The Molinari Twin

Craig Smith (with input from Bob Cole)

Part of the enjoyment of a new mechanical music machine is the story of its acquisition. We try to collect both the instrument and, wherever possible, its history. And the last chapter of its history is how it came into our hands. People love to ask and it's fun to tell about the lengthy search or the happy accident that brought the music box or barrel organ into our home. But COAA member Bob Cole may be unique when he answers that question about his Molinari barrel organ. He didn't find it in a dusty attic—he didn't track it down through previous owners—and he didn't inherit it from his uncle Luigi.

He actually made it himself! That's right, from casework to barrel pinning to pipe making, he built it from scratch (**Figures 1 & 2**).

Figure 1 (above). Front view of Bob Cole's replica of a Molinari Organ.
Figure 2 (below, right). A rear view of the organ at a recent COAA rally.

And I got to watch!

About 10 years ago, I received a call from Jeff Vincent. He and I collaborate on restoring antique barrel organs. Jeff wanted me to meet a fellow who had built a small, roll operated crank organ—could he bring him over to our house. Sure, I said, bring him over. But quite honestly, I didn't expect much because I know how difficult it is to restore and tune an antique organ, much less build one from scratch.

What a surprise! Not only was this organ beautifully made, but also it sounded great. Even the carrying case was finished to perfection. Through research, experimentation and trial-and-error, Bob Cole had made a crank organ that was the equal of any you can buy. He took what he had read about the builders of antique (and modern) machines and filled in the blanks with methods he invented himself. As he learned more by reading and observing different machines, he continued to compare designs and make improvements. In the following few years, he built two small, roll-operated reed organs—both to the same high quality.

We kept in touch through numerous phone conversations and occasional visits. Bob would call with questions and comments about antique machines but I suspect that I was learning more from him than he did from me. In any case, a second opinion always has value—sometimes to the person asking the question and sometimes to the person who is responding. It was during one of these conversations that I learned that Bob would really like to make a real barrel organ. The problem was the barrel—or more specifically, the music on the barrel. Great arrangements were essential. Who would want a beautifully made organ that had lousy music on the barrel? Bob wanted to know if I thought he could copy an existing barrel to provide the music, if he made the rest of the organ himself. Also, would anyone be willing to loan his or her organ to him for several months if he decided to go ahead.

At about the same time, my friend Jeff had another problem. He had acquired the remains of a small barrel organ from the auction of the Musical Museum in Deansboro, NY. He wanted to use the parts to make an organ that he could use to show how a barrel organ works. All

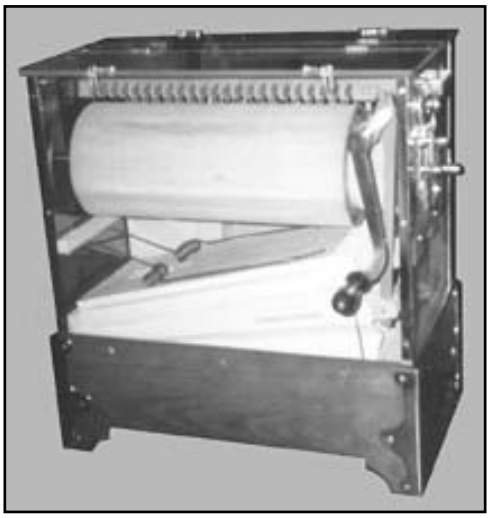


Figure 3. Jeff Vincent's transparent organ case.

the parts were there except the case. Since I had seen an organ with a transparent plastic case at a recent MBSI meeting, I suggested that approach. Great, but he didn't have the tools or the time to make such a case.

As a bystander to these problems, the solutions were obvious. After a few phone calls, Jeff offered to loan Bob his Molinari organ to copy and Bob offered to make a plastic case for Jeff's naked organ parts (**Figure 3**). In fact, Jeff's 1920 Molinari went back and forth several times in the 19 months it took Bob to build the replica.

