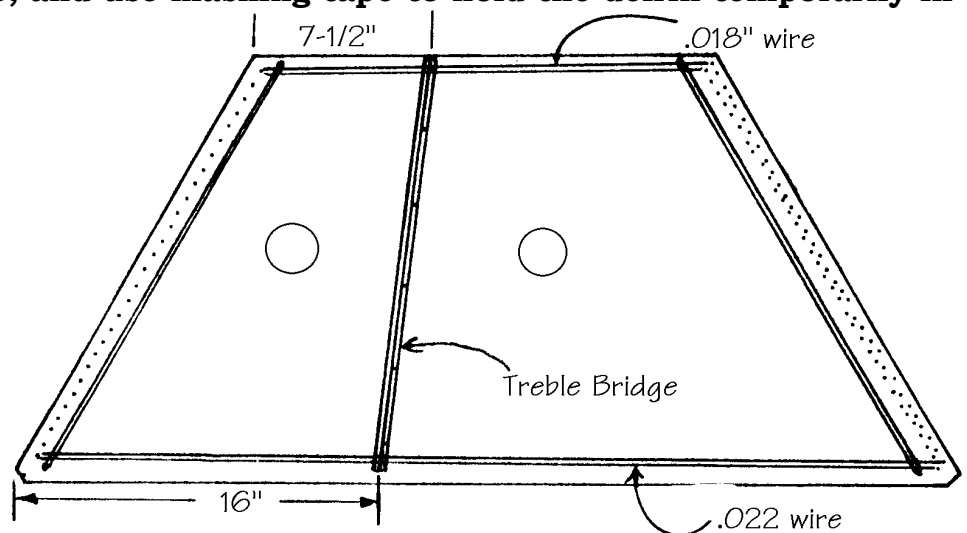


Now you are ready for stringing! You may want to ask a friend to help you with this part of the project, as it often seems to require more than two hands. You also will need the tuning wrench (supplied in the kit), some masking tape, and a wire cutter for these next few steps.

___ 9. Center both brass tubes in the grooves along either side of the instrument, holding them in place with a little tape until you have a few strings installed.

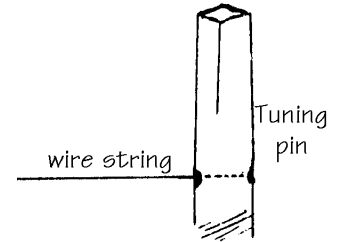
___ 10. Cut the black DELRIN rods just a little longer than necessary to fit the length of the maple BRIDGES, and use masking tape to hold the delrin temporarily in the groove along the top of each bridge. We like to have the DELRIN extend about 1/4" beyond each end of the BRIDGES.

___ 11. Stand the TREBLE BRIDGE (the longer one) on the instrument so that the upper end is about 7-1/2" from the rear left corner of the box, and the lower end is about 16" from the front left corner, as shown. Hold it in place temporarily with a little masking tape.

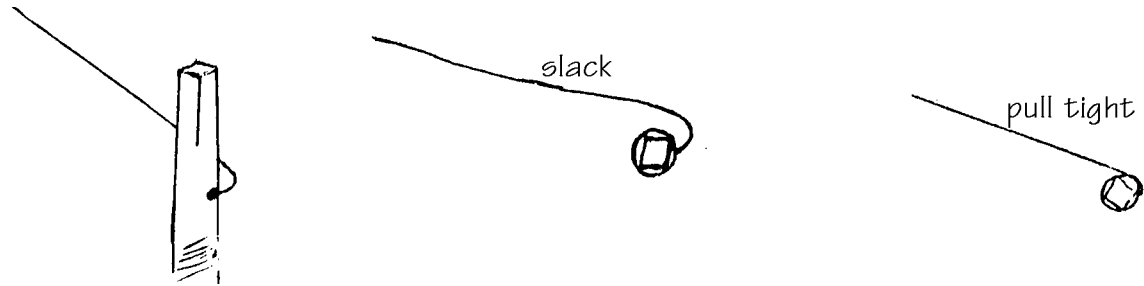


12. Locate the coil of wire marked .022" and pull out about 8 feet from one end. This will be used for the longest course (pair) of strings at the front of the instrument. Here is how to install it:

a) Poke the end of the wire into, but not all the way through, the small hole in the lowest tuning pin at the lower right corner of the dulcimer.



