

Collapsible harp. Design and building experience.

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As politicians say, no matter what a Russian does, it turns out either Kalashnikov or the CPSU. It seems, something similar appeared this time too.

I noticed that some harp models, such as Musicmakers' Limerick or Dusty Strings' FH36b have a sound box top of cylindrical shape, and a cut in a neck matching to it.

"If it's round, it means it should turn!" - I thought, and, similar to collapsible travel guitars, designed a collapsible harp. Limerick Lap Harp was taken as a prototype.

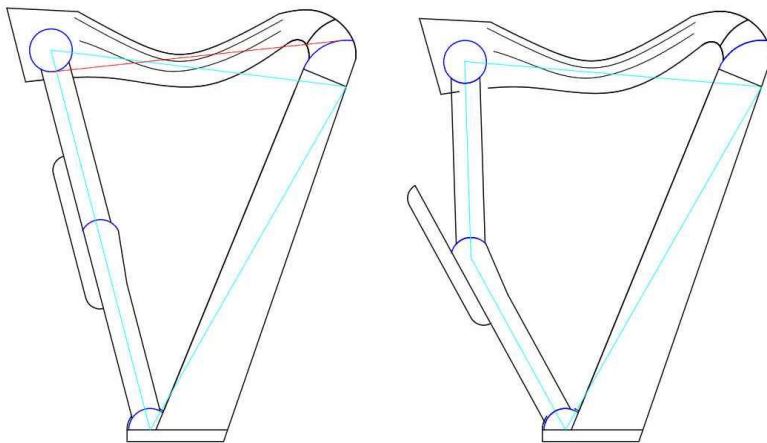
Here are three groups of design key-points: the harp design itself, the string clamps and the harp casing.

Harp design

Pillar made of two parts with swivel connections. Unfortunately, beautiful harp pillar curviness had to be sacrificed. All three connections must be in one line. It is good if the middle connection moves inside beyond the line for a couple of millimeters. It prevents against spontaneous collapsing. However, pillar parts are to be screwed tightly after assembling.

The pillar lower end inserts into a groove on a middle-bottom of the sound box front. Upper end inserts into a pocket on the left-lower end of the neck. Thus, the neck has same shift on both ends, and strings plane comes out perfectly flat.

..."Collapsible Limerick" parts templates were already printed – but I thought: will the string force stabilize the neck resting on pillar and sound box top, or, or the contrary, wrest it out?



(collapsible harp early drafts)

Swears a bit, I remade the design entirely. And now all strings' fixations are above the neck rest line.



(The harp and her casing)

The neck is protected from moving along the sound box head with a rib inserted to a groove on the sound box head.



But there are concerns that lateral clearances in swivel connections may affect the rigidity of the structure. The harp is currently being tested.

The harp range is E2 to C6.

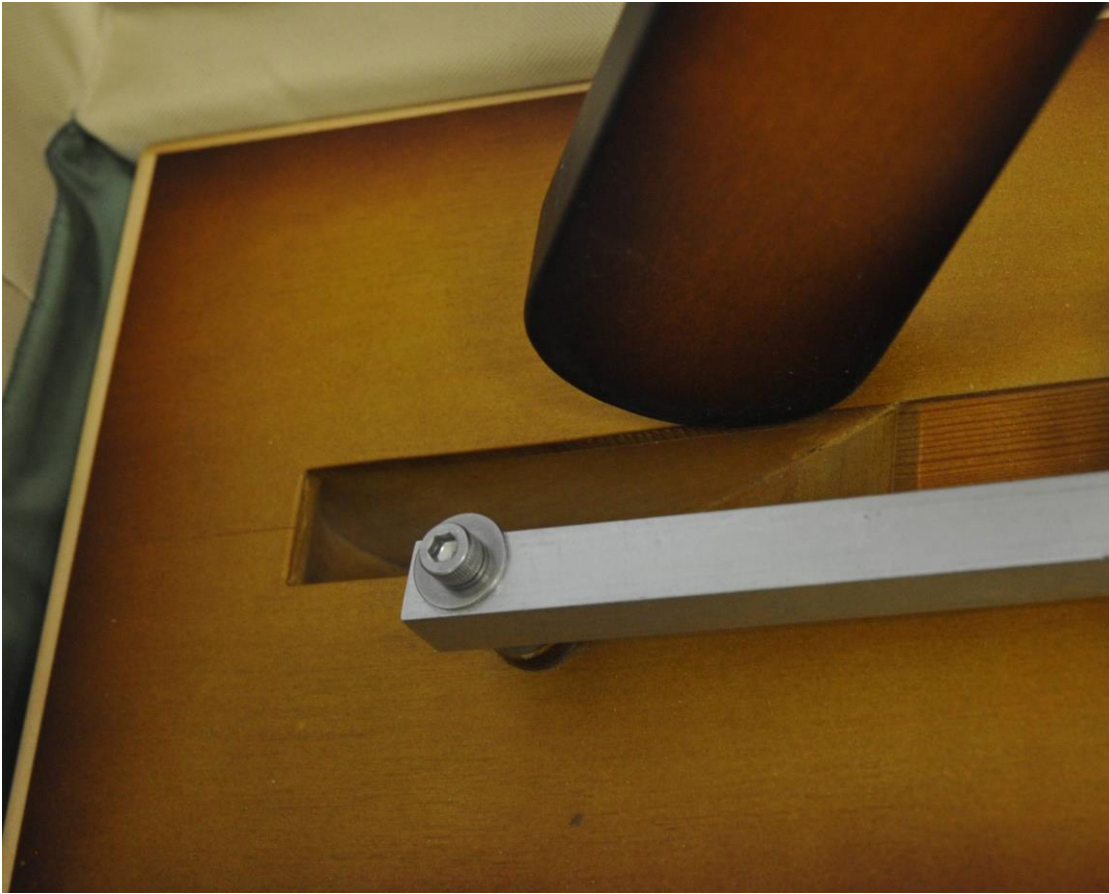
Strings are nylon monofilament.