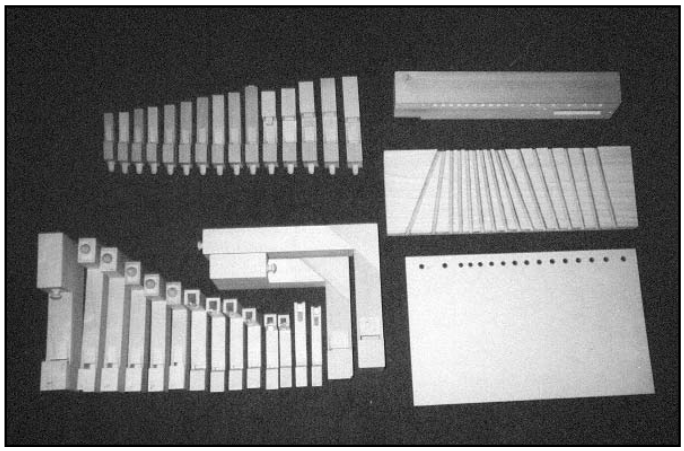


Figure 4. The completed pipes, case bottom and chest. Also in view are the parts for the riser.

The first step was to make measured drawings of all the parts of Jeff's Molinari organ—a job in itself. Based on these drawings, Bob made a prototype case from birch plywood to use while he made and fitted all the internal components. Of course, the case was made in two parts (base and upper case) like the original with a thin bottom in the upper case. Next came the pipes and the bellows system.

The pipes were made from fir and maple (for the fronts). Bob had saved a couple of prime quality fir 2 x 4's years ago and he bandsawed off a few thin pieces to make the pipes (**Figure 4**). The wood was then sanded to precise dimension on a thickness sander he made for the purpose. The freins for the violin pipes on the bottom were made from brass stock using a cutting jig and a bending fixture (**Figure 5**). He did resort to using bought screws to hold them in place. In fact, Bob made every part of the organ except the common

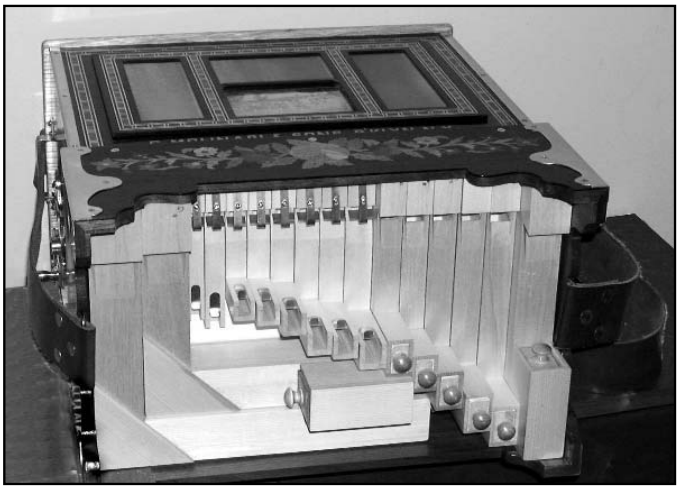


Figure 5. A view of the bottom pipes.

hardware. In total, there were 31 pipes—15 stopped pipes on top of the windchest and 16 pipes (eight open violins and eight stopped flutes) on the bottom of the case (**Figure 5)**. The pipes and most of the rest of the organ were glued with yellow wood glue.

The bellows, reservoir and the riser (that conducts the air from the windchest to the pipes on the bottom of the organ) were made from clear, quarter-sawn fir that Bob had been saving for about 30 years. The wind chest was made from clear poplar. The chest was actually glued up from several layers of poplar but the surface where the pallet valves are mounted is aircraft grade plywood, to provide an absolutely flat and smooth surface for a good seal (**Figure 6**). Wind channels and pipe mounting holes were machined before assembly. The bellows and reservoir are covered with pigskin, with 1/64" thick plywood stiffeners. The pallet valves are covered with thin sheepskin. Finally, the reservoir springs were carefully bent from piano wire to match the originals, as were the pallet valve springs.