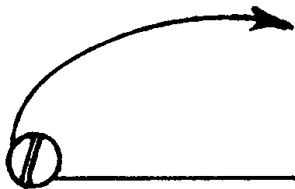
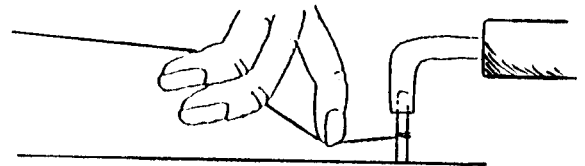
b) Use the tuning wrench to turn the pin **CLOCKWISE** about one-half turn before putting tension on the wire.



c) Pull on the wire to "set" it in the pin. This puts a kink in the wire at the point where it enters the tiny hole in the tuning pin. If the wire pulls out of the pin when you pull on it, cut off the kinked end and try again.

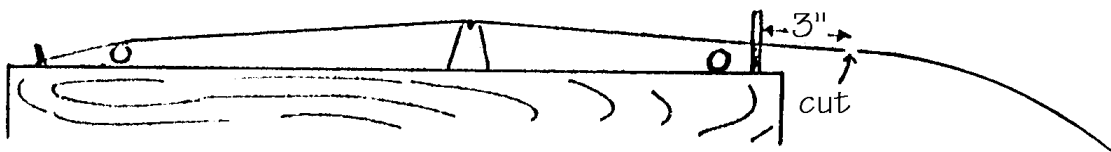
NOTE: This may seem like a silly exercise, especially if the wire keeps coming out of its place when you pull. We install strings this way because the sharp ends are left hidden in the tuning pins where they can't poke fingers or catch on clothing. It really does work.

d) Keeping tension on the wire at all times turn the pin about two complete revolutions with the tuning wrench, guiding the wire **DOWNWARD** as it winds around the pin.



e) Maintain tension on the wire as you stretch it across the dulcimer (over the treble bridge) to the lower left corner and wind it clockwise around the lowest wood screw (just a single loop around the pin is sufficient-- no need to do a complete 360 degree circle).

f) Pull the wire back across (over the treble bridge) to the right corner again and cut it off from the coil so that you have a bout 2 or 3 inches excess wire to wind onto the second tuning pin.



g) Poke that end of the wire into (but not all the way through) the second tuning pin and turn the pin about one-half turn clockwise before "setting" the wire as you did with the first end.

h) Continue turning the pin clockwise to wind the excess wire DOWNWARD toward the wood until all the slack is taken up. **IT IS IMPORTANT TO HAVE THESE STRINGS MAKE FIRM CONTACT WITH THE BRASS TUBES ON BOTH SIDES OF THE BOX.**

VOILA ! You have just installed your first course (pair) of strings. If you are not completely frazzled by now, you'll succeed just fine with the rest of the project.

___ 13. To hold the upper end of the treble bridge firmly in place, we recommend attaching the highest course (pair) of strings at the rear of the instrument. **FIND THE COIL OF WIRE MARKED .018" FOR THIS COURSE.** Attach this wire in the same way as you installed the first pair, following steps "a" through "h", and using the last pair of tuning pins on the right and the last hitch pin on the left.

___ 14. Now you should be able to remove the masking tape that was holding the parts in place.

IMPORTANT NOTE: The rest of the strings that cross the treble bridge will be attached to **EVERY OTHER PAIR OF TUNING PINS** and **EVERY OTHER HITCH PIN**. The pins that are left between these treble courses will be used for the strings that cross the bass bridge. We will get to those later.

