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SUPPLEMENT

rev.4 2004 7 15 Akihiko Yamanobe

Partly corrected in 5 concerning annealing tangents from the original in Magnano.

To think on clavichord in Japan, I tend to think on the basis of physics or a on a physical approach because we have almost no original clavichord in Japan. I would like to explain what I did on designing a clavichord in the following order.

1 General structure
2 Consideration on a corner
3 Considering key design
4 Balance washer
5 Low-temparature annealing (normalizing) tangents
6 On japaned/chinoiserie instrument

fig.1 General Structure

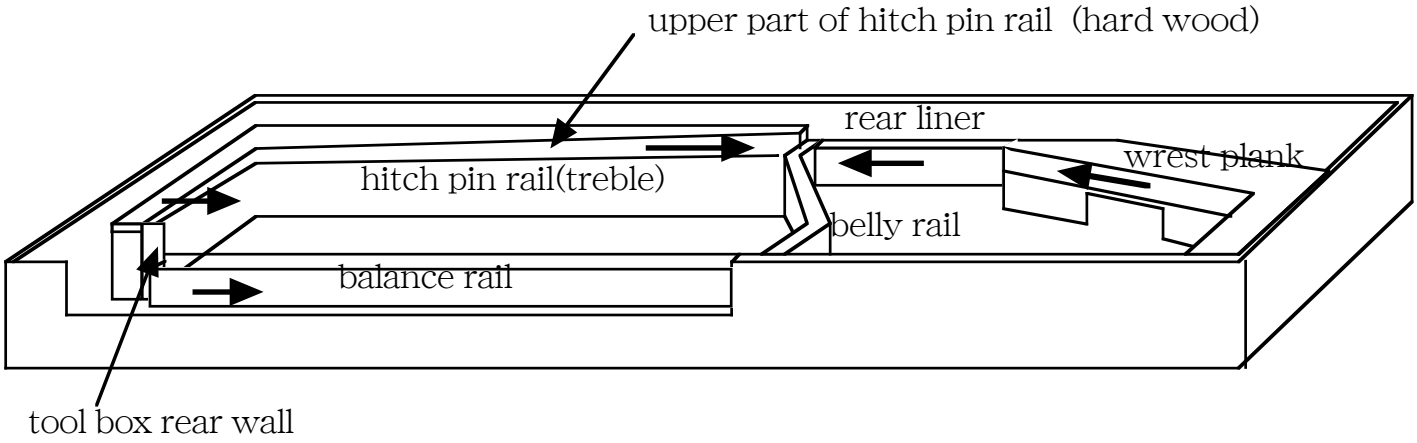


fig. 1a hitch pin rail (Hubert's design)

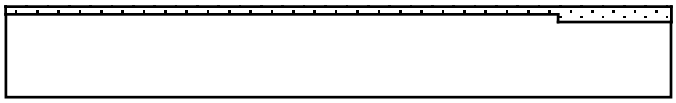
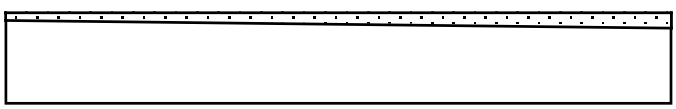


fig. 1b hitch pin rail (my design)



1 General structure

Most makers want to make clavichord as light as possible. I am another. On this purpose

it is necessary to think how the strength caused by strings is applied to a instrument. fig 1 showes each strength by arrows. The hitch pin rails (bass and treble) wrest plank consist of upper part (hard wood) and lower part(soft wood). I make the upper part of bass hitch pin rail 8mm thick. But if the upper part of treble hitch pin rail is also 8 mm thick, it does not get contact with belly rail. Even if we use very strong glue between lower and upper part of hitch pin rail, it does not make up or compensate this.