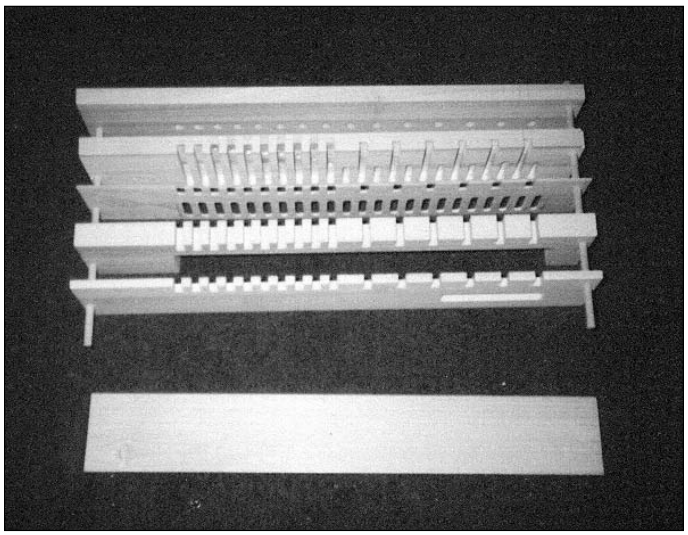
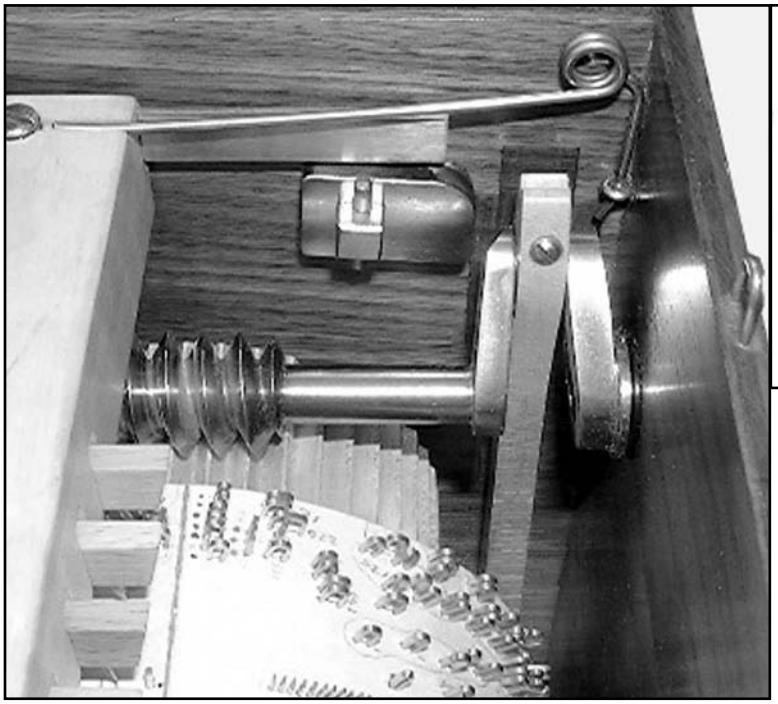


Figure 6. The chest parts before assembly.



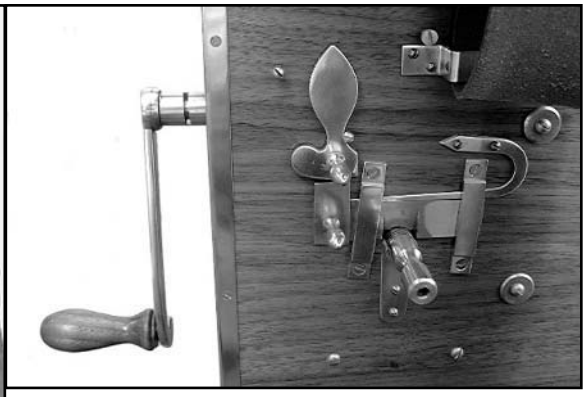


Figure 7 (above). The crank and barrel controls were made from brass and steel.

Figure 8 (left). The worm gear, cog, eccentric and other hardware.

Figure 10 (below). The switches mounted above the original barrel.