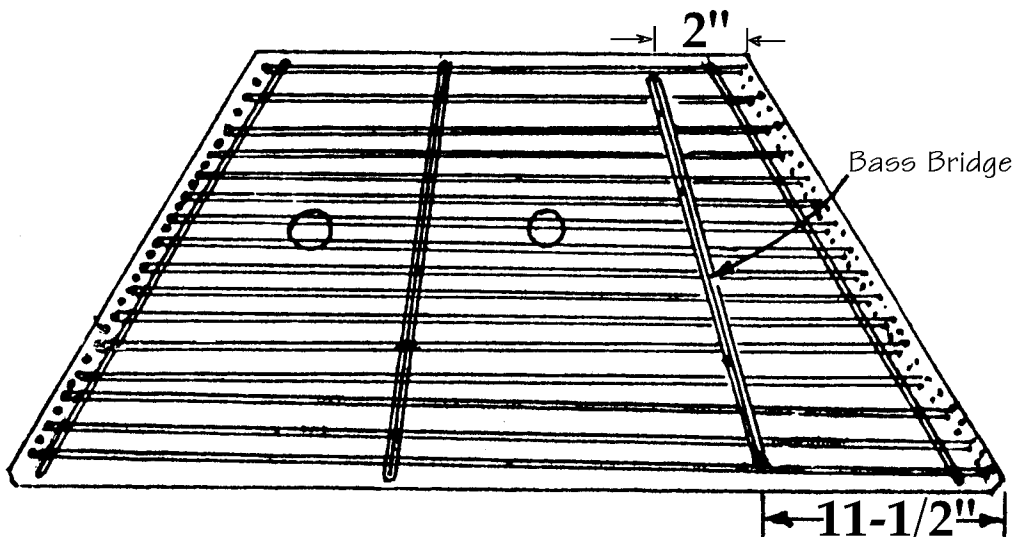
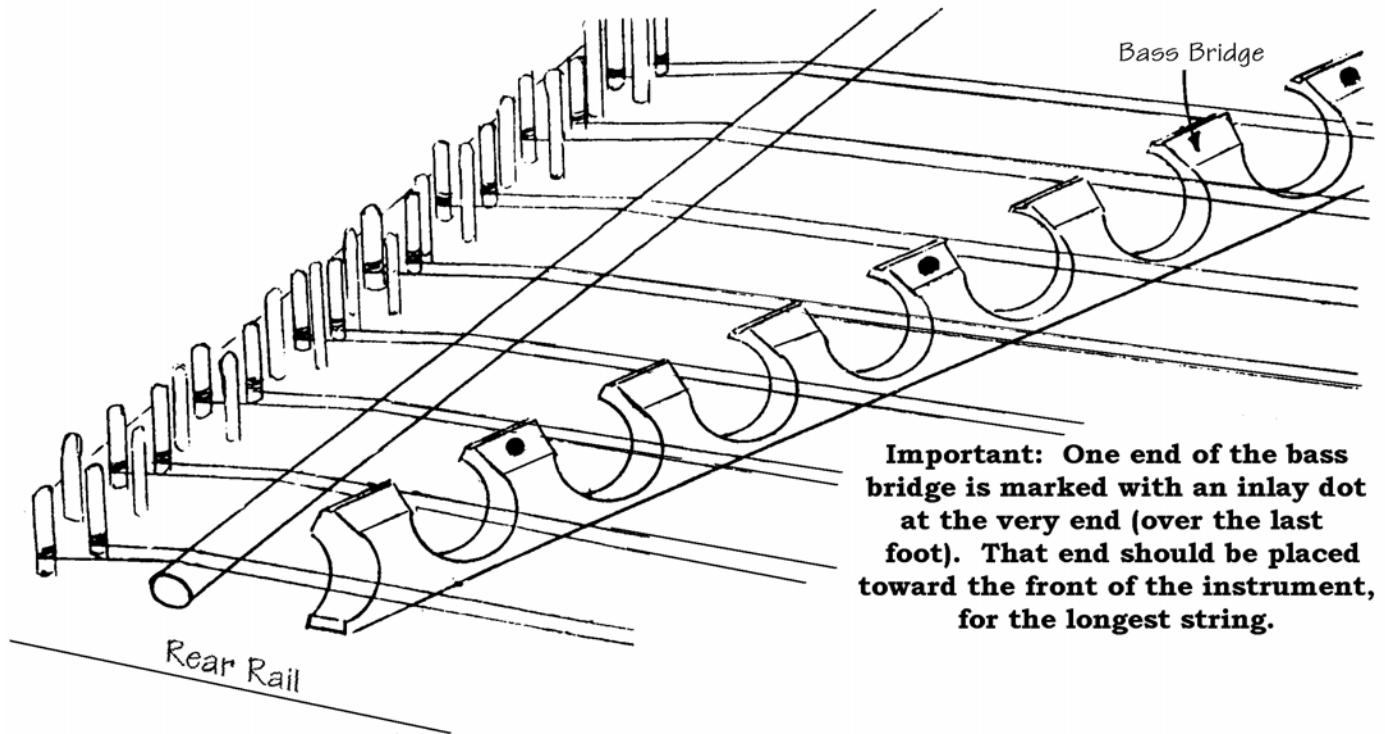
The size of the wire gets smaller as you progress toward the rear of the instrument, and the notes become higher in pitch. Here is the preferred arrangement of wire sizes for the treble bridge:

STRING SIZE CHART	
TREBLE BRIDGE	
.022" wire	-- FRONT 7 COURSES
.020" wire	-- MIDDLE 4 COURSES
.018" wire	-- REAR 4 COURSES
THIS MAKES A TOTAL OF 15 COURSES OF WIRE ON THE TREBLE BRIDGE, ONE OVER EACH "FOOT".	

___ 15. Continue stringing the wires across the treble bridge, bringing them up to a reasonable tension, but not trying to actually tune them yet. Be sure to change sizes of wire according to the chart above, and be sure to skip every other hitch pin on the left and every other pair of tuning pins on the right.

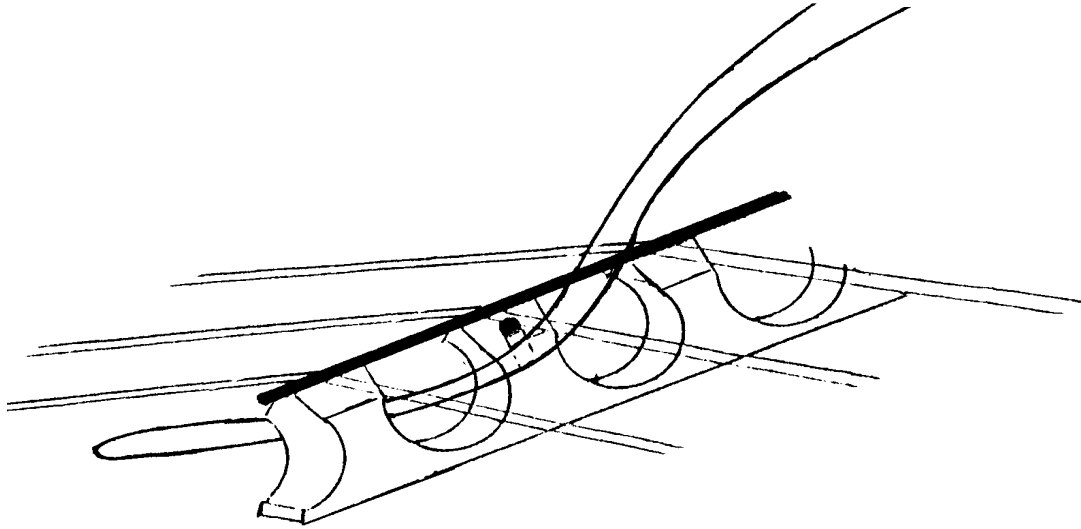
YOU'RE DOING A GREAT JOB -- TAKE A BREAK BEFORE STARTING ON THE BASS BRIDGE -- You'll want to be well rested before the next challenge....

___16. When all 15 courses are in place on the treble bridge, you can begin stringing the bass bridge. Stand the bass bridge toward the right side of the instrument as shown in the drawing. The "feet" should all fit between the wires that pass over the treble bridge



You will discover that the BASS BRIDGE can be shifted around somewhat to fit the spacing of the treble strings. Unlike the TREBLE BRIDGE, it doesn't matter if you angle it a little differently than shown, because you will only play the strings on one side of this bridge.

___17. The longest course (near the front of the instrument) will be .022" wire. You will attach it to the dulcimer in virtually the same manner as you did the treble strings, **WITH ONE IMPORTANT EXCEPTION: the bass strings must go OVER THE BASS BRIDGE, and UNDER THE TREBLE BRIDGE!** Just an interesting twist to complicate matters a little for you....