Please find that the upper part of the treble hitch pin rail in fig 1. It gets thicker toward the treble. In this manner the upper part of hitch pin rail can get a contact with belly rail.

fig.2 General plan view

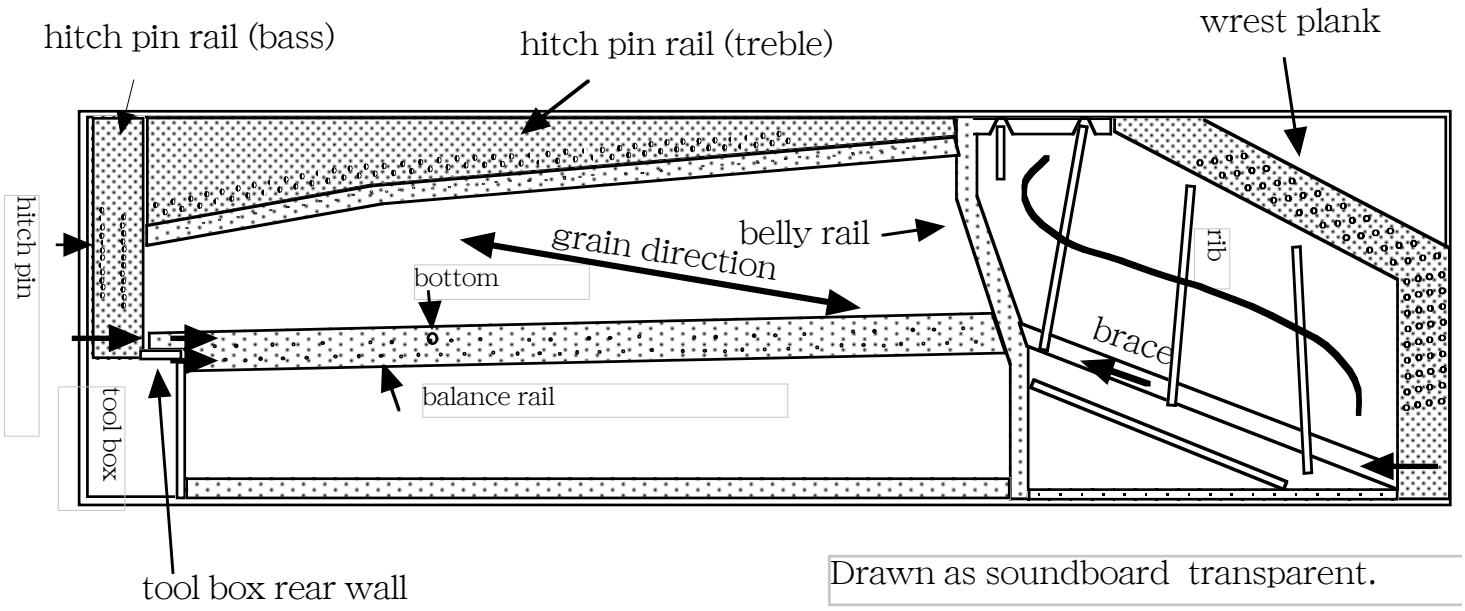


fig 2 shows top view. Please find the tool box rear wall. The bass hitch pin rail want to move to the right. The rear wall brings this force to the balance rail. There is another pass behind the rear wall. The balance rail its self has a contact with lower part of the bass hitch pin rail. So on this part there are two passes for the force which is shown by two arrows on the fig 2. The vibration of bass hitch pin rail goes into two ways at the left side of the tool box rear wall and comes together at the right side of the tool box rear wall. These two vibrations when they meet again, are not equal becase they are transformed by materials and at the glueing phase. It is not good basically. Perhaps is desirable or rational for force-resistant structure. This structure may cause slightly peculiar or coloured sound.

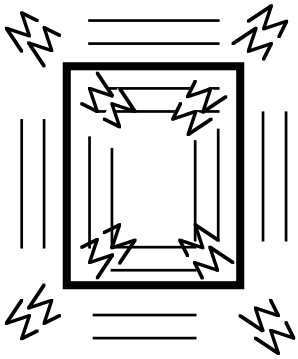
2 Consideration on the corners

Sharp edged corner on the case of the instrument, keys or any part should be avoided. The violin or cello does not have sharp corners. All the corners are round.
So, I made almost all the corners of the case, hitch pin rails, balance rail, soundboard bars, the cut off bar and keys round so that I do not remain sharp edges so far as I can. Following is a consideration on the vibration of the part.

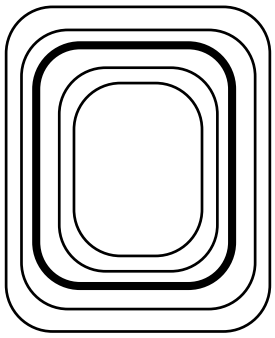
fig. 3 Act of the corners edge

The thin lines show longitudinal waves. The thick line shows a cross section of the part, for example a key, soundboard lib, case and so on.
The vibration of the part, for example a key, make waves in the air like this. At the surface of the part, there come back the reflected wave. It will disturb the normal vibration of the part if it has a sharp edged corner.