Next came the crank assembly (**Figures 7 & 8**). Bob started with a large steel bar and machined it down to the size needed for the worm that drives the barrel cog. On each side of the cog, the shaft was reduced to the correct diameter for the shaft itself. Then the threads on the worm gear section were cut to 4 threads per inch (tpi) on a thread-cutting machine lathe. Finally, the back end of the shaft was internally threaded (10 tpi) to accept the screw on the crank. This was done by Jim Foote, who had made this unusual size tap when he restored his own Molinari organ. The eccentric arms were made separately so that they could be slipped onto the shaft and silver soldered in place with the appropriate 90-degree offset. The brass and steel hardware that positions the barrel was fabricated from bar and rod stock at this time, as were the maple connecting rods.

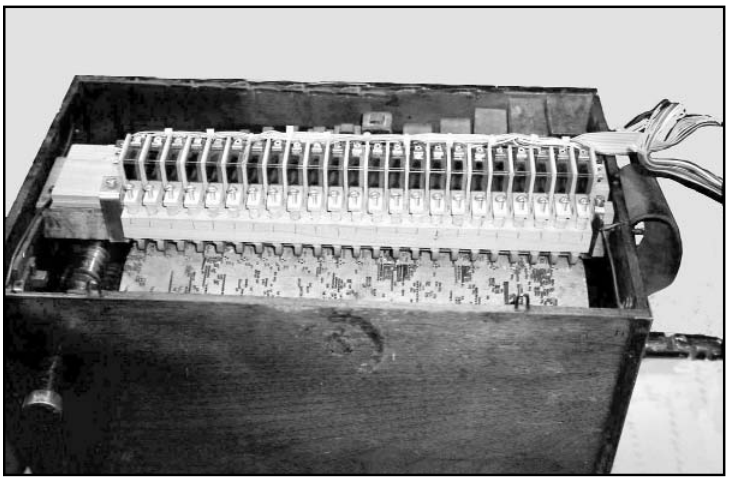


Figure 9. Craig and Bob happily marking the pattern for the barrel pins.

Next came the key frame that holds the individual keys and positions them with respect to the barrel and stickers (the stickers and sticker guide were made from poplar). It is very important that the spacing of the keys and barrel pins be exactly the same. So Bob made a metal spacing template to match the spacing on the original organ. The body of the key frame was machined from a solid piece of birds eye maple. A groove was made the full length of the bottom to accept the steel rod that holds the keys. The rod was placed into the slot and a strip of maple is glued in. This created a precisely located hole that runs the full length of the key frame. Then the rod was removed and the key frame blank was clamped in the milling machine. Using the metal template, Bob cut 23 slots to accept the 23 keys. Each key was made from beech, with an adjustment screw eye at one end and a metal finger (made from a nail) at the other. Then the key was put into a positioning jig and the finger was ground to shape. The hardware necessary to position the key frame in three dimensions was fabricated from steel rod and flat stock.

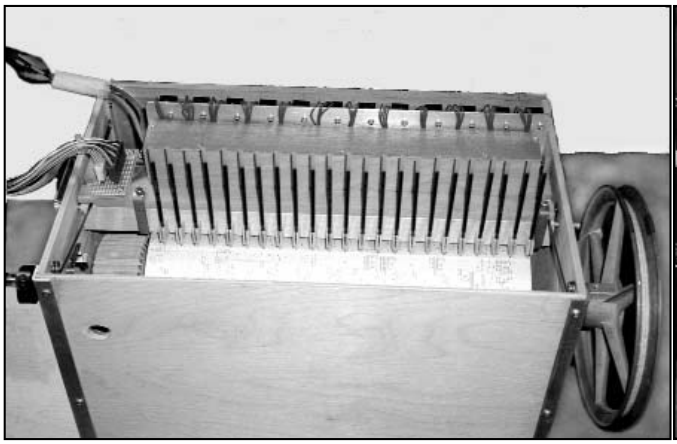


Figure 11 (above, left). 23 pens mounted above the new barrel.

