

Hurdy Gurdy

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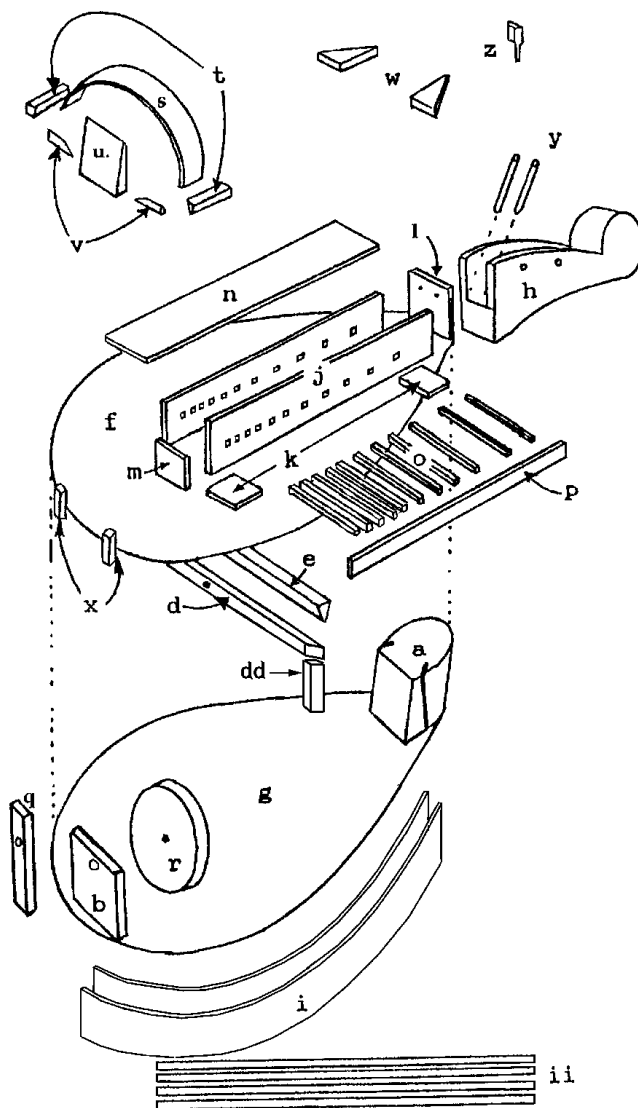


HURDY GURDY KIT

1 set of assembly instructions

WOOD PARTS:

- a 1 heel (walnut)
- b 1 tail block
- d 1 predrilled inner brace
- dd 2 support blocks for drilled brace
- e 1 triangle inner brace
- f 1 soundboard (solid mahogany)
- g 1 back (cherry/walnut laminate)
- h 1 peg head
- i 2 pre-bent sides
- ii 4 lining strips (soft wood)
- j 2 keychest sides (walnut)
- k 2 keychest base pieces (walnut)
- l keychest head end (walnut)
- m 1 keychest wheel end (walnut)
- n 1 keychest lid (walnut)
- o 12 keys (walnut)
- p 1 button stock (walnut)
- q 1 tailpiece (walnut)
- r 1 wheel (walnut)
- s 1 wheel cover (curved walnut)
- t 2 wheel cover blocks (walnut)
- u 1 melody bridge (walnut)
- v 2 drone bridges (walnut)
- w 2 drone nuts (walnut)
- x 2 drone anchor blocks (walnut)
- y 2 dowels, 1/4" dia, 2" long
- z 24 key tangents



HARDWARE:

1 axle 5/16" X 7"	2 Nylon covers for drone gear posts
1 T-nut, 5/16" (in wheel)	1 set strings
1 brass cap nut, 5/16"	2 melody, Viola D
1 washer	1 drone, Cello G
2 steel hex nuts	1 drone, Cello C
1 wood screws, 1-5/8" drywall	2 hinges with screws
1 brass crank, 1/8 x 4 x 1-1/4"	1 cake of rosin
1 crank knob & screw	1 ball of cotton
1 nylon axle bushing, 4" long	1 strip of thin felt, 1/2" X 12"
4 black tuners/w screws, sleeves, washers	2 small rosettes for peg head

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 make those plans so you can avoid delays later when you reach those steps of construction.

A NOTE ABOUT GLUE

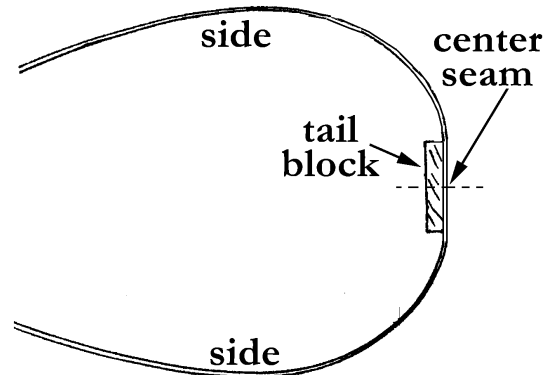
DO NOT ASSEMBLE THIS PROJECT WITH EPOXY OR SUPERGLUE OR HOT MELT GLUE! Find a good woodworking glue. Many luthiers (guitar & violin makers) still use the natural hide glues that have been around for centuries, carrying on a fine old tradition, but that does not mean that you must do the same. We build 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:

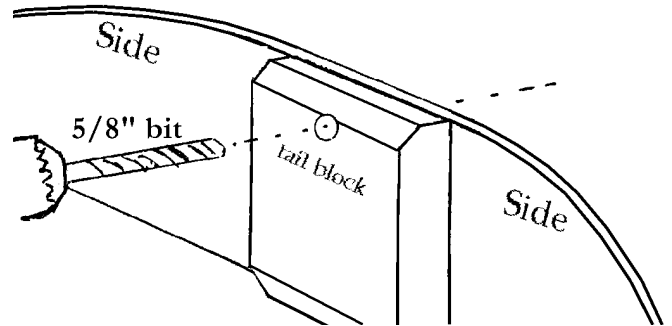
____1. The soundchamber **SIDES** are pre-bent and must be joined at the tail end. Check the fit of each **SIDE** into the **HEEL BLOCK**, sanding the ends as necessary to make them slip into the slots easily.

____2. Tape the tail end of the **SIDES** together, on the outside, and glue the **TAIL BLOCK** to the inside, centering it on the seam. Line up the edges carefully. The hole in the tail block should be centered on the seam. Use clamps to hold the parts together until dry.

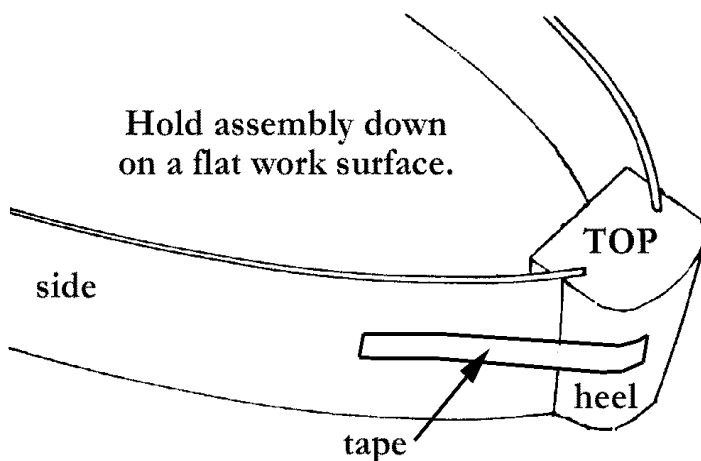


CAUTION: Double check to see that the **TAIL BLOCK** does not "drift" out of position under the clamps. You want good alignment of this piece in order to glue the **SOUNDBOARD** and **BACK** successfully.

____3. Use a 5/8" drill bit to open the hole in the **TAIL BLOCK** all the way through the **SIDE**. Take care to keep this hole clean and straight.



NOTE: If you do not have a good 5/8" drill bit, use a smaller bit and then use a rat-tail file to carefully enlarge to the same size as the hole in the **TAIL BLOCK**.



____4. **IMPORTANT:** There is a top and a bottom to these parts. The top of the **TAIL BLOCK** is nearest the hole for the axle, and the top of the **HEEL BLOCK** has the narrow slots nearest the square corners. You'd be smart to mark the top of the **HEEL** and **TAIL BLOCKS**.

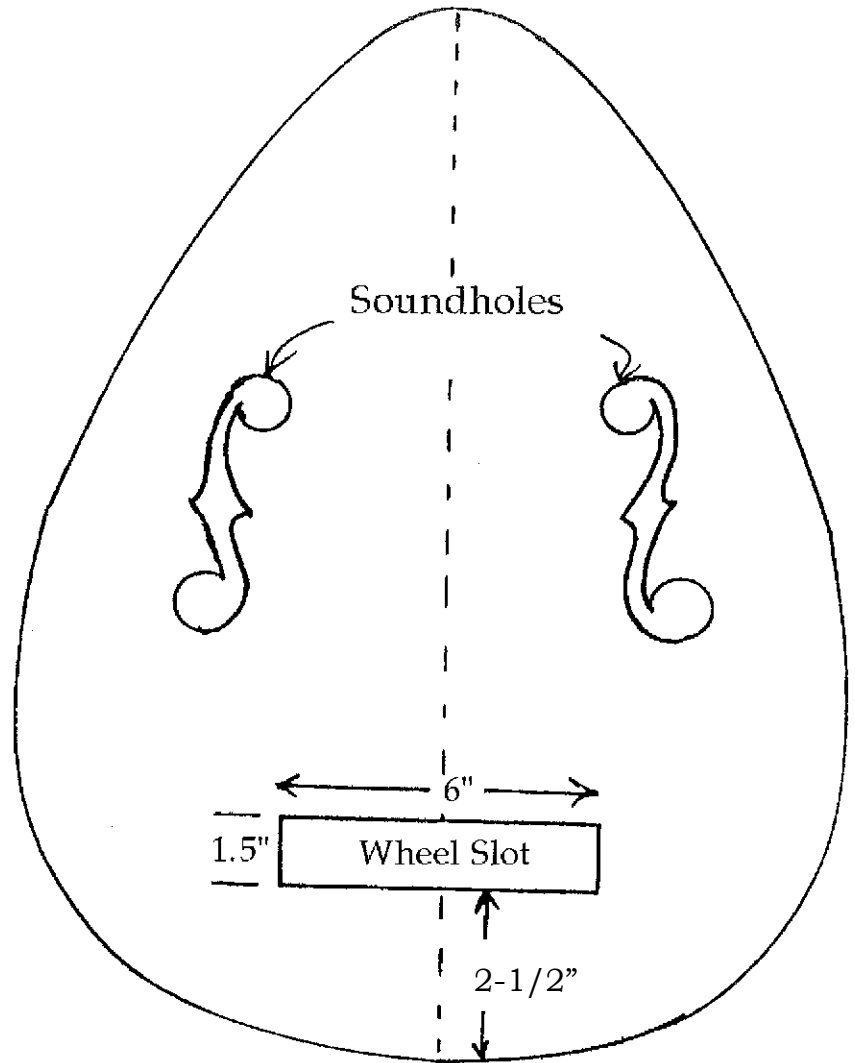
____5. Test-fit the **SIDES** into the **HEEL BLOCK** without glue first. If they don't slide into the slots easily, just sand the inside surfaces of the **SIDES** near each end, as necessary to achieve an easy fit.