3a. sharp edged corner



3b. round corner



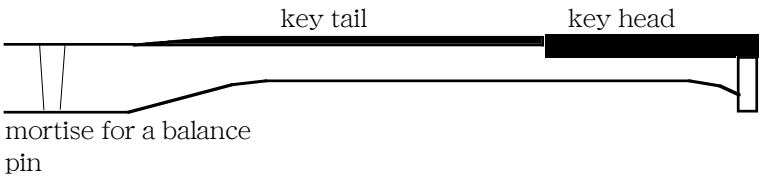
These figures are exaggarated. Actual waves should be more complexed.

3 Considering key design

It is obvious that on clavichords a key is more important than harpsichords because the key is not a tool to push a jack but it supports the vibration of the string with a tangent.

To make the corner of the key round is one way to produces a natural sound. So I make all the corners round, and sanded by a fine file so that there remains no coarsely or rough surface. What the problem is the key top. No one is willing to play a clavichord without key tops. Generally speaking key tops disturbs natural sound. Someone may noticed that after glueing key tail the tone changes quickly. Key tail may be the worst perhaps because it is glued on a key in a long area or there may be another reason. I file the key tail thin in the back. This reduces the badness of the key tail a little bit.

fig. 4 key design



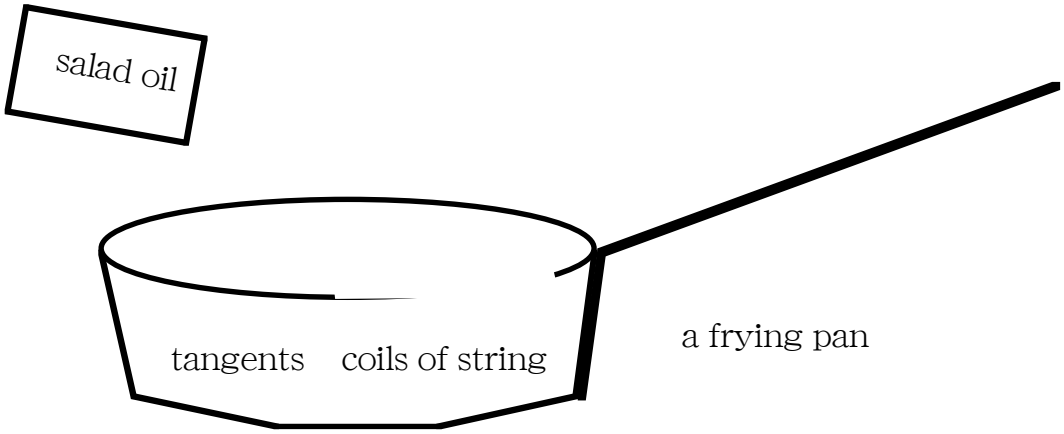
A hole is not drilled through the key but the hole stops before comming out the opposite side. The tangents are cut to the length that the bottom of the tangents come firmly into the key themselves not stopping in the holes.

4 Balance washers

I use very good cow skin for balance washers. They should be smaller the better. They are 5.5 mm in diameter. Very weak natural glue has soaked into them in order to eliminate rustling of the skin. I do not know yet if the glue treatment to skin washers works very good or not so much.

5 Low-temparature annealing (normalizing) tangents

I boiled tangents in oil in order to eliminate remaining stress of them. The tangents are cut from a sheet of brass. So they should have stress in themselves. And this should disturb natural vibrations of tangents. I feel this treatment improves the tone quality so far as I tried. But from the point of metal-engineering there needs further survey on what occurs in the metal.



Caution Salad oil may not be good for brass or other metal !

Because salad oil may get them rusty. Machine oil or better oil will be available.

Caution in addition I boiled not only tangents but also strings once. The temperature of the salad oil was generally low, so there was not large differerence of strength of wire so long as I ever tried. But it is not good if the wire is annealed to a certain level, because brass wire gets too weak.

6 On japaned/chinoiserie instrument

I thought that the japaned finish which is called URUSHI attractive, but URUSHI is very hard when it is dried. So the vibration reflects at the phase between the wood – the film of URUSHI and also film of URUSHI-air. This will colour the sound of the instrument in comparison with a more natural finished instrument. Especially on clavichords this colour may not be so small as on harpsichords.