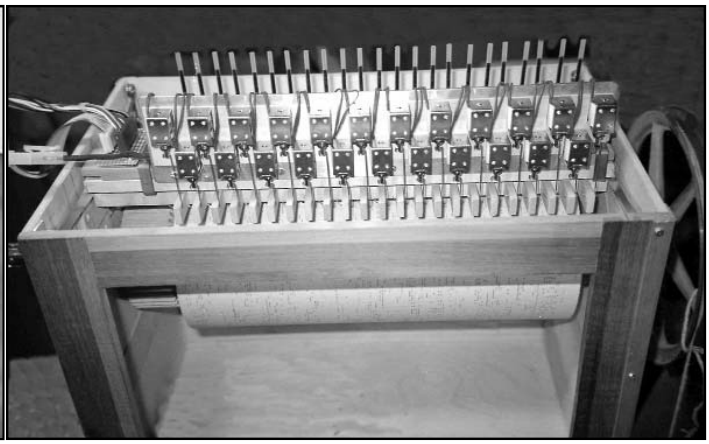


Figure 12 (above, right). The solenoids that activate the ball point pens.

Then came the tricky part!

As in an antique organ, the barrel itself was glued up from poplar staves, like a cider barrel. Tune selection grooves were cut into a steel bar and the bar was mounted concentrically in the barrel. This shaft was mounted in the lathe and the barrel was turned to the correct diameter. The large drive gear (cog) was turned from end-grain beech. With a thread-cutting tool mounted sideways on the tool rest of his lathe, Bob made repeated cuts across the surface of the cog (see **cover photograph** for details) until each of the 44 teeth was at the right depth—a tiresome task at best, but nothing compared to what came next.

Pinning the barrel was a four-step process—read the original barrel, mark the new barrel, make the pins, and insert the pins. My suggestion was to make a barrel reader so we could put the music into a computer and make any necessary adjustments. A barrel reader would also make it possible to read an orphan barrel, to investigate the tuning of an organ during restoration and to provide music for Jeff's transparent organ (which has no pins in the barrel). In fact, Bob and I actually built a barrel reader at this time, but, instead of using it on his replica, he came up with another, clever method to read the old barrel and to mark the new barrel at the same time.

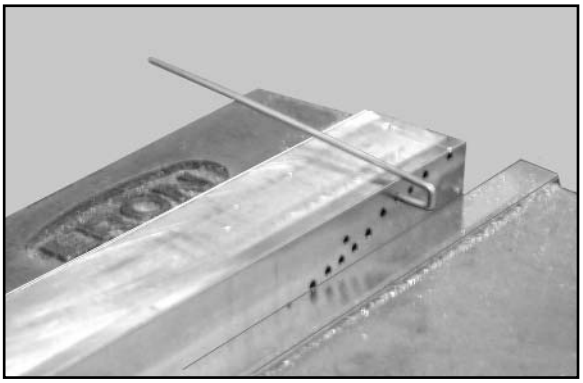


Figure 13. The fixture used for bending the bridges to the correct size.

First he covered the new, blank barrel with white paper, mounted the cog to the barrel and mounted the barrel in the prototype case. Then he placed the original organ next to the new organ and made a coupling to clamp the two barrels together, end-to-end (**Figure 9**). Now the barrels could be turned in sync. Next he made a set of micro-switches mounted on a frame above the keys on the original organ (**Figure 10**). Then he made a special key frame for the new organ that had ballpoint pen refills where the key tips would normally be and solenoids to pull up the other end of each key (**Figures 11 & 12**). The pairs of switches and solenoids were connected in series with a power supply. When a key on the original organ was lifted by a pin on the original barrel it would cause the corresponding solenoid on the key frame of the new organ to pull in—which caused the pen tip drop, making a mark on the new barrel. Simple but effective!

We all got together for a barrel-marking bee. I turned the crank of the Molinari while Bob and Jeff made sure that the machinery operated properly. We did each tune twice to