Sound box is made of pine furniture panels.

Sound board is made of spruce, laminated with veneer, tapered.

All the rest is made of birch plywood.

One side of each swivel connection has a hornbeam hardwood insert. Unfortunately, it doesn't protect against scratches on varnish during assemblies-disassemblies.



(groove in the sound box and the pillar lower end)



(pillar parts swivel connection)



(the pocket on the neck)

All hardware is made of carbon steel and phosphate-coated.



Tuning pins – throughout the neck type, M7x0,5 threaded with die on understated diameter 6,75mm. It makes thread cross-section trapezoidal. I think, such pins should wear neck holes less.

Top of pin square end is convex for C and concave for F. Hope, it could be useful during tuning, especially for blind musicians.

Using zither-type pins makes tuning less comfortable, but, for this harp, it could make the casing a bit smaller and more simple.

Bridge pins are made of 5mm hexagonal rod, threaded with die M5 on 4,6mm turned diameter. Angle string groove, unlike radial, could make a contact with string of any diameter more stable, I think.

Soundboard inserts are made of blind rivets. The hole on the cap side is countersunk with radial (R-type) center drill to prevent string tear on a sharp edge of the hole.

String clamps key-points

String clamps are important part of the harp concept. They are attached to the neck and the sound box near strings' ends. The clamps holds strings against winding out from the tuning pins and displacements inside the sound box during harp disassembly.

Actually, I have never seen such clamps on collapsible guitars.

Embedded elements for threading clamps to harp parts are turned from brass and glued in by epoxy resin.

Clamps are made of aluminum alloy extruded square tubes. Using welding for mounting thread inserts inside was my great mistake. Welding makes hardened alloys terribly weak.

Plastic garden hose is pulled on these tubes. So, strings are clamped between hoses with square tubes inside.

Tubes are connected with many screws, so clamps installation is laborious. It's way to make it faster – to replace screws with eccentric cams like on bicycles.

All screws are to be unscrewed during disassembling are captive screws. It prevents loss. A captive screw can be easily made from a regular one by turning the neck under the head.

Now the harp is stringed with monofilament nylon. Such bass strings are undertightened and sounds slacky, but softly and unobtrusively.

General problem with strings of the harp is absence of constant force for strings stabilization. The harp disassembling to be carried without preparatory strings loosening. Strings are relaxing after disassembling, and they raise pitch a bit after assembling. So, collapsible harp is to be tuned more frequently than usual one. According to a chief master of a workshop where the harp was built, using fluorocarbon strings instead of nylon could only make the things worse. Generally, collapsible travel guitars are usually metal-stringed.

However, the harp is supposed to be used for travelling and practice. Therefore, these flaws do not seem very significant.

Casing

The harp casing is essential and integral part of the concept. Disassembled harp parts in bag could be damaged easily, so they should be packet together firmly with inserts preventing parts contact regardless of position of the casing.

