The Mammoth Piano

- Dean Petrich, RPT -

What is a Mammoth Piano (http://www.mammothpiano.com)? It is a seven-foot-tall vertical piano with a modified grand action inside, designed and built by Chris Chernobieff in Monroe, Washington. I have been following the progress of this project from inception to completion and am convinced that this piano is worth knowing about. When I first saw the Mammoth standing in the room I said, “Wow!” When I played my first note I was amazed at how long the sound sustained. When Chris had me tune the piano, it took me a couple octaves to figure out a pattern, but once I got going it was actually so fun that when I finished, I wanted to tune another one. When I finished tuning the piano, I asked him, **“What on earth inspired you to build a giant upright piano?”**

Inception

Chris said he had built some instruments in the past – particularly a couple harpsichords, a dulcimer, and began building a violin. The building streak was always in him ever since he was little. He had always thought of building a piano, but the major hurdle was the cast iron plate. Years later he read an article in the Journal by Rubenstein about building the 12’ piano. This re-sparked his interest. What struck him was that he used a steel plate that was cut out by a water jet. Chris looked into this and found that there are two ways to cut out steel plates: water jets and lasers. Intrigued by this concept, Chris saw that a door was open and saw that at last he could build a piano.

Being in the piano service business, while going from home to home Chris noticed that a lot of homes have minimal floor space but a lot of head room. Having a 9’ grand that takes up no more space than an upright piano could be a potential market. These dimensions would also be very appropriate for churches.

Inspired by Fridolin Schimmel

He asked himself, “What if I could make an upright to its full potential?” An optimal upright might be an instrument with a grand action and maximum length strings. Actually, he found that placing a grand action in an upright had been done several times in the past. The prominent man who did this was Fridolin Schimmel (1865-1953) in Faribault, MN; he was indeed related to the Schimmels in Germany. As Chris looked up grand actions in the patent search, Fridolin Schimmel’s name came up frequently. He actually owned the Schimmel Nelson Piano Co. On May 19, 1896 he patented the Verti-Grand (Patent #560,431), which was about 6’ tall, and one is now in a museum in Faribault; there is an article on this piano in the *Music Trade Review*. This particular piano was an upright piano with a grand action. The interesting thing in this design was that the hammers were upside-down and near the floor in order to emulate the gravity effect of a grand piano. When he patented this piano he had included two separate action designs. The top of the piano curved like a grand, which was an elegant design. However, since the tuning pins followed the curve, the strike point had to be at the bottom of the piano.

Choosing a Patent Design

In the beginning Chris thought he was blazing a new path, since currently on the market there are no grand actions in uprights; but when he discovered that this had already been done before by Schimmel, he looked at other Schimmel designs. Schimmel had also designed two grand actions that could be installed in any upright. Of the two designs, the first patent Chris looked at (Patent #896,763 from August 25, 1908) was impractical to work on in a piano; for example, in order to adjust the drop, the thickness of the felt had to be trimmed or enhanced from the back of the piano. Schimmels' second design (Patent # 1071801 from September 2, 1913) appealed to Chris because this design was more traditional and practical, was easy to adjust, easy to work on and easy to build. This was Schimmel's last piano design that he never built; a year later he voluntarily left the piano business because the parts he was receiving from Germany were no longer available. Since he refused to build pianos of inferior quality, he went into furniture building and tool design. Even so, Chris had to modify this design to fit a 7' high piano, using a 9'scale. The main change was to make the stickers 3' tall. The other major change Chris made was to invent a sticker assist spring; this spring ended up working so well that the need for leads in the keys was eliminated. Once he determined that the action model worked well, the next task was to design the piano.

Designing the Piano

First Chris made a drafting board that was 8' tall and 6' wide. He designed the whole piano on paper first, using scaffolding. This took about a month. Then he called a machine shop and told them he was going to bring down the design. The shop said, "Oh, don't bother bringing the paper down. Just send us a DWG file," to which Chris responded, "What's that?" It turned out that Chris had to scrap the drawing and ended up buying "TurboCad Pro 14," which is a computer-assisted drawing program. With this program came a couple training courses to learn how to use the program; Chris spent the next three months learning this program, which at first was discouraging. Using his original paper measurements, he was able to re-design the piano onto the computer.

Research

Eight months went by from the time he started learning the cad program to the time he submitted his final design to the shop. During this period Chris read Samuel Wolfenden's writings and many Journal articles. Wolfendon liked a wedged-shaped soundboard, which interested Chris, so he kept this concept in mind. Two Journal articles in particular were extremely useful. One was "Selecting the Dimensions of Soundboard Ribs" from PTG Journal April 1964 by Ulrich Laible. This information was indispensible for Chris' project. The other was "Some Thoughts on the Design of Bass Strings." This was a three-part series by Richard M. Brown, RPT, Portland, from the August 1998 issue of the PTG Journal. Richard Brown's bass string article makes things simple with five rules. One of them is that there is a relationship between tension and length: divide the tension by the length to find the ratio; as a reasonable universal rule, this ratio is 4.5.

Also during this eight-month process, Chris tore apart and examined about twenty upright pianos and totally dissected them, all the time looking for differences and similarities. He measured the ribs, the relations between the bridges and the cabinets, the scales, the plate designs, the struts, and he took micrometer readings of the soundboards at various points. This experience of piano dissection was more eye-opening than reading books.

Soundboard Liners

For example, he started noticing a problem with soundboard liners, which Chris believes is the foundation of a piano. This was his most significant realization. When Chris popped the soundboard out of a Hobart Cable, the whole liner was made of maple except for the top part which was made of poplar; here the liner in the treble was shaved thin to about ½" wide and it was barely glued on. Most piano liners were flat surfaces; he thought, "No wonder soundboards go flat when they are gluing arched soundboards onto flat foundations." Chris wondered if there were some internal crimping going on with such a design, so he set out to make something better.