____6. When satisfied with the fit, glue the **SIDES** into the slots, as shown, on a very flat table top (or floor).

Use masking tape to hold the **SIDES** in the slots until the glue dries.

THE SOUNDBOARD

____ 7. Find the **SOUNDBOARD**. We have already cut out the wheel slot and two “f” shaped “soundholes” on one face. Draw a center line down this face (if it isn’t there already), centering it on the “f” holes and the wheel slot.



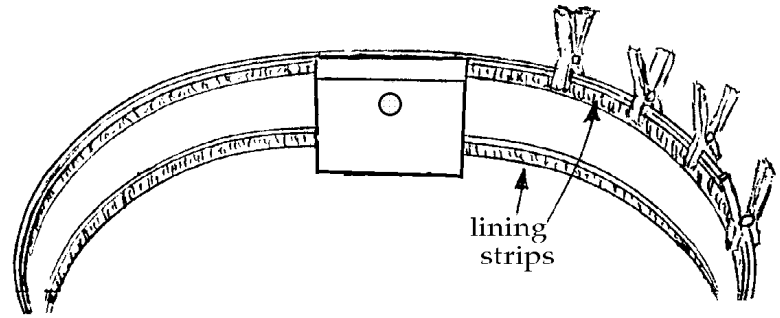
POINT OF INTEREST

The “soundholes” are a bit of a mis-nomer, as they do not contribute to the volume or tone of the instrument. There is enough opening around the WHEEL to take care of that.

____ 8. Sand the edges of these holes in the **SOUNDBOARD** now. It will be harder to do that later on.

_____ **9.** Before proceeding further, you should check the symmetry of the **SIDES** of the instrument. To do this, trace around its shape on a large piece of paper, and then flip the frame over and compare the shape to your outline. Use strong tape pulled across the instrument to change the curves until you are satisfied with the symmetry. No need for perfection here, but you don't want the instrument to be obviously misshapen.

_____ **10.** Leave your bands of tape in place while gluing and clamping the four **LINING STRIPS** inside the **SIDES**, so the edges are flush, as shown. Clothes pins do a nice job of clamping these **LINING STRIPS**.

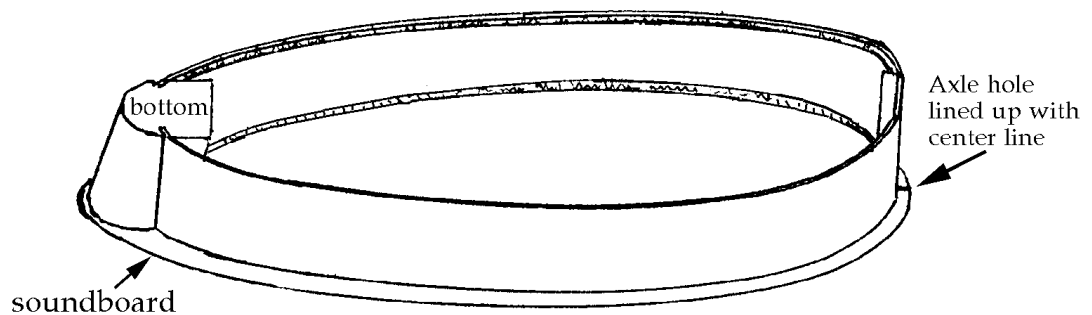


When dry, the instrument should hold its correct shape pretty well. Carefully sand all four edges so they are flat and smooth, ready for gluing the **SOUNDBOARD** and **BACK**.

Check for symmetry again, stretching tape across the backside if necessary, and then proceed with the next step.

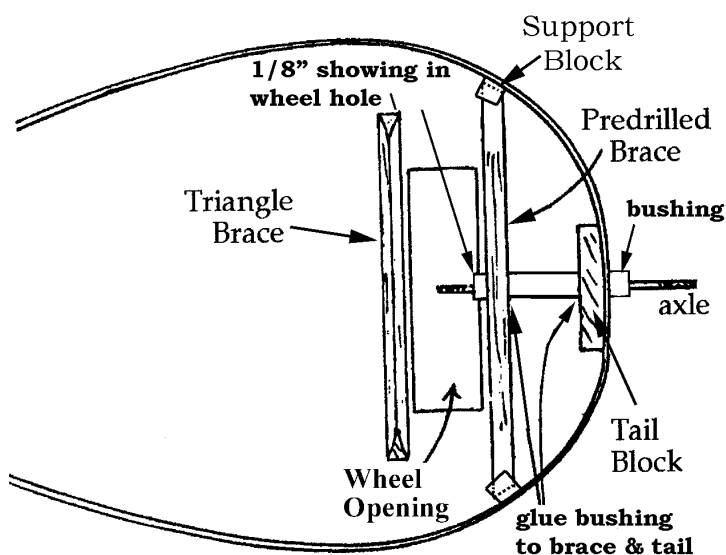
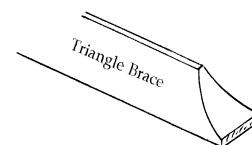
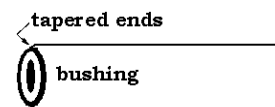
_____ **11.** We cut the **SOUNDBOARD** a bit oversize, just to make sure it will fit, so you need to line it up carefully on the soundchamber. Transfer the center-line to the backside of the **SOUNDBOARD** and align the soundchamber on it so the center-line matches the seam at the **TAIL** and the middle of the **HEEL BLOCK**. When satisfied, glue the assembly to the **SOUNDBOARD**, using weights or clamps to hold the parts firmly together.

Leave roughly equal overhang all around.



____ **13.** Position the **PREDRILLED INNER BRACE** inside the **SOUNDBOARD**, just 1/8" from the edge of the wheel slot, as shown.

Before gluing, taper the ends of the **NYLON BUSHING** and insert it through the **TAIL BLOCK** and into the **INNER BRACE**. Then insert the **AXLE** into the **BUSHING**, making sure that you can turn it easily with your fingers. Glue the **INNER BRACE** to the **SOUNDBOARD**, about 1/8" from the wheel opening, making sure the **AXLE** remains easy to turn. Use weights or clamps to hold the brace until the glue dries.



____ **13a.** Glue the **TRIANGLE INNER BRACE** along the other side of the wheel slot, 1/8" away from the edge of the hole.

____ **14.** This is a good time to secure the **NYLON BUSHING** in place so it doesn't slide or turn when you play the instrument. Leave 1/8" of the **BUSHING** showing in the **WHEEL OPENING**, as shown. The excess length should stick out at the tail end. Put some epoxy glue or Superglue on the **BUSHING** at the inside edges of the **BRACE** and the **TAIL** to secure it in this position, keeping the glue away from the outside of the instrument.

Add the two **SUPPORT BLOCKS** over the ends of the **PREDRILLED BRACE**, gluing them onto the ends of the brace and to the inside of the **SIDES**, as shown. This anchors the **BRACE** securely at the ends and helps reduce unwanted overtones in the melody strings. Clamp them to the sides until dry.

THE BACK

15. Check the fit of the **BACK** to the soundchamber. When satisfied, glue the **BACK** to the soundchamber, spreading glue all the way around the circumference, including the **HEEL** and **TAIL** blocks. Use weights or clamps to hold the parts firmly together until the glue dries.

16. Now is a good time to trim off the excess **SOUNDBOARD** and **BACK** to match the **SIDES**. A router with a flush-cutting bit makes short work of this step, but you can also accomplish it by hand with a rasp or some coarse sandpaper wrapped around a wood block. You may, if you wish, leave a small lip of wood overhanging the sides. In either case, it is important to clean off any excess glue that squeezed out along the joints. Glue blobs, smudges, and drips may be difficult to see now, but they will show up on the finished instrument like spinach in your teeth, so it is best to take care of these things as you go along. We like to clean away excess glue before it gets rock-hard, using a sharp chisel or knife to peel it off the wood.

____ **17. (OPTIONAL)** Another nice option, if you have a router, is to inlay some decorative binding around the circumference of the **SOUNDBOARD** and **BACK**. All you need is a straight bit of any size (good and sharp). Here is how to set it up:

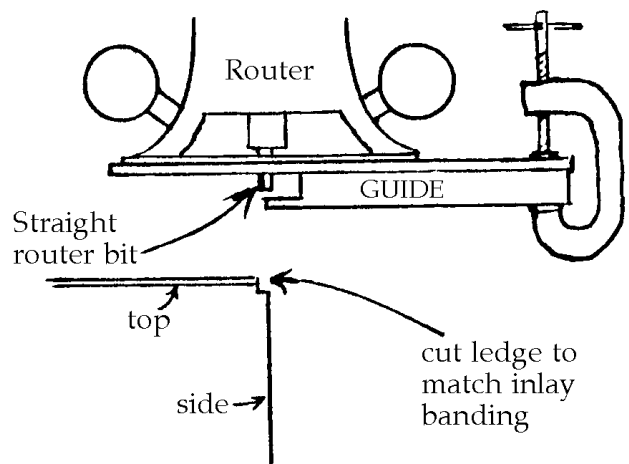
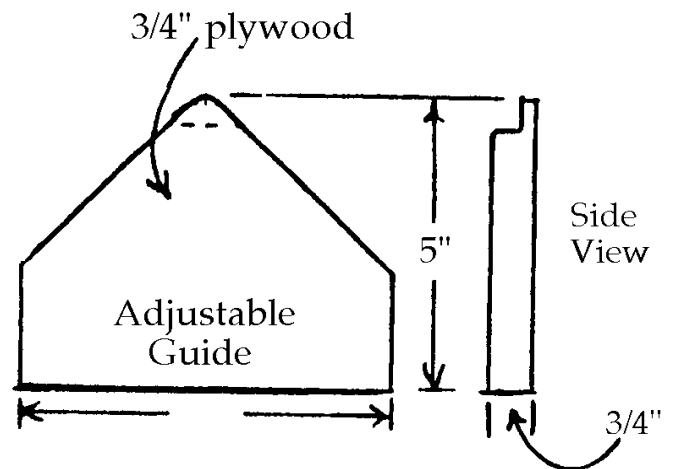
a) Make a guide board to clamp to the base of your router or to the top of the router table. This is simply a triangular shaped scrap of plywood with one point hanging over the router bit, as shown.

b) Adjust the depth of the cut by sliding the guide board over the top of the router bit.