HINT: We find the easiest way to put the string under the TREBLE BRIDGE is to put a bend in the wire about 3 feet from the end, then push that bend under the treble bridge and hook it around the hitch pin. Then the two ends can be cut to proper length and attached to the tuning pins.

___18. String all 14 bass courses in the same manner you did the treble ones (you're an expert by now, right?), changing wire sizes according to this chart:

STRING SIZE CHART	
BASS BRIDGE	
.022" wire	-- FRONT 6 COURSES
.020" wire	-- MIDDLE 4 COURSES
.018" wire	-- REAR 4 COURSES

THIS MAKES A TOTAL OF 14 COURSES OF WIRE ON THE BASS BRIDGE, ONE OVER EACH "FOOT".

HURRAH!! THE STRINGS ARE ALL IN PLACE. Hope you haven't been keeping track of all the time invested just in stringing....

TUNING

____ 19. Before you can successfully tune this instrument, you must make sure the **TREBLE BRIDGE** is in just the right position. It must divide the vibrating portion of its strings into a perfect ratio of 2:3 in order to play a proper scale, because you will play some notes on the right side and some on the left, and the length of the strings helps determine their pitch.

You can slide the **TREBLE BRIDGE** sideways one way or the other to achieve this proper placement. You may make careful measurements and calculations to verify its location, or you may verify it "by ear", which is perhaps the better approach, since your ear is what will complain if the thing is out of tune!

Here's how to go about it:

a) Pluck the lowest string (at the front of the instrument), on the right side of the **TREBLE BRIDGE**. If the string is so loose that it just "twangs", then tighten it up until you get a clear sound.

b) Pluck **THAT SAME STRING** on the left side of the bridge to see if that note is a musical fifth interval above the first note. "So, what is a musical fifth interval?" you ask.

The **FIFTH INTERVAL** is the span between "do" and "sol" on the scale. So if you pluck the string on the right side of the bridge and consider that note as "do", then you can sing "do, re, mi, fa, sol" and check to see if the note on the left side of the bridge (same string) matches the note "sol". Or, a quicker way to sing the fifth interval is to hum the song "Twinkle, Twinkle, Little Star". The span between the first "Twinkle" and the second "Twinkle" is a fifth interval. Of course, if you can't sing in tune, then you'll find this a worthwhile exercise! Go back to measuring the 2:3 ratio of vibrating lengths, or find a musical friend....

c) Now, if the note on the left of the bridge is **HIGHER** than it should be (more than a fifth interval above the right side), then you must **LENGTHEN** the amount of wire on that left side of the bridge to lower the pitch. Do that by sliding the bridge to the right, just a little. Then test the interval again.

d) If the note on the left side of the bridge is **LOWER** than it should be (less than a fifth interval above the right side), then you must **SHORTEN** the length of wire vibrating on the left side of the bridge to raise the pitch. Do that by sliding the bridge to the left, just a little. Then test the interval again.

e) Once you are satisfied with the interval on the longest string at the front of the dulcimer, test it also on the shortest string toward the rear of the dulcimer. Use the same technique for adjusting until you hear a perfect fifth.

f) Now that the front and rear of the **TREBLE BRIDGE** are correctly placed, you need only make sure that the rest of the bridge is lined up in a straight line between the ends. That should ensure that all the strings will give a fifth interval from the right side to the left.

NOTE: If, after completing this exercise, you happen to find a string that does not sound a fifth interval across the TREBLE BRIDGE, then something else is amiss. Chances are, the string is not making firm contact with the BRASS TUBE along the right-hand side. To correct this problem, you must unwind the string part way and then re-wind it so that the windings go DOWNWARD toward the wood, making firm contact with the brass tube. (This is only important for strings that cross the TREBLE BRIDGE. No need to worry about those that cross the BASS BRIDGE.)

WHEW! NOW YOU CAN ACTUALLY BEGIN TUNING....

___ 20. Start with just the BASS BRIDGE strings first, beginning at the lowest strings near the front of the dulcimer. You may want to cut out the TUNING CHART provided in the kit and slide it under the strings for ease in determining what note to tune the strings to.