While Chris was waiting a couple weeks for the plate to be made, he built a soundboard press. He had previously built a soundboard press using the David Hugh's design; this time Chris made some improvements on the design to make the press easy to assemble and reassemble. Once the plate was made, Chris had to go to the metal shop personally to tell them where specifically the welds should be placed for the struts and bracing. With the finished plate finally in his shop, Chris was able to begin building the piano body.

He made a liner jig so that he could make the correct curves and angles for the soundboard liner, knowing how important it is to have the soundboard mate perfectly with the liner. Chris made a big router jig so that his liners were in an arch to match the arch of the soundboard. This soundboard-liner mate is a contributing factor to why the Mammoth piano has such a wonderful sustain.

Plate & Body

Chris built the back frame, put the liner on the back posts with the soundboard glued to the liner, and added the pin-block, the plate, and the strings. What makes this piano different from others is the soundboard liners and the steel plate.

After the soundboard was installed, there was very little sustain. When he installed the plate, he first screwed down the top part of the plate. Then he raised the nose bolts (reaching from the center of the plate to the back posts) so the bottom of the plate was raised above the liner. With the plate off the liner about ¾"at the bottom, he screwed down the bottom bolts, placing the plate under tension. Once the plate was in, it sung like an opera singer: it kept ringing and ringing. When he took the bottom bolts off the plate, the sound was dead again. With a steel plate, Chris was able to use the flexibility of the steel to enhance the tone of the soundboard – something that can not be done safely with an iron plate. What is happening is that with the plate bowed out, the top and bottom of the soundboard are squeezed. The whole structure becomes like a bow: not only is the plate bowed a little, but the back posts are bowed as well. With everything under compression, the tone becomes remarkable.

Action Construction

During this process he also began making action parts and other steps. By having everything designed on Turbo-Cad he was able to make all the parts ahead of time and could then put them together as he needed. When Chris started this process, he was told that the most time-consuming part would be building the action; this turned out to be true. Hand-making all the action parts took about four months. Chris would print out a specific part off TurboCad, such as a repetition lever, and get a copy of this on paper. He then cut out the pattern and placed it on a piece of wood. The first step was to cut out the pattern from a piece of wood 120 times. The next thing was to make a slot on each piece. In other words, from each paper pattern he would make a sample piece and a series of jigs so that he could mass-produce the same series of operations on each action part.

Challenges

The design, construction and completion of Chris' first Mammoth piano took about 2 ½ years. During this entire process, the most difficult part was drilling tiny holes accurately. If these holes are off at all, the hammers won't travel correctly. To get this accuracy with a drill bit that can wander, Chris found a person who makes drill bits and spent some time on the phone to learn about different kinds of drill bits and different ways of drilling. There is a method called "pecking." The natural tendency to drill a piece of wood is to put the bit on top of the wood and to push the bit through. With "pecking" you lightly hit the bit onto the surface of the wood a little at a time in succession. It takes practice to get the feel for getting the pressure, bit speed, bit strength, how hard to peck, how frequently to peck, and knowing the type of wood grain.

The other challenge was the dampers. The Mammoth has the unique situation with such long strings that the dampers can only be so big due to the pivot of the damper lever. When dampers are longer than 2¼" they tend to stay on the strings without lifting: the top part of the damper will lift, but the bottom part barely leaves the string. After much tedious work, and using over-dampers on certain notes, Chris got all the dampers to work. Del Fandrich commented that damper leaks are more of a mass problem than a spring problem. When the spring is too strong, the feel of the key is too strong. Instead, the solution is to replace the wooden damper heads with brass damper heads to add more weight so the dampers stay on the string better. Chris followed this advice and installed brass damper heads on the longest strings in the bass and tenor sections.

Standing Up the Mammoth for the First Time

While the piano was built on its back on sawhorses, standing it up for the first time was very scary. The piano weighs about 1200 pounds. Trying to stand it up without doing any damage to the cabinet, which would cost more money and time in repairs, was a concern. Chris used a winch and had extra people to help. Chris had several concerns: would it be tippy? Would it fall right over? That would be an awful crash. Would the piano need to be bolted to the wall for safety?

Once the piano was standing up for the first time, Chris was greatly relieved. With eight double-rubber casters under the piano, it turned out to be quite stable. To test it, Chris had his help standing behind the piano while he tried to lift the piano by the key bed, and it was much harder to lift than he imagined. For moving the piano, Chris made a special grand board and a special cover to keep the cabinet from getting scratched, so that three movers could move this piano like a grand. He also machine-bolted the cabinet together, making it possible for the entire cabinet to be disassembled if necessary. The cheek blocks, key bed, legs, and toes blocks are all removable, so that the disassembled cabinet itself, lying on its side, is only 1’ wide, 5’ tall and 7’ long.

Plans

Currently Chris’ over-all plan is to have a small manufacturing company making about twelve pianos a year. He has three designs – the “Mammoth VCG” (Vertical Concert Grand), a 7’6” grand piano, to be called “Liberty”, and a 9’6” grand piano, to be called “Jupiter”. Notice that all of these names represent really big things. He wants to be a small company that thinks big. By keeping the company small he would be able to achieve quality, uniqueness of design and rarity. He wants to avoid mass-production because he likes the craftsmanship required for things hand-made. Chris is also contemplating making a Mini-Mammoth that would be 6’ tall for universities and for homes with lower ceilings. It would be equivalent to a 7’ grand and would fit in a practice room. As he talks, he continues to list countless more possibilities.