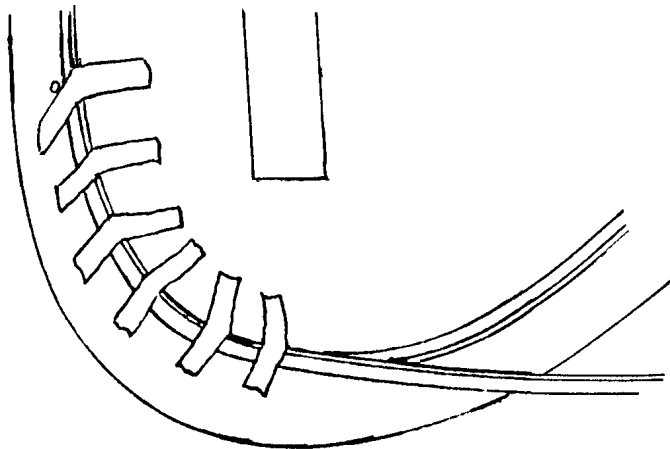
c) Adjust the height of the cut by raising or lowering the router bit.

d) Make a sample cut in a scrap of wood and check your inlay banding to see how it fits.

e) When satisfied with the adjustment of the cut, rout a ledge all the way around the circumference of the soundchamber, stopping where the **SIDES** meet the **HEEL** (it is hard to bend the inlay banding around the sharp curve of the **HEEL BLOCK**).



f) Glue your **INLAY BANDING** into the slot with the appropriate adhesive (carpenter's glue for wood inlay, or airplane cement for plastic binding). Use masking tape to hold the decorative strips in place until dry.



THE KEYCHEST

The **KEYCHEST** consists of two long walnut **SIDES** with square holes cut in them, a walnut **LID**, and four small pieces of walnut that hold the **SIDES** together at the correct spacing:

- a) The **HEAD END** is the larger square piece to be located at the end nearest the **PEGHEAD**;
- b) Two **BASE** pieces are smaller rectangular pieces that lay flat against the **SOUNDBOARD**, forming just a partial bottom to the keychest;
- c) And the **WHEEL END** is identical to the **BASE** pieces, but stands up at the end nearest the **WHEEL**.

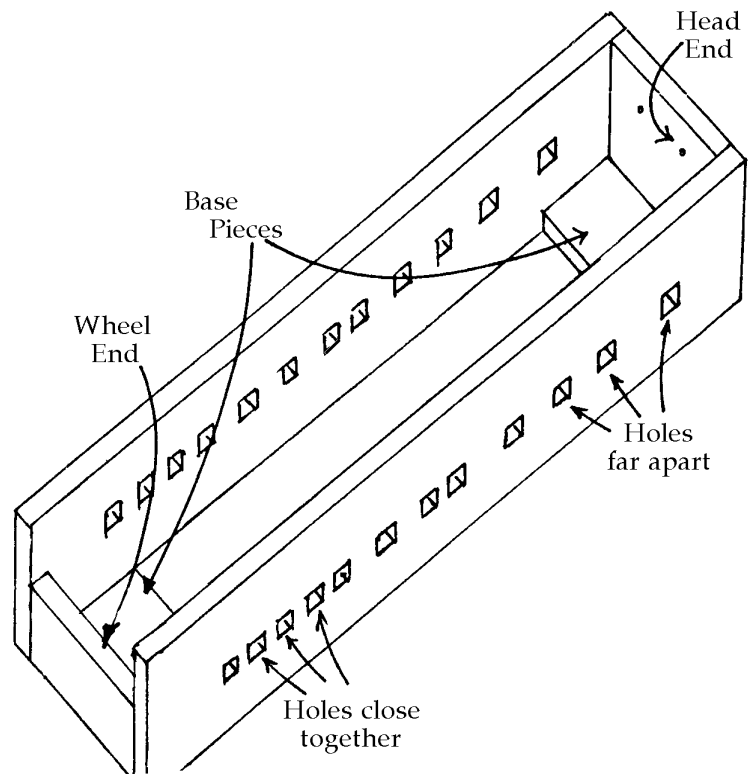
18 *Be very careful* to assemble the keychest correctly. Here are a few details that must be observed in order to have a playable instrument.

A) Make sure that both **SIDES** are mirror images of each other. Notice that the square holes are spaced farther apart near the **HEAD END**.

B) The **ENDS** and **BASE** pieces must all be oriented so they fit properly between the **SIDES**.

C) The keychest parts must be squared and parallel in order for the **KEYS** to slide easily.

When satisfied with the placement of each part, glue the keychest together on a flat surface, using clamps, tape, or large rubber bands to hold the parts firmly until dry.



HINT: When dry, sand and round over the sharp edges of the KEYCHEST so it feels good to the touch. Rounded corners always look better than sharp corners.

___ **19.** Do a little fine sanding on the **SOUNDBOARD** now, too, while it is easy to work on the entire surface. We like to use an electric orbital sander (palm sander) with 180 grit sandpaper for a quick smoothing and cleaning of flat surfaces. Dust carefully afterward.

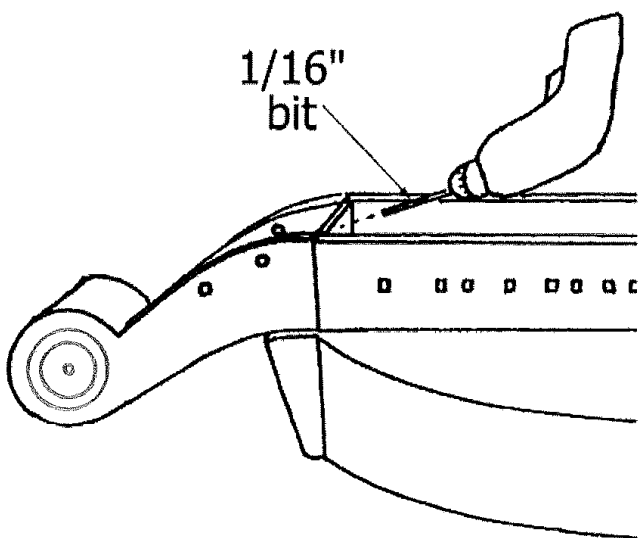
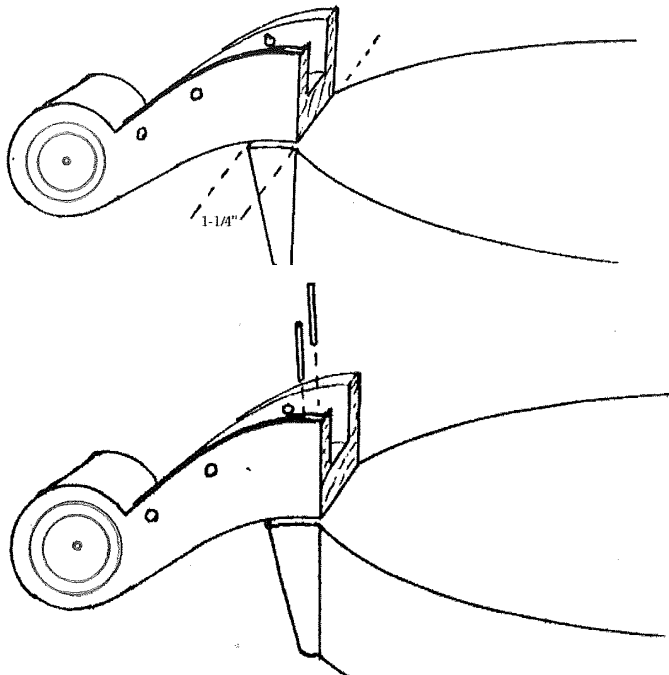
THE PEGHEAD

Draw a light pencil line on the **SOUNDBOARD** 1-1/4" from the narrow end, as shown.

The **PEGHEAD** and **KEYCHEST** will meet at that point. Test how well they fit together in that position.

___ **20.** Sand the **PEGHEAD** to your satisfaction and glue that to the soundboard first, lining it up with the pencil line. Double-check to see that the **KEYCHEST** will also fit properly, but don't glue that down yet. You need easy access to the scroll for the next step.

___ **21.** Reinforce the joint of the **PEGHEAD** to the **SOUNDCHAMBER** by placing two 1/4" dowels through the **PEGHEAD** into the **HEEL BLOCK**, as shown. Use a 17/64" drill bit to bore two holes about 1-1/2" deep. Glue the dowels into the holes and trim off with a sharp chisel flush with the bottom of the **PEGHEAD**.



___ **22.** Two small holes (1/16" bit) must be drilled at an angle through the **TALL END** of the keychest for the melody strings. They should be 1" apart and about 5/8" from the top edge of the **TALL END**, as shown. Use an awl to punch-mark the locations before drilling, so your drill bit does not wander. **Accurate placement of these holes is quite important.**

No, your electric drill cannot fit down into the keychest -- that's fine, because these holes should be drilled at an angle, aiming toward the cavity in the **PEGHEAD**.