Furthermore, casing internal space arranging needs to take into account the length of the upper string connecting the soundboard and the neck, and the space for levers to place the neck relative to the sound box accordingly.

At first it was planned to protect strings with a hood while the harp disassembling. The hood was planned to be made from two layers of a fabric with Velcro. These flaps, sticking together by Velcro from both sides of the string plane, were to transform many strings into one sheet. But I was warned that Velcro could harm strings. So, I was going to use small magnets instead. Finally, I gave up the idea of the hood.

After my low-effective wanderings around different studios in different towns, the complex requirements were fulfilled, and the casing was finally created by fashion designer from Volodarskogo village.

Casing has a frame, bent and glued from cellular polycarbonate and coated with polyethylene foam. So, the casing is pretty rigid. Bottom and cover sheets are made similarly. Bottom bed with hollows for the parts, inserts and cover onlay are made from dense furniture foam and covered with a fabric. Foam parts loaded places are reinforced with EVA foam. All the inserts are strapped to the casing to prevent loss. Cover onlay has pockets.



(the casing frame)

Assembly order

All the tools needed for assembly is one 5mm Allen wrench.

1. Open the case, take the Allen wrench from the pocket.



2. Get inserts out, take the pillar parts from their hollows. Insert one part into swivel pocket of another part. Hold these two parts in one hand.