ALL PAIRS ARE TO BE TUNED IN UNISON

The lowest pair of strings that crosses the bass bridge will be tuned to the D below middle C (the middle line on the bass clef). The next pair that crosses the bass bridge will be tuned to E below middle C and the next to F# below middle C, etc., as shown on the TUNING CHART.

Be careful to check that you are turning the proper pin for the string you wish to tune. Then pluck the string and turn the pin while string is still vibrating so you can hear the pitch change and you can stop turning when you reach the proper tone.

Tune all the strings that cross the BASS BRIDGE according to the TUNING CHART (note that you must skip every other pair of pins on your way toward the rear of the instrument).

___ 21. Because the TREBLE BRIDGE is placed to give you a fifth interval from the right side to the left, you need only tune one side of that bridge -- the other side will automatically come into correct pitch. (That's the first break you've had in this project, eh?)

So, go ahead and tune the longest pair of wires at the front of the instrument to a G# below middle C on the right side of the TREBLE BRIDGE. Tune the next pair to A below middle C and the next to B below middle C, etc., as indicated on the TUNING CHART.

___ 22. Now, don't expect the instrument to be playable yet.... By the time you finish tuning the highest string on the TREBLE BRIDGE, the bass strings will have already gone out of tune. Don't give up! This won't happen every time. Two things are occurring that contribute to the problem on a new instrument:

- 1) the wire is actually stretching a little, and**
- 2) the box is flexing slightly under the tension of all those strings.**

We usually tune a new instrument twice and then give it a little time to adjust (say, overnight) before tuning again. It should hold pretty well after the third tuning.

CONGRATULATIONS! YOU REALLY DID IT. WE HOPE YOU ENJOY LEARNING TO PLAY YOUR HAMMERED DULCIMER. WITH PROPER CARE, IT SHOULD GIVE YOU MANY YEARS OF MUSICAL PLEASURE.

Care And Feeding Of A Hammered Dulcimer

STRINGS: You should not need to replace the strings of your instrument unless they break or become rusty. To prevent rusting, simply wipe the strings occasionally with a rag dipped in household oil.

TUNING PINS: Occasionally we hear from someone whose TUNING PINS have rusted. This can happen if exposed to excessive moisture or ocean breezes. If you live in a humid climate or near the ocean, treat the tuning pins to an occasional oil bath too.

WOOD SURFACES: The main challenge will be to clean the dust from under the strings. Not that a little dust hurts anything, but when you finally decide to tackle the situation, you'll need to push a rag through the narrow spaces with a small dowel or thin stick. You may wish to treat the rag with a dust-gathering solvent or a furniture polish -- that's fine. We often use Endust, Aulwood, Old English, or plain old Johnson's Lemon Wax. They all work well. For the tiny spaces that can't be reached with a rag, we use a paint brush coated with some Endust.

MUSICMAKER'S KITS, INC.

(Hwy 36 behind Joseph's restaurant)

P.O. BOX 2117

STILLWATER, MN 55082-3117

(651) 439-9120

email: info@musikit.com

ACCESSORIES FOR THE HAMMERED DULCIMER

We carry a number of items to help you enjoy playing this unusual instrument. Here is a brief list of accessories:



HAMM-02	Pair double-side hammers	\$24.95
CASE-12	Gig bag for Performance Dulcimer	99.95
TUNER-1	Chromatina electronic Tuner	99.95
TUNER-2	Korg CA-20 electronic tuner	32.00
CORD-02	External Pickup & Cord for Tuner	19.95

STAND-3	Scissor Stand kit, 25"	69.95
STAND-4	Finished Scissor Stand, 25"	99.95
STAND-7	Scissor Stand kit, 37"	79.95
STAND-8	Finished Scissor Stand, 37"	109.95



STAND-5	Adjustable Hammered Dulcimer Stand kit	\$129.95
STAND-6	Finished Adjustable Stand	275.00

PODI-10	Podium music stand kit (cherry)	129.95
PODI-12	Finished Cherry Podium	250.00
PODI-15	Podium music stand kit (walnut)	129.95
PODI-17	Finished Walnut Podium	250.00



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PO BOX 2117
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(651) 439-9120
 email: info@musikit.com

-Please see current catalog for latest prices-