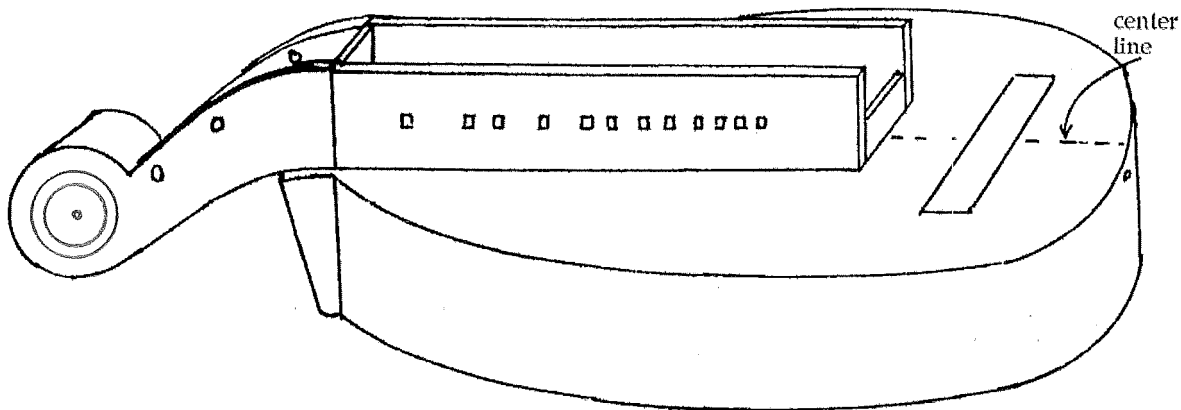
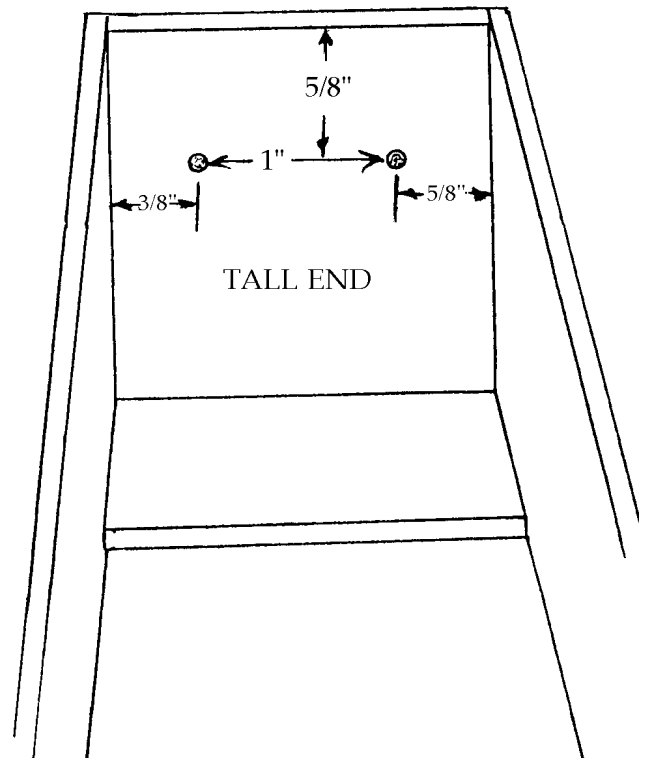
___ **22-b.** Now would be a good time to glue the decorative rosettes into the peghead, though you could wait until after applying the finish, if you want the inside of the hole to be finished. Some people paint the inside of the hole black for contrast. When you glue the rosettes to unfinished wood, you can use Elmer's Wood Glue, but if you wait until the wood is finished, you'll need to use Superglue or epoxy to hold them to the finished surface.

(holes off center on purpose)

____ **22a.** Test-fit the **KEYCHEST** onto the **SOUNDBOARD**, as shown above. Sometimes, if the soundboard is slightly curved downward in the center (concave), it is hard to get the **KEYCHEST** to make contact with the spruce along the length of the **KEYCHEST**. If that happens with your kit, then you'll need to get some clamps through the soundholes to hold the **KEYCHEST** firmly against the **SOUNDBOARD** while gluing (**step #23**).

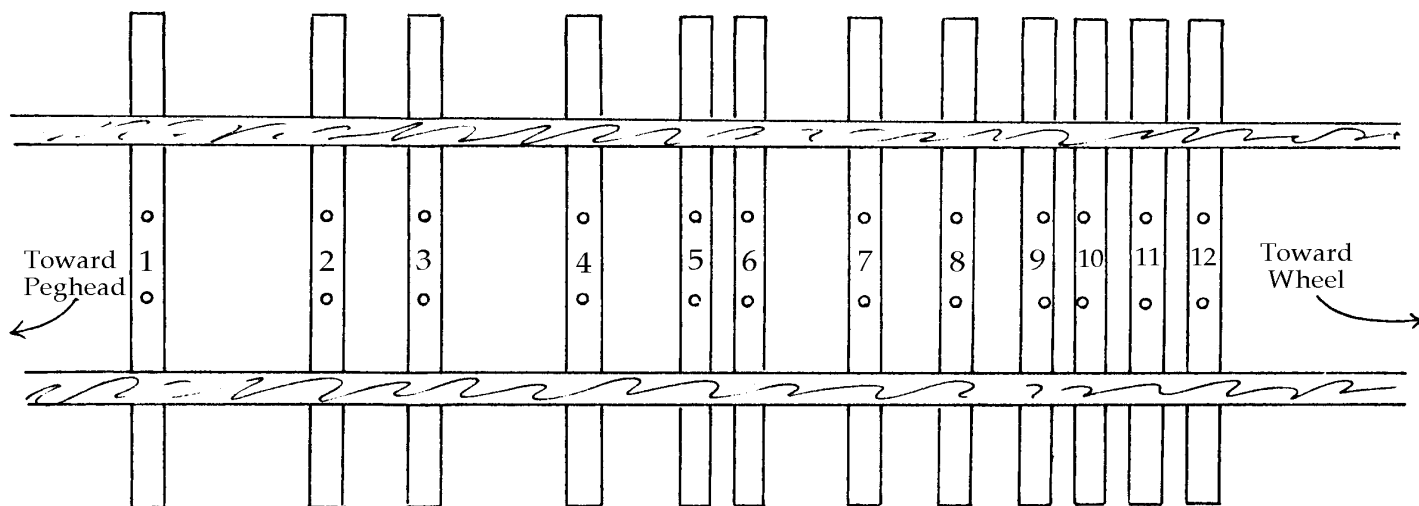
Another option, if your soundholes are not large enough or convenient for clamping, you could cut openings through the **SOUNDBOARD** inside the **KEYCHEST** for your clamps.

____ **23.** Now you can glue the **KEYCHEST** in place. Glue it to the **SOUNDBOARD** and to the **PEGHEAD**, centered on the center-line, using weights and/or clamps to hold firmly.



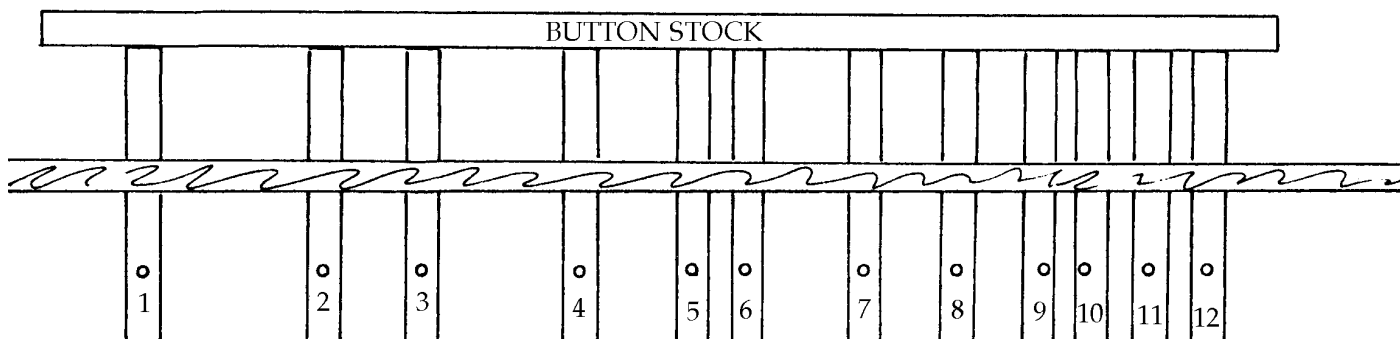
____ **24.** The **12 KEYS** may need a little sanding to get them to slide smoothly in the square holes of the keychest. Fit them with their small holes facing vertically. Check the square holes to make sure they are cut cleanly too. A triangle file or fingernail file may be helpful in removing wood fuzz or glue residue from the corners. The **KEYS** should slide freely enough that they will fall out when the **KEYCHEST** is tipped at a 45 degree angle.

Once the **KEYS** are fitted, we recommend numbering them so you will replace them in the same positions later.



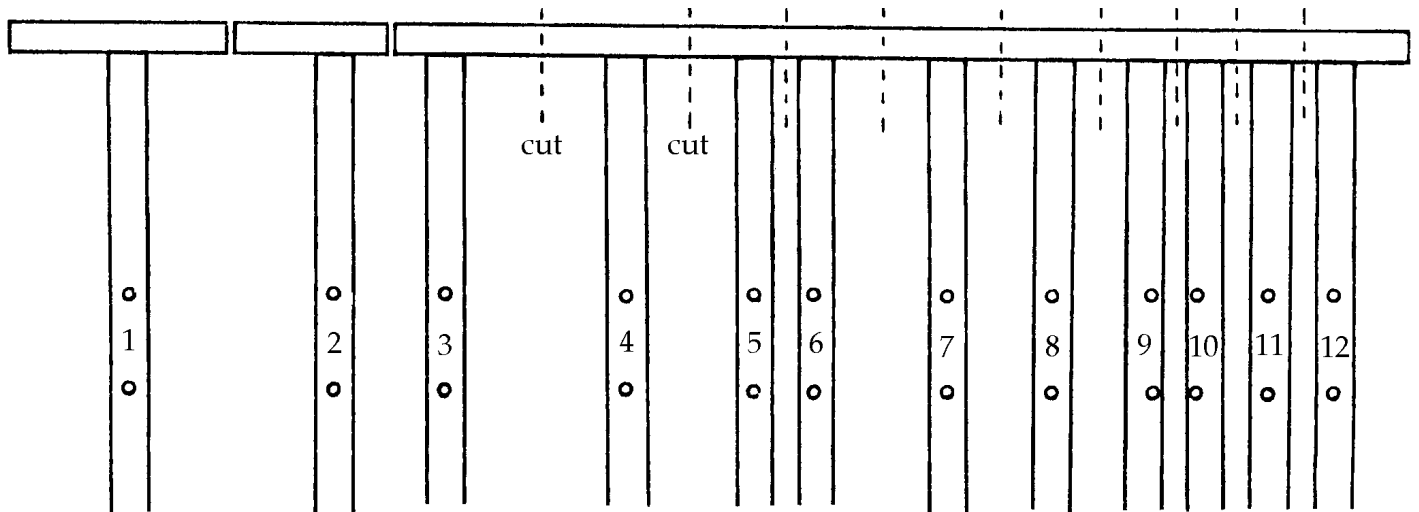
25. When the **KEYS** are properly fitted and correctly positioned, you may glue them to the **BUTTON STOCK**. This is best done with the **KEYS** in place in the **KEYCHEST**. Glue the **BUTTON STOCK** to all the **KEYS** at once, so they will all be interconnected. You'll cut them apart later.