3. Take the neck with another hand, place its upper side to the sound box top.

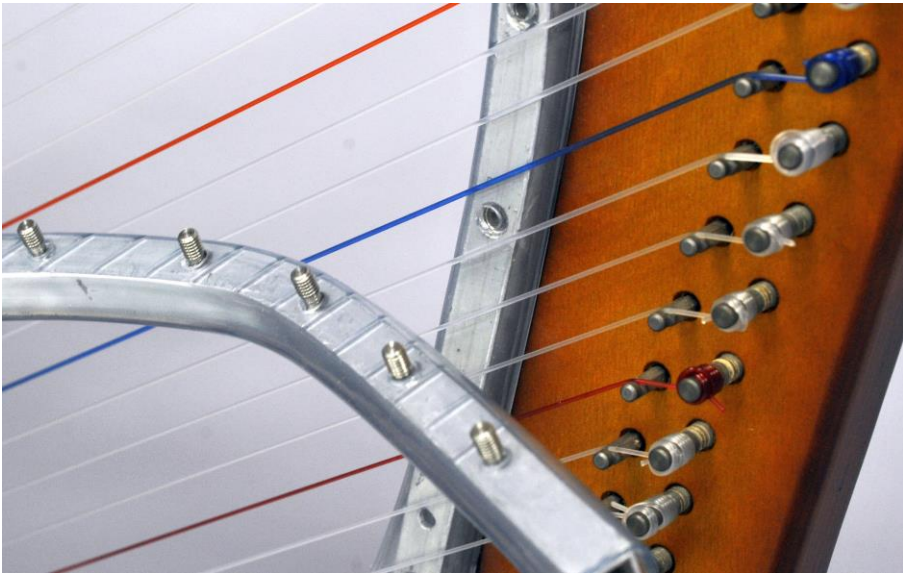


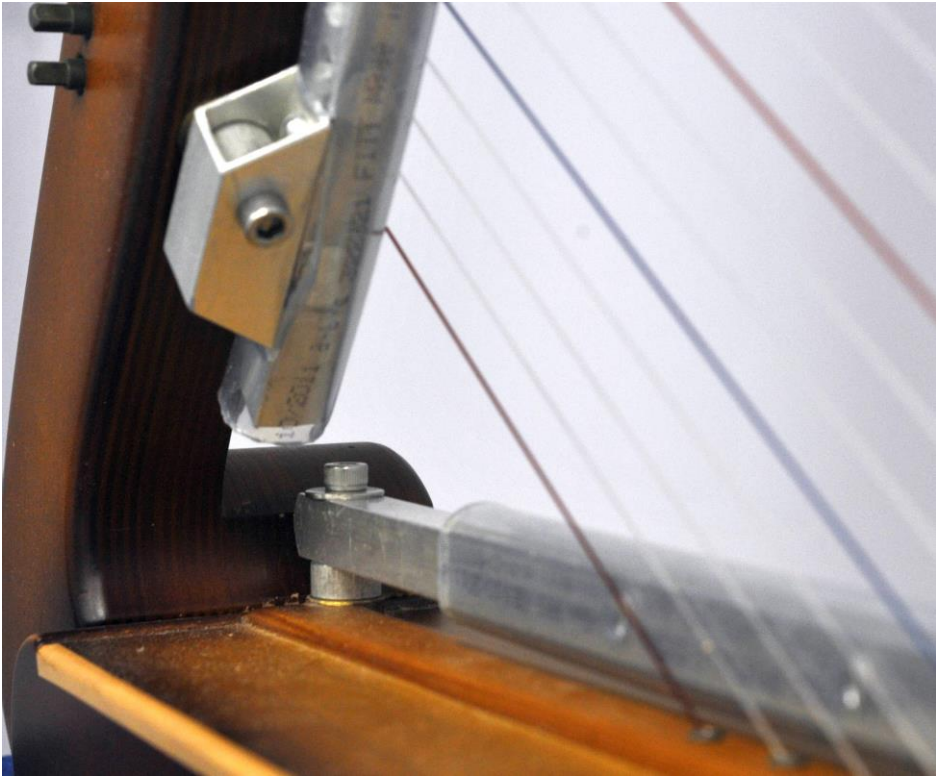
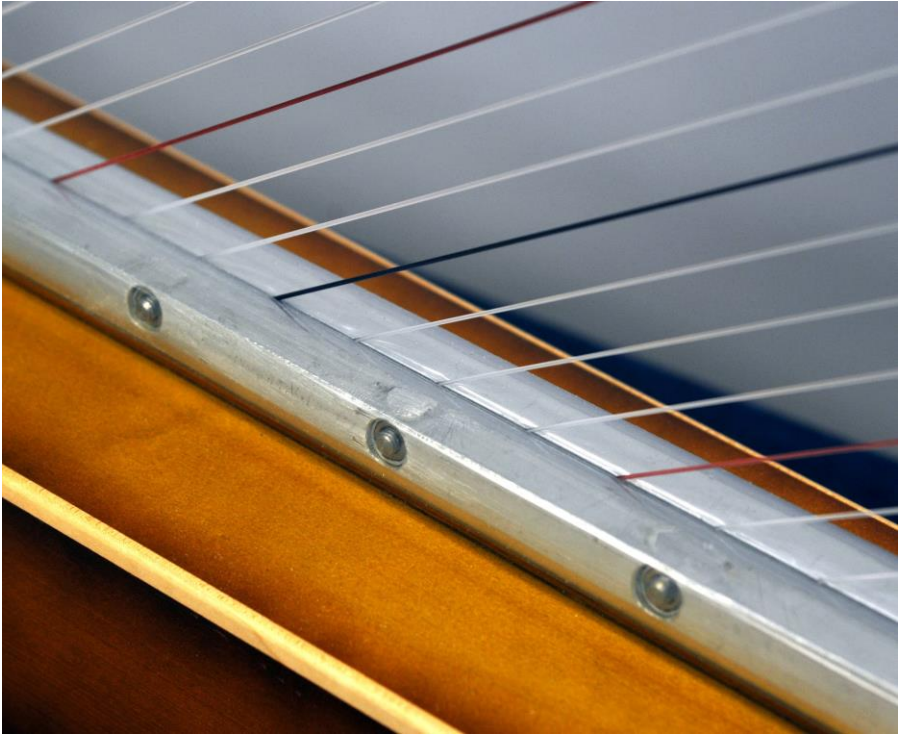
4. Insert ends of the pillar to the sound box groove and to the neck pocket. Straighten the pillar. Screw the parts immediately, at least for a few turns. Then it is OK to release hands. Do not forget to tighten the screw.



Straightening of the pillar is within the capabilities of ordinary man, but it could be hard to fragile harpist girl. It would be good to use something like a trigger clamp for this purpose. Or to meet a nice guy.

5. Release the clamps, then remove them from the harp.







6. Take the assembled harp from the casing.

Disassembly is performed in reverse order.

It is important to hold and control all parts while dismounting the pillar.

A tuning wrench made from brass CuZn38Pb1.5 , polyurethane coated, with maple handle. Brass is softer than pegs steel, but, I think, it's better to change wrenches due to wear than tuning pegs.



The wrench hole is eight-pointed star (square on square) made using rotary broaching with synchronization.

It is planned to equip the harp with levers. But what's about levers – somewhen next time.

Hope, this concept will make harps more portable, live music more common, and the world at least a bit more peaceful.

Thanks

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