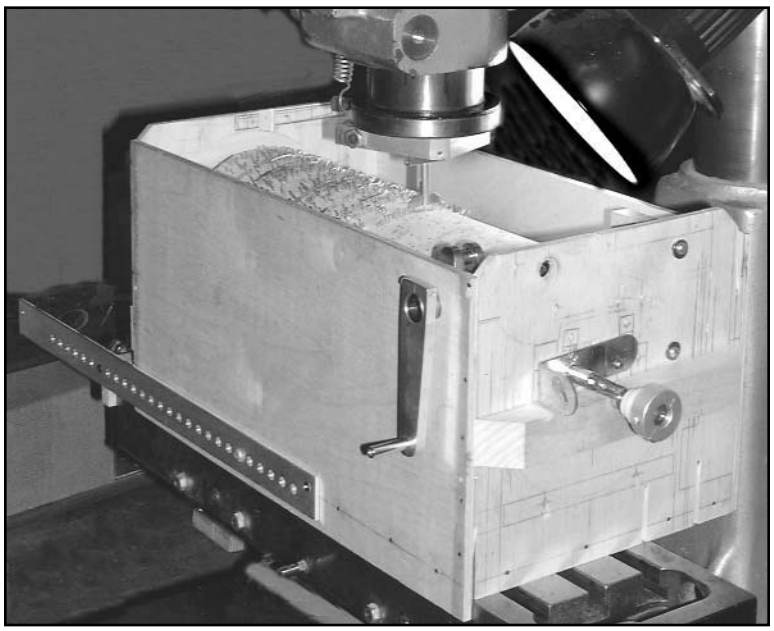


Figure 14. The fixture used for pinning the barrel.

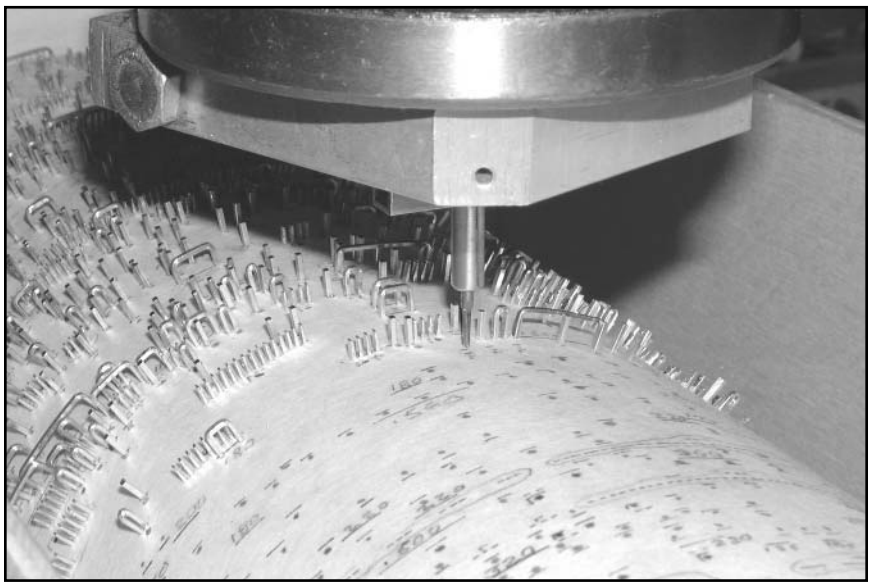


Figure 15. Pressing the pins to depth on the milling machine.

ensure that the marks were consistent. Just to be sure, Bob went back later and measured each bridge and marked the exact length on the barrel.

On to the next step—making the pins. 100 years ago they had brass wire of the correct shape and machines to make the pins and bridges automatically. Those days are gone, along with the machinery. While all the pins were 0.045" wide, they were of different thickness and the bridges were of different lengths. Bob started with 0.045" square brass wire. Most pins and all bridges were thinner so Bob used his thickness sander to reduce the square stock to 0.045" X 0.030" or to 0.045" X 0.020". Then he used a cutting jig to make all the single pins from either the original square wire one of the thinner wires. All the bridges were made from the thinnest stock. To make them, Bob created a jig with a series of holes at different distances from the edge (**Figure 13**). By inserting the end of the wire into the appropriate hole, he could use the jig to bend and cut the 10 different length bridges required. In some cases, two bridges were placed end-to-end to create longer notes.

The total number of pins cut? About 4500!