CUSTOMER SUGGESTION: One builder recommends slotting the **BUTTON STOCK** with a shallow groove on one face to fit the **KEYS**. Good idea! This would make it easier to glue so many parts together at once.



Note that the **BUTTON STOCK** is to be glued on the right side of the **KEYCHEST** as you look from the wheel end of the instrument. This is best for right-handed players. You will turn the crank with your right hand and push the keys with your left. If you wish to make this a left-hand instrument, simply glue the **BUTTON STOCK** to the other end of the **KEYS** (and fasten the **KEYCHEST LID** in reverse when you get to that step).

When dry, pull all the **KEYS** out of the **KEYCHEST** with the **BUTTON STOCK** and use a bandsaw or jigsaw to slice them apart midway between the **KEYS**. We hope you numbered the **KEYS** so you can easily figure out where to place them again!

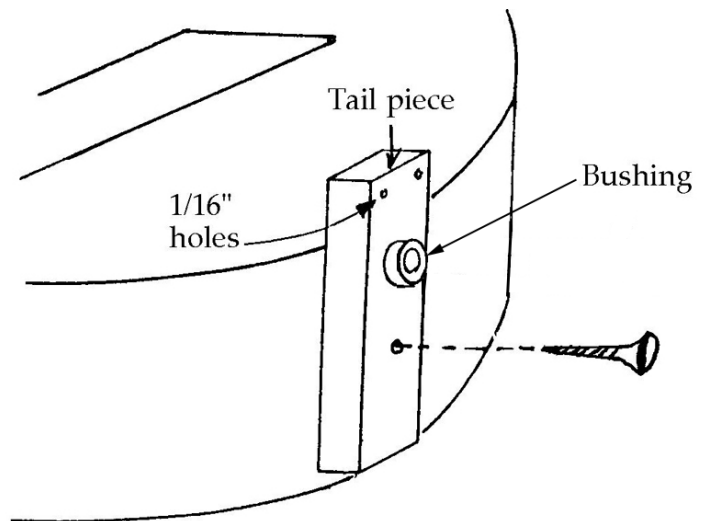


This would be a good time to sand and round over all the rough edges and corners of the **BUTTONS**, now that they have been cut apart. Handle with care so the **BUTTONS** don't break off the **KEYS**. Set the **KEYS** aside in a safe place while you work on other parts of the soundchamber.

BRIDGES & NUTS, ETC.

____ **26.** Before installing the **TAIL PIECE**, drill two 1/16" diameter holes through the **TAIL PIECE** in the positions illustrated. These will be for the **MELODY STRINGS**.

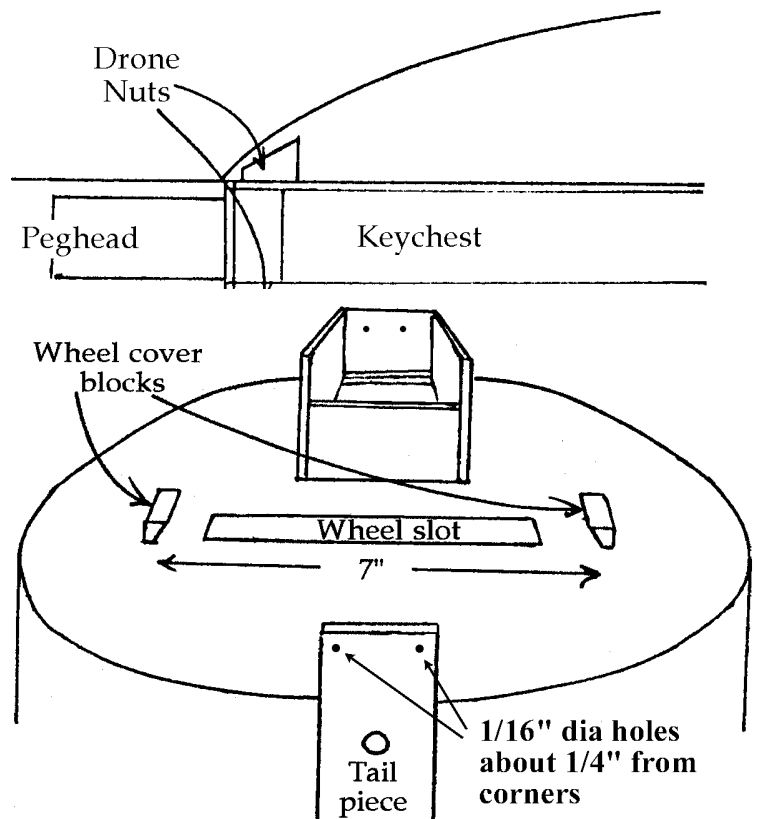
We also like to round over all sharp corners of the **TAIL PIECE** so it looks and feels smooth.



____ **27.** The **TAIL PIECE** can now be installed. Apply glue to the mating surfaces and use one wood screw to pull the **TAIL PIECE** firmly into place.

____ **28.** Sand the two **DRONE NUTS** to your liking, rounding over the sharp edges and sanding off the saw marks left by our machines. When satisfied, glue them in place near the narrow end of the instrument, so they contact the **SOUNDBOARD** and the **KEYCHEST SIDES**, as shown.

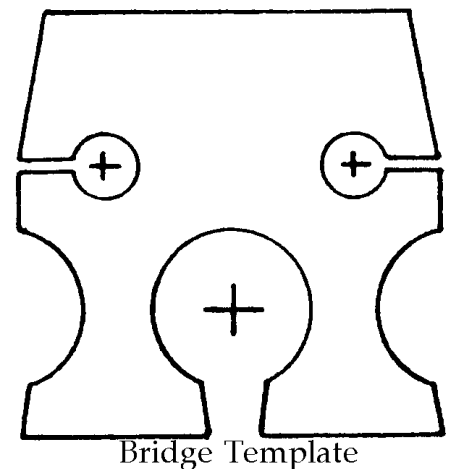
____ **29.** Sand the two **WHEEL COVER BLOCKS** in the same way. Glue these blocks near each end of the wheel slot, in an upside-down sort of way. Look carefully at the illustration. Place them 6-1/2" to 7" apart (centered on the wheel slot) so the curved **WHEEL COVER** will be held securely between them (test-fit the **WHEEL COVER** before gluing the blocks in place).

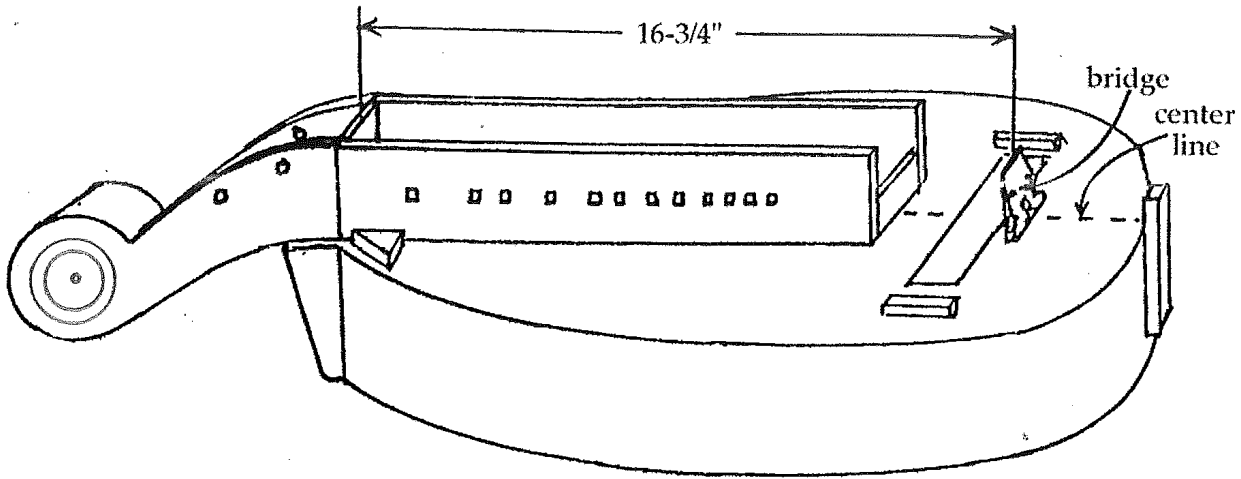


NOTE: The WHEEL COVER will not be glued in. You want to be able to remove it frequently for tuning and adjusting the strings. That is why the WHEEL COVER BLOCKS are cut at angles to hold the cover without glue.

____ **30.** Cut the **MELODY BRIDGE** to the shape outlined here. Sand to remove rough edges and saw marks.

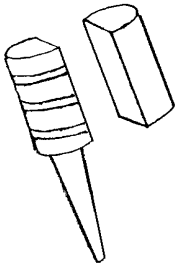
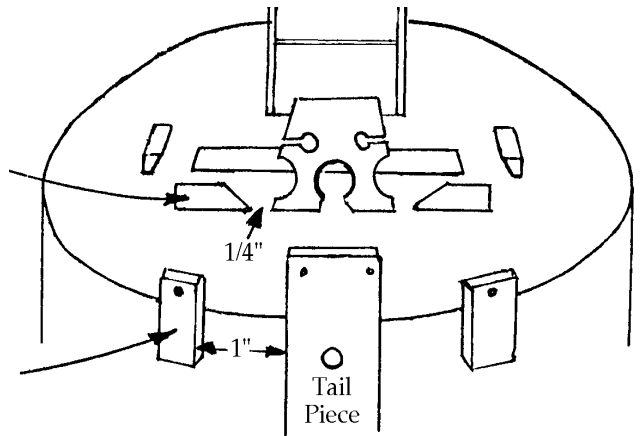
____ **31.** Glue the **BRIDGE** to the **SOUNDBOARD** so that the edge near the **WHEEL** is exactly 16-3/4" from the inside edge of the **HEAD END** of the **KEYCHEST**. That should put it within about 1" of the wheel slot, as shown. Center the **BRIDGE** on the center-line of the **SOUNDBOARD**.





___ **32.** Glue the two **DRONE BRIDGES** on either side of the **MELODY BRIDGE** with the pointed ends sloping down toward the center of the instrument, as shown. Position them about 1/4" from the main **BRIDGE**.

___ **33.** Drill one 1/8" hole near the end of each **DRONE ANCHOR BLOCK** and then glue them near the **TAIL** of the instrument, as shown. Position these blocks about 1" from the **TAIL PIECE** with the tiny hole above the surface of the **SOUNDBOARD**.

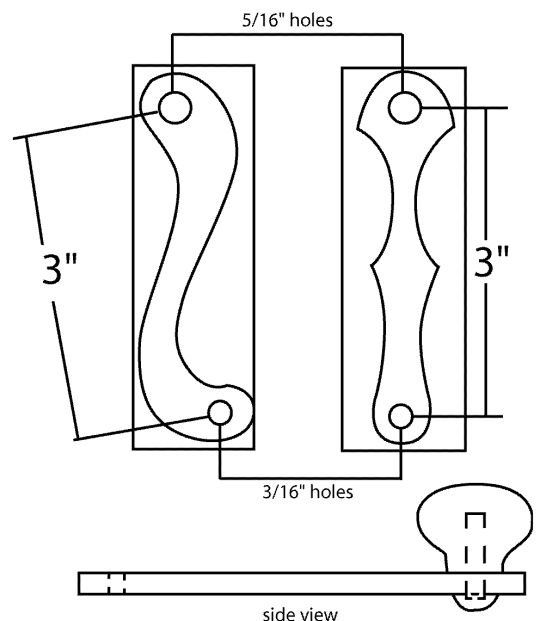


___ **34.** The **KEY TANGENTS** come in two parts which must be glued together before installing into the **KEYS**. Use clothespins or spring clamps to glue the rounded walnut pieces to the maple parts with tapered posts, as shown.

___ **35.** You are done with all the gluing on this kit! Now it is time to prepare everything for the finish. We recommend sanding the entire instrument and all remaining wood parts (except the **WHEEL**) to remove any glue spots, machining marks and scratches, and to round over any sharp corners.

Drill a 5/16" hole near one end of the brass bar and a 3/16" hole near the other end. The holes should be about 3" apart.

___ **36.** When shaping the **BRASS CRANK**, you may want to be a little creative. Brass is soft enough to be workable on a jigsaw or bandsaw, and it is fun to cut this piece into a curved shape. If you take the time for fine sanding and buffing, you can make this a very shiny accessory on the instrument.



APPLYING THE FINISH

Here are some suggestions on finishing (use only one of the following options):

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.

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 gel urethane called MUSICMAKER'S INSTRUMENT FINISH. Our complete finishing kit includes detailed instructions, sandpaper sheets and a half-pint can of satin gel urethane varnish. The advantages of this 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.

Apply the finish of your choice to all wood parts except the **WHEEL**. Don't forget to coat the **BRASS CRANK** and the wooden **CRANK KNOB** too.

HINT: For finishing the KEY TANGENTS, we drill a bunch of small holes in a scrap of wood to hold these tiny parts.

Now you are ready to tackle the **WHEEL**. This is the most important part of the Hurdy Gurdy, so take your time in truing it up.

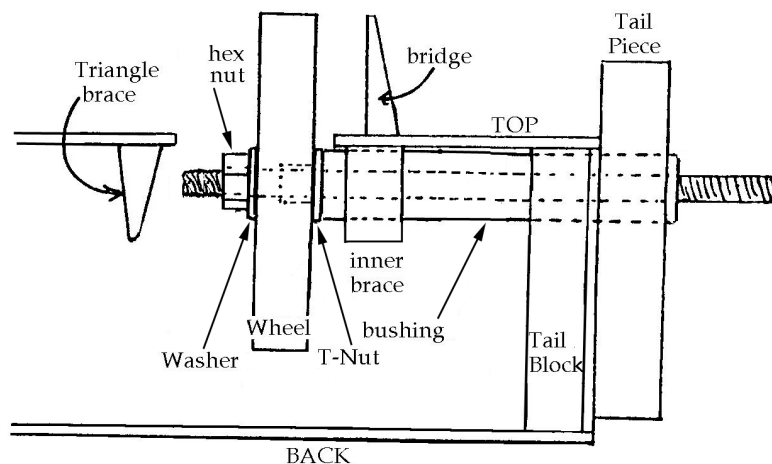
TRUING THE WHEEL

____ **37.** You want the **BUSHING** to protrude a little beyond the **TAIL PIECE** to act as a bearing surface for the **CRANK**. The exact amount is not critical, as long as you can fit all the parts on the **AXLE**.

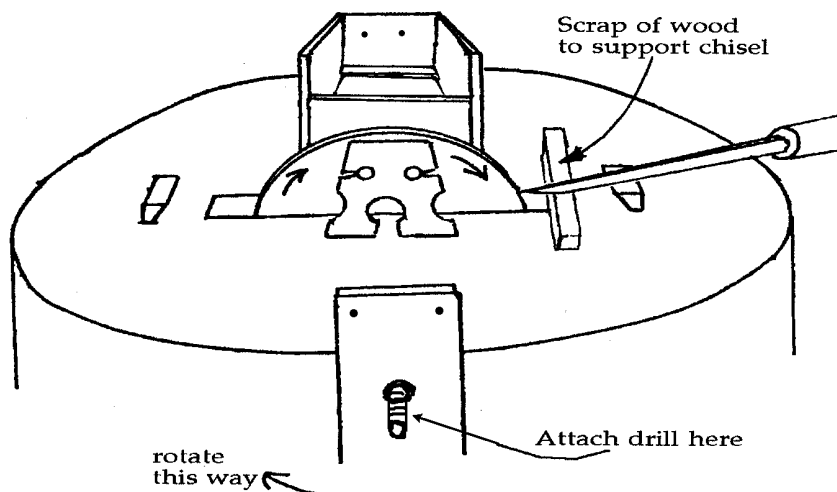
a) Insert the **AXLE** into the **BUSHING**.

b) Pound the **T-NUT** into the **WHEEL**, on the side where the center hole has been enlarged.

c) Turn the **WHEEL** onto the axle, with the **T-NUT** facing toward the **TAIL END**. The **AXLE** should protrude beyond the **WHEEL**. Add the washer and the **HEX NUT** and use a wrench to tighten the **HEX NUT** up against the **WHEEL**. The **WHEEL** must be securely pinched between the **T-NUT** and the **HEX NUT**.



38. Now to true the wheel, you must have an electric hand drill and a **SHARP** chisel. We have not found another system to be sufficient to the task, so dust off the old grindstone and sharpen a chisel -- it will be worth the effort. You may want to ask a friend to help with this step, as it is a bit challenging to hold the chisel steadily while the wheel turns.



Lay a small scrap of wood across the wheel slot and hold the chisel very firmly on the scrap so the sharp edge just contacts the **WHEEL**. Turn a **HEX NUT** onto the axle and then fasten the chuck of your electric drill onto the end of the axle. Rotate the wheel toward the chisel by spinning the axle with the electric drill. Hold the chisel as steadily as you can, letting the blade scrape against the turning wood. If it only contacts the wheel at one point in the circle, that's fine. Let the chisel remove that "high" point of wood. Pretty soon the blade will make continuous contact with the rotating wheel. Then you will know that the wheel is true. Inspect it carefully for signs of the sanding scratches left by our machines. Continue truing the wheel until all those machining marks are smoothed off.

HINT: You will have an easier time with initial truing if you use just one corner of the chisel for cutting against the wheel. Move the chisel across the face of the WHEEL in order to eliminate the major "bumps". Then you can switch to using the full width of the chisel blade against the wheel so as to remove the gouges left by the corner cuts.

If the wheel has some side-to-side wobble, turn your chisel diagonally against the edges of the wheel and scrape the corners.

Take your time on this because an uneven wheel will create music with a "wow-wow" effect as it pushes on the strings up and down. (You want your friends to say "Wow!", but you definitely do not want the hurdy gurdy to go "wow-wow".)

Follow after the chisel with medium (120 grit) sandpaper and then a fine (180 grit) sandpaper to make sure the **WHEEL** has no rough spots on the surface that will contact the strings. Just hold the sandpaper against the **WHEEL** as you spin the axle with the electric drill.

____ **39.** Now you can install the **BRASS CRANK**. Start by attaching the **WOOD KNOB** to one end of the **BRASS CRANK** (end with the smaller hole). You may need to cut the mounting screw shorter with a hack-saw. One customer also recommends placing a scrap of felt as a washer between the brass and the knob to make the knob turn more smoothly and quietly. I like to put a drop of epoxy glue on the threads of the knob and leave the screw just slightly loose, so the knob can turn without coming unscrewed.

____ **40.** Install the other **HEX NUT** onto the **AXLE** and turn it down to the **BUSHING** by hand in order to take up the play in the **AXLE**. Place the brass **CRANK** on the axle, and then screw the brass **CAP NUT** against the **CRANK**. Make sure the axle turns freely, but has very little play in it. Tighten both nuts to hold the **CRANK** securely.

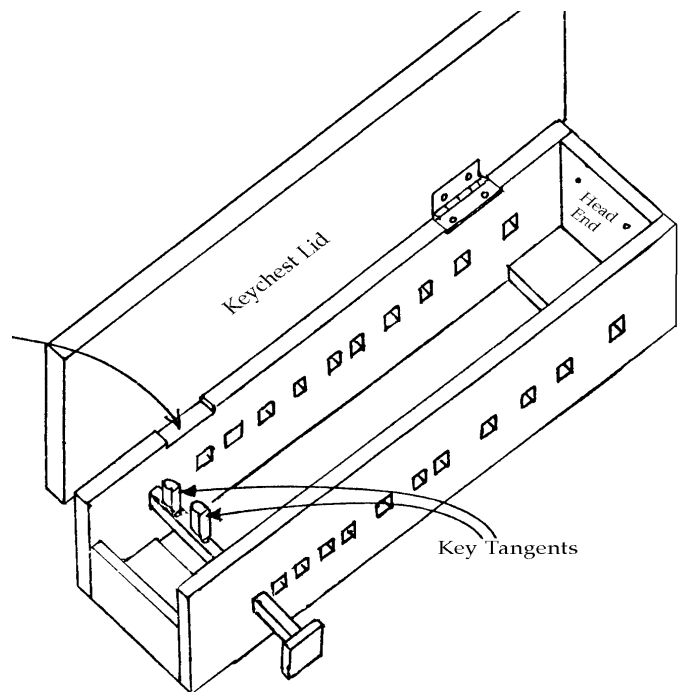
BE CAREFUL HERE! Your goal is to tighten the HEX NUT against the CAP NUT, not against the tail of the instrument. You should end up with a little gap between the instrument and the HEX NUT.