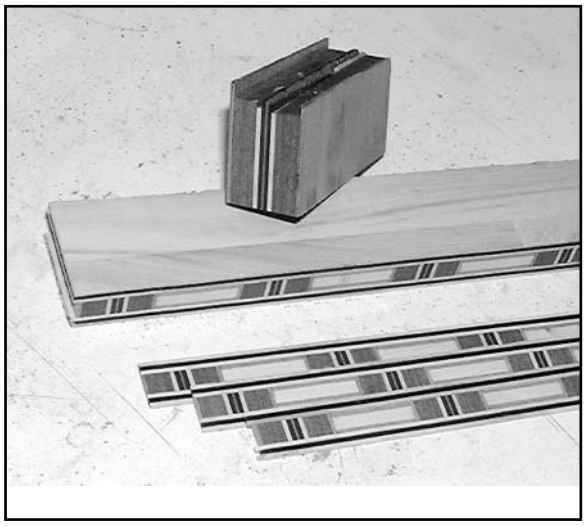


Figure 17. Examples of marquetry construction.

One more fixture was needed to mount the barrel on the milling machine so that the pins could be inserted. It was a box, like the upper case, with provision for the crankshaft and the tune selection knife (**Figure 14**). Along the front was that template with the correct spacing for the 23 keys. With a locating pin in the first hole in the template and the knife in the first tune groove, the table was moved to the correct position for the first row of pins on the barrel and locked. By moving the pin to each of the 23 holes in the template and the knife to each of the seven grooves in the shaft, the barrel was moved to each of the 161 rows. Bob used a two-part tool in the mill to insert the pins. First a sharpened, rectangular punch was used to make a hole in the barrel at each pin location—two holes for a bridge (**Figure 15**). The pin was inserted part way by hand. Then a contoured metal cap was placed over the punch and the pin was pressed in to the correct depth. This process took about 160 hours over a period of five weeks (see **Figure 16** for the partially completed, new barrel).

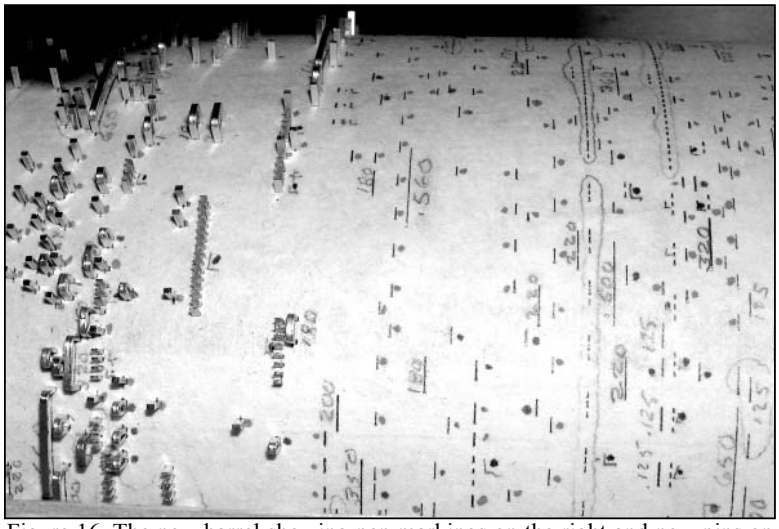


Figure 16. The new barrel showing pen markings on the right and new pins on the left.

Last came the real case. Nobody makes walnut plywood in the correct thickness any more so, big surprise, Bob made it himself. The inner ply even has an insert so that there is no end grain showing along the top edge of the case or the base. The corners are finger-jointed, like the original, even though they don't show behind the brass corners. The decorative band-

ing around the front was a lesson in geometry. A solid block was glued up from many layers/blocks of walnut, padauk, ebony and maple. Thin strips were sliced off the block, sanded to the right thickness and glued to the front panel. Finally, Bob made Xerox copies of the marquetry on Jim's organ and cut thin sheets of veneer from blocks of exotic hardwoods. He then glued the picture to the veneer, cut out each of the 64 pieces (using the Boulle method) and assembled the pieces into a floral design with an ebony background (**Figure 17 & 18**). Bob used some tricks from the original craftsmen. For instance, to make the long thin holes through the edge of the wood, he made tiny "D"-shaped spoon bits that don't wander off center.

He actually made it himself! That's right, from casework to barrel pinning to pipe making, he built it from scratch!