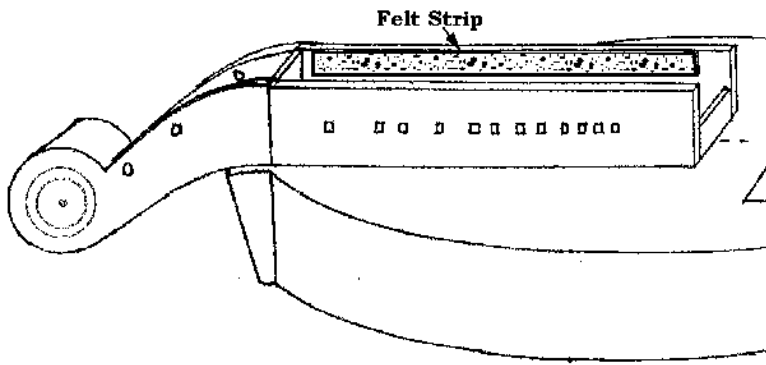
____ **41.** Install the **KEYCHEST LID**, using the **HINGES provided**. Place the hinges on the "up-hill" side of the keychest, opposite where the key buttons will be. The lid will generally remain closed while playing, making a nice platform on which to rest your left hand. You will open it for purposes of installing new strings or adjusting the intonation of the keys. We recommend cutting a shallow mortise in the keychest side for the hinges, as shown.

CAUTION: The tiny screws that come with the hinges may be a bit too long. To avoid having them poke through the top surface of the KEYCHEST LID, sand off the points to shorten them a bit.

____ **42.** Insert all 12 **KEYS** into their proper holes in the **KEYCHEST**.

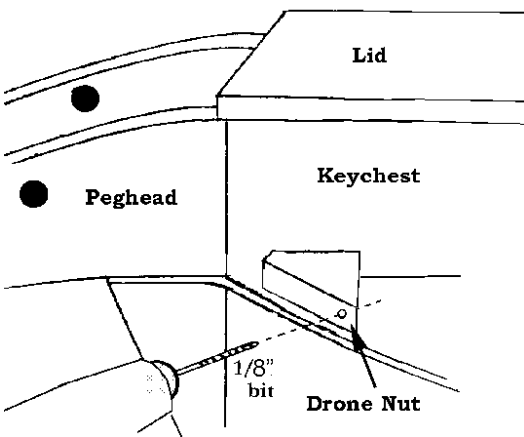
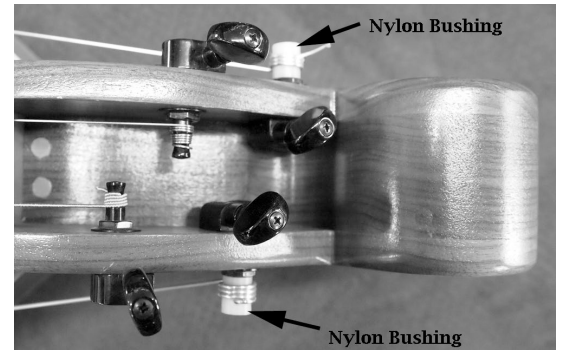
____ **43.** Carefully fit all the **KEY TANGENTS** into the predrilled holes of the **KEYS**. Note that the stems of the **TANGENTS** are tapered, so they become tighter as you push them in. You want them to go down far enough so they will not touch the **LID** when it is closed. Sand the stems of the **TANGENTS** if necessary to get them to fit down far enough into the **KEYS**.





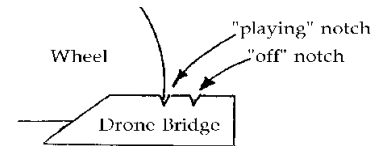
____ **44.** The **KEYS** will rattle a bit as you play. One way to reduce this extra noise is to put some **FELT PADDING** inside the keychest, as shown. Use a few drops of glue to hold the **FELT** in place on the inside of the **KEYCHEST**.

____ **45.** Install the four black **GEARED TUNERS** into the **PEGHEAD**, as shown. Notice that the two furthest from the keychest (closest to the end of the head) must be installed from the inside of the **PEGHEAD**, aiming outward for the drone strings. The other two are installed on the outside of the **PEGHEAD**, aiming inward. Yes, it is a bit challenging to insert the tiny "keeper" screw in the inside. If you cannot manage that, just tighten the sleeve to hold the **GEARED TUNER** from moving.

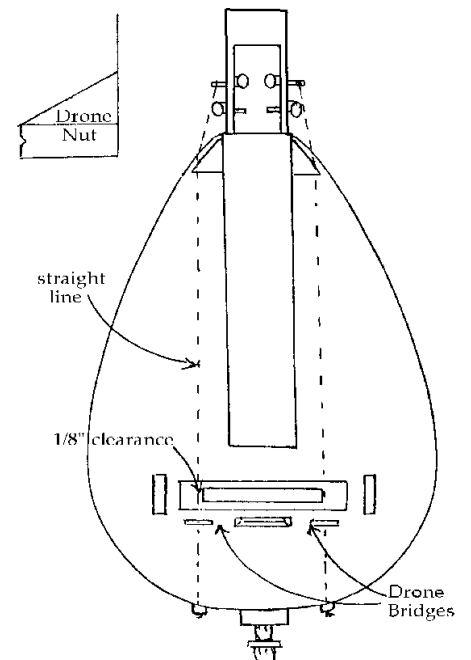


____ **46.** Use a 1/8" bit to drill a small hole near the point of each **DRONE NUT** so the drone strings can be threaded through the holes. Drill from an angle, as shown, to make sure the string cannot buzz inside the hole.

The easiest way to figure the correct position for the notch in the **DRONE BRIDGE** is to hold a straight-edge against the **WHEEL** and the **DRONE NUT**. File a notch in the **DRONE BRIDGE** where the straight-edge crosses it. This will hold the **DRONE** string lightly against the **WHEEL**.



We like to file another notch to the outside of the "playing" notch on each **DRONE BRIDGE**, so the string can also be held away from the **WHEEL** in the "off" position.

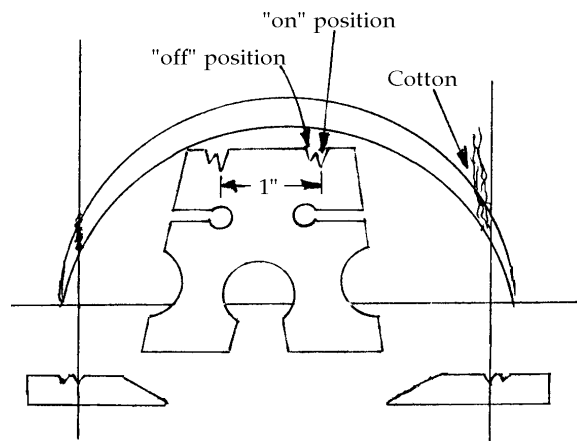
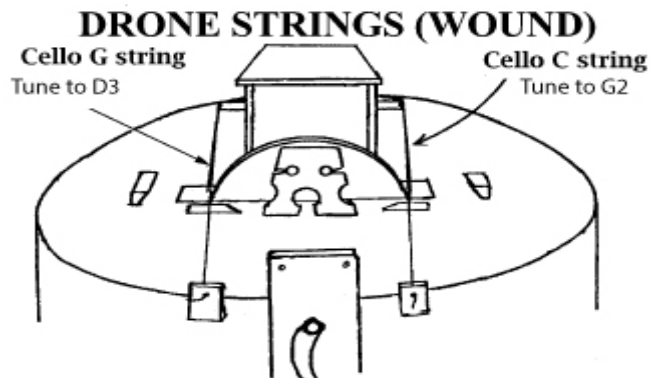


____ **47.** Install the two drone strings (Cello C and G) by threading them through the holes in the **DRONE ANCHOR BLOCKS** and pulling through until the brass ring stops against the wood. Note these are two different diameter strings. We like to put the heavier one © on the right side.

Slide the two nylon bushings over the posts of the tuning gears that show outside of the **PEGHEAD** (see photo on step 45), and line up the string holes. Thread the drone strings through the holes drilled in the **DRONE NUTS** and the **GEARED TUNERS** on the outside of the **PEGHEAD**, as shown. Wind the strings up tightly by turning the **GEARED TUNERS**. The bushings help ease the tight winding of these thick strings. You'll need to cut off a fair amount of string length so you don't accumulate too many wraps around the bushings.

Check to see that the drone strings rest in the notches of the bridges.

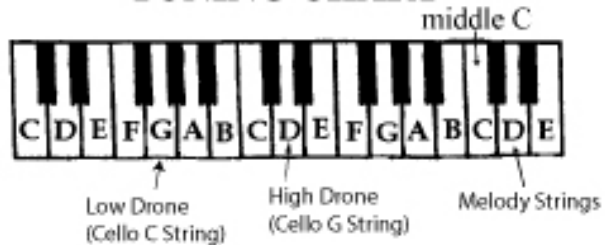
48. Hold the cake of **ROSIN** against the **WHEEL** and turn the **CRANK** several revolutions to apply some rosin to the wheel. The drone strings should begin to make noise--I mean, music! You can listen to one at a time if you pull one string away from the wheel while turning the crank. Tune these drone strings to the D notes in the bass clef. This will give you the key of D major (Note: we use two different size strings here to allow tuning the drones a 4th, 5th or an octave apart, depending on the key you want).