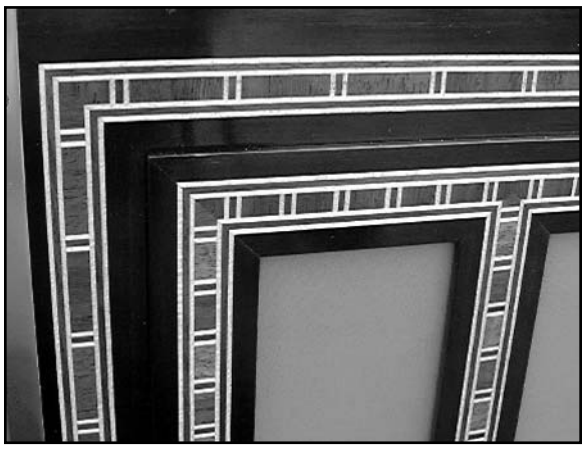


Figure 18. Detail of the front panel banding.

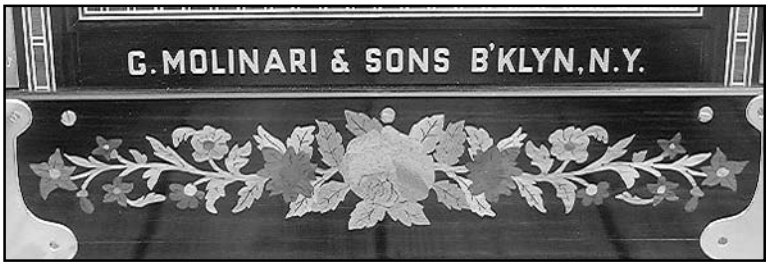


Figure 19. Gold waterslide decal and marquetry.

After several coats of varnish, the case was ready for its nameplate and tune sheet. The original name on the front was a gold decal with the Molinari name on it. Since Jeff's decal was damaged, Bob made a tracing and I scanned it into the computer where I could fill in missing elements and clean it up. We then used a special printer to make a real, gold, water-slide decal that he could apply to the organ (**Figure 19**). In the meantime, Bob made copies of several pages from a type font book and cut out individual letters to compose the text for the tune sheet (based on Jeff's damaged original). He then had a print shop make a copy on appropriate paper and typed in the tune list, just like the original (**Figure 20**).

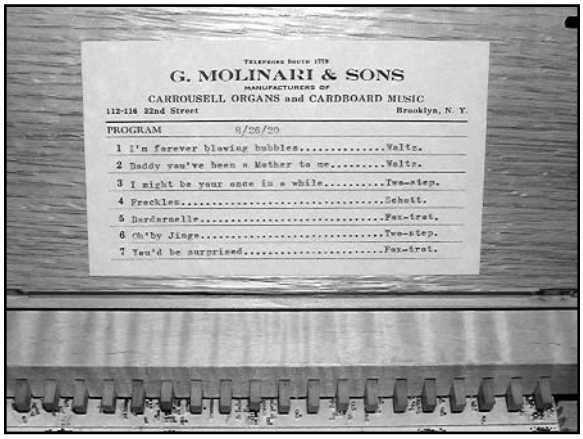


Figure 20. The tune sheet.

So, there you have it. From a stack of raw wood and metal to a twin of Jeff's Molinari organ in three easy lessons—well, maybe a few more than three. I asked Bob why he did it and this is what he said.

"I had six reasons:

1. For the **challenge**—it certainly was
2. To **save money**—it certainly did (the cost was less than $300+including $50 for the ebony and $150 for the brass wire)
3. To have a **reliable organ** made from new parts—they are all new
4. For the **learning experience**—it was (for me too—CAS)
5. To **learn respect** for the original craftsmen—boy, did I ever!
6. To **add another organ** to our collection—we finally did"

Craig Smith retired from Xerox in Rochester, NY in 1999. A member of both COAA and MBSI , he has been collecting and restoring music boxes and barrel organs for over 25 years. Recent projects include the barrel reader mentioned in the article and the restoration of two, English, barrel-operated, street organs made around 1800. Bob Cole retired from Spectracom in 1999 where he was a product engineer responsible for the mechanical design of electronic products. He is a member of both COAA and MBSI. He has no background in music but his hobbies include flying his own plane, making models and woodworking.