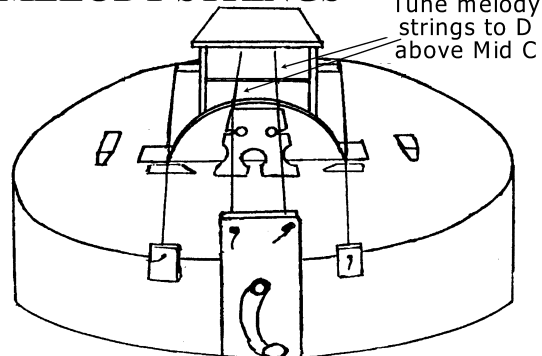
49. The strings need some padding to protect them from wearing thin and to give the rosin a little something more to bite into as the wheel turns. We provide 100% cotton balls that work well for that purpose.

Pull a very small amount of cotton from the ball and hold it near the string as you turn the crank. The **WHEEL** should "grab" the fibers and start winding them around the string as it turns. You want a thin layer of cotton to cover each string where it contacts the wheel. Re-tune both drone strings, if necessary, to the proper notes.

TUNING CHART



MELODY STRINGS



50. Use a triangle file to put two notches in the treble bridge, **1"** apart. Use a straight-edge (or string) from the holes at the opposite end of the keychest to your notches, making sure the strings will pass **at least 1/8"** away from the key tangents inside the box (3/16" will be safer). Make these notches deep enough so the melody strings will just barely contact the wheel. **BE CAREFUL NOT TO FILE THESE NOTCHES TOO DEEPLY, AS IT WILL BE DIFFICULT TO FILL THEM IN LATER IF YOU WISH TO RAISE THE STRINGS.** File a shallower notch to the left of each melody string to be used for the "off" position.

51. Install the Viola melody strings by threading them through the small holes in the **TAIL PIECE**, and pulling all the way to the brass rings. Enlarge the holes if necessary to accommodate the wrapping thread near the ends.

IMPORTANT: THE MELODY STRINGS PASS THROUGH THE MIDDLE OF THE KEYCHEST. YOU NEED TO TILT THE HURDY GURDY AT AN ANGLE SO THAT THE KEYS ALL SLIDE AGAINST THE FELT BEFORE INSTALLING THE STRINGS. THAT WILL PUT THE TANGENTS IN THE PROPER PLAYING POSITION.

Put them into the **GEARED TUNERS** with the holes on the inside of the **PEGHEAD** and wind them up until taut. They should barely touch the wheel, giving a "shisper of sound as you turn the crank. Too much pressure against the wheel will make them sound harsh.

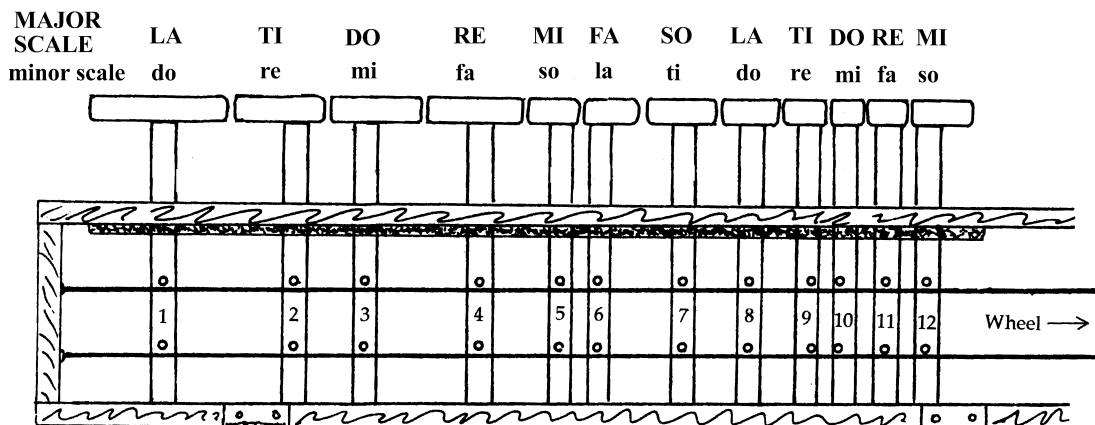
Tune the two melody strings as shown, for starters. This will give you the key of G major or E minor (other tunings will give you different major, minor and modal keys -- see chart on page 24). You can lift off the strings that you don't want to hear by hooking them in the "off" position, as shown. That way you can tune one string at a time.

Feed a small amount of cotton onto these melody strings too. That will protect them and make them sound a little louder and sweeter. It will take awhile for the strings to settle in and stay at the proper pitch. The knots at the tail piece may need to be tied around a scrap of heavy string or to prevent the knot from pulling into the hole in the wood.

The volume of the strings can be increased in two ways: **1)** rub more rosin onto the wheel; and **2)** lower the strings more firmly against the wheel. The second method is easily done by filing the notches in the bridges in such a way as to hold the strings closer to the **WHEEL**. Be careful with the melody strings though. Too much pressure against the wheel causes the higher notes to sound rough and scratchy.

52. When the four strings are all playing clearly and in tune, check out the sound of the **KEYS**. Pushing a **KEY** into the **KEYCHEST** causes the **TANGENTS** to make contact with both melody strings at the same time. This shortens the "vibrating length" of the strings, making them vibrate at a higher frequency (pitch).

The major scale starts on the **THIRD KEY**, which should make the melody strings sound exactly an octave above the drone strings when engaged. That is "do" of the scale. Now walk your fingers up the scale as you move from one key to the next, turning the **CRANK** all the while. Hold the instrument at an angle on your lap so the **KEYS** fall back against the **FELT PADDING** when you let them go.



If any notes sound out of tune, you can correct the pitch by turning the **TANGENTS** inside the **KEYCHEST**. Turning them toward the **WHEEL** will raise the pitch, and vice versa. Make sure to adjust both **TANGENTS** on a key identically, so they make the two melody strings sound the same pitch.

The notes that are most fussy are those nearest the wheel. A slight change in the **TANGENTS** will make quite a difference in pitch.

NOTE: Sometimes, even after very careful construction, we find the upper melody notes wavering a little in pitch as the wheel is turned. Consult the **CARE AND FEEDING** suggestions at the end of these instructions for more help.

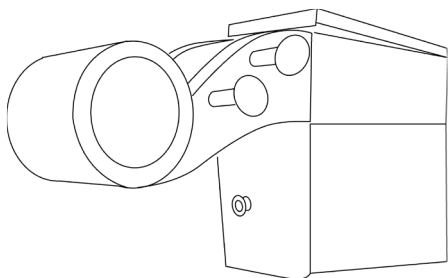
FURTHER HINT: Customers have occasionally thought that the key placement must be off because all the notes are considerably out of tune. This is usually caused by having too much cotton on the strings. A bulky wad of cotton somehow hampers the vibration of the string, causing inaccurate tuning, so keep the cotton to a minimum.

____ **53.** When satisfied with the sound, install the **WHEEL COVER** by wedging it between the **two WHEEL COVER BLOCKS**. It should be held firmly in place without need for glue, but sometimes we add felt to the inside edge of each **COVER BLOCK** to achieve a more secure grip. One manufacturer also adds a string to tie the **COVER** to one of the **COVER BLOCKS** so you don't lose the thing or inadvertently leave it behind somewhere.

DIFFERENT TUNINGS:

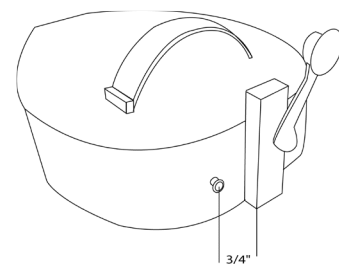
Key	Tuning	Heavy Drone	Light Drone	Melody Pair	Position Of "Do"
F major	CFC	Low C	F below middle C	middle C	3 rd Key
D major	DDA	Low D	Low D	A below middle C	3 rd Key
A major	EAE	Low E	A below middle C	E above middle C	3 rd Key
D Aeolian (minor)	DAC	Low D	A below middle C	middle C	1 st Key
G Dorian	DGC	Low D	G below middle C	middle C	4 th Key

CONGRATULATIONS! You have assembled one of our more complex musical instruments.



This instrument is **easier to play if you add a strap or belt** to help hold it on your lap. Attach the ends to the **HEEL** and **TAIL** of the Hurdy Gurdy, making sure that the strap does not interfere with the operation of the crank. We offer an adjustable strap with two mounting buttons:

STRAP-2 Strap with 2 buttons



Install strap button 3/4" off the edge of tailpiece, so it does not interfere with crank

CARE AND FEEDING OF YOUR HURDY GURDY

You should know that this can be a cranky instrument (pun intended). Don't be surprised if it requires a bit of tuning and adjustment every time you play it. Here are some hints to help you work out the excessive squeaks and squawks:

GENERAL THEORY OF ROSIN APPLICATION: Too little rosin makes a weak sound, too much rosin causes chatters and squawks. We just hold the cake of rosin against the wheel while turning the crank about a dozen revolutions, and that usually suffices for initial application. After applying the rosin, hold a smooth block of wood against the wheel while turning the crank. This burnishes the rosin and polishes the surface of the wheel. A highly polished wheel makes the sweetest sound.

COTTON-PATCH COROLLARY: We find it best to be minimalistic with cotton -- just enough to pad the string where it contacts the wheel. It is also good to check the cotton occasionally for clumps of rosin that cause the string to jump and chatter against the wheel. In other words, change your cotton frequently and often, especially after adding rosin to the wheel.

STICKY KEY SYNDROME: Remember, you must hold the instrument at an angle while playing so the keys will fall away from the strings after being played. Make sure the keys slide freely enough to fall away when you let go after playing a note. If the key tangents hang up close to the string, they will interfere with the vibration, causing high-pitched harmonics instead of the notes you want to hear.

STRING ACTION AXIOM: The big question is how deep to cut the notches in the bridges to obtain the proper pressure of strings against the wheel. The drone strings are not so fussy -- we like fairly good pressure on those. But the melody strings can be tricky. The highest notes won't play well if the strings press too firmly against the wheel. If you need to raise a melody string, glue a sliver of wood in the notch under it.

CHILD'S-PLAY POSTULATION: The more the kids abuse this thing, the better it starts to sound! Honestly, we find that our display model instrument that gets cranked by every child who walks into the store is the one that sounds the best. But it takes awhile to get "broken in." Our best suggestion is to hire a youngster to sit out behind the barn and serenade the cows for a few days.

Thanks again for your patronage, your patience, and your sense of humor. With your help we can re-populate the street corners of the world with hurdy-gurdy players! Heaven help us....



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