Jigs III
Making a Barrel Organ Cog

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Photographs by the author

Introduction

In past articles I dealt with the design and construction of fixtures that were made to help in the uniform fabrication of identical parts and many parts of the same sized shape. Some of the parts made were cut of wood, others were of leather and even paper.

As described in both of the previous jigs articles, time was spent in the beginning of the parts fabrication process to set up general purpose tools (table saw and drill press) to safely and consistently do a specific job.

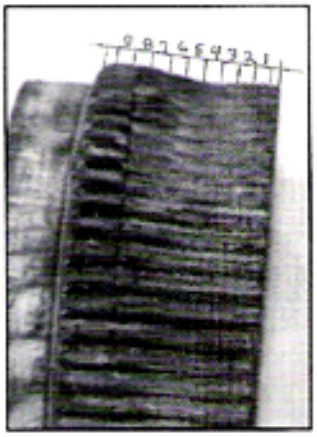

Photo 1. The original cog gear from a Gavioli organ.

Project History

Recently I was asked to reproduce a barrel drive gear for a 1895 Gavioli nine-tune street organ. This organ had been carefully and lovingly restored by its owner, but after rebuilding nearly a dozen pipes, refinishing the case and recovering the pump bellows and pallet valves, he still was able to hear it play only three of the nine tunes pinned on its only barrel.

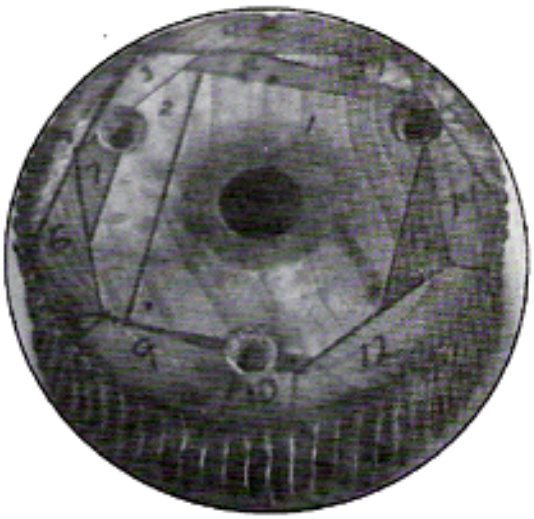

Photo 2. Original gear constructed of 18 separate pieces of wood.

Sometime between 1899 and its most recent restoration, previous owners had apparently oiled the worm and barrel cog along with the cranking shaft and its bearings. This action caused the teeth in the barrel cog, made of fir, to soften and rot away (Photo 1).

Before the restoration, in order for the organ to be played, the previous owners had altered the crank shaft case hole. It was filed downward elongating the normally round hole so the cranking shaft could be forced deeper (and deeper) into this worn and rotten cog. It is my belief that this alteration was done to allow the operator to continue to play the more popular songs pinned on the barrel. What I viewed as the less popular songs were those that still had comparably more usable teeth on the gear. They were the last three songs on the barrel (in positions labeled 7, 8 and 9). Owing to this logic, the most popular songs must have been located at approximately the third, fourth and fifth positions on the barrel (Photo 1).

Description of the Gear

In remaking a part, it is always my intention to make that part just as it was originally constructed. I do this mainly because I view the original design and construction as time- and task-tested technology and partly out of respect for the original builders. I made an exception, however, in making this gear.

The original cog (approximately 4 ½" in diameter x 2 1/8" thick) had a core made of maple and walnut with an outer rim of what seemed to be fir. Eighteen different pieces of wood were glued together in a very loose pattern, as seen in Photo 2 (a view of the case side of the gear). The construction mystery deepened when I viewed the barrel side. I found only 14 different pieces on that side of the same gear. This bizarre construction led me to believe that this gear was not made in any special design fashion but was made up from all of the scraps of lumber that happened to be lying around the shop floor on the day the manufacturer made gears.

No matter, I carefully made measurements of the original gear, or what was left of it (Illustration 1), and noticed the center shaft hole was tapered 1/32" in 2 1/8"

allowing the outer 1/3" of the center hole to tightly hold the barrel shaft. With this design the gear, when originally installed, could have been shimmed between it and the barrel to eliminate any wobble. I also noticed that the inner face of the gear, the surface that mated with the barrel, was slightly concave allowing only about ½" around the gear to rest against the barrel. I am sure this was also originally done to help in correctly mating it to the barrel.

The Need of a Jig

The same kind of repetition used in making many of the same parts used in player pianos was present in making this cog with its consistent divisions.

Therefore, my focus in the reproduction of this gear changed from that employed in the past. Instead of making 160 identical parts, as in making new striker pneumatics for the player piano, one action was performed many times at different places on the same part to make the gear.

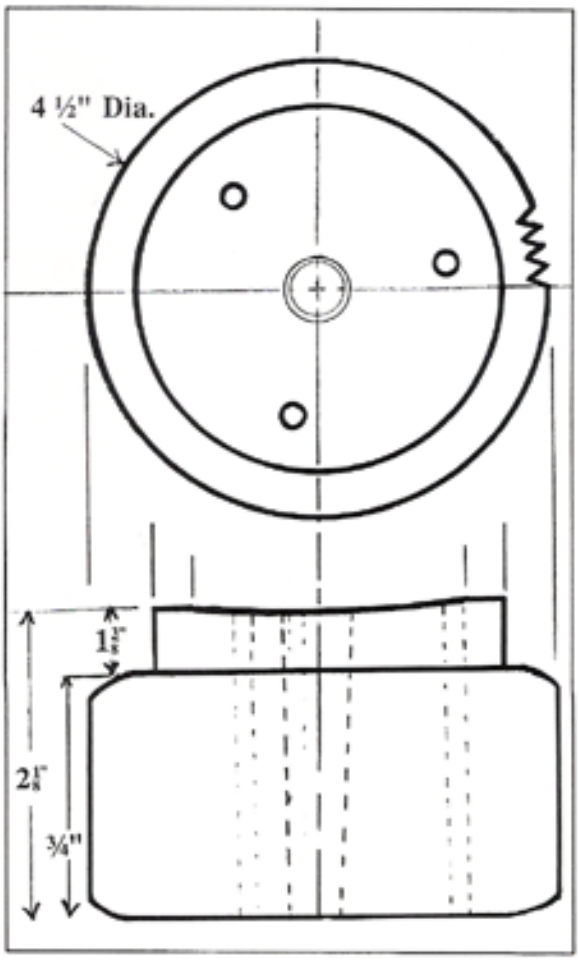

Illustration 1. Dimensions of the original cog gear. This drawing is only to show a rough shape, not as a working drawing.

Wood Stock

After seeing many barrel organs, noticing their construction, reading many of the available books on the subject and doing restorations including the gear for my personal barrel organ, I concluded that ash was the wood of choice in barrel gear construction and repairs. This is the wood I used in making my gear.

Machines and Power Tools

In a previous jigs article I described using both my table saw and drill press. Both tools were used to build this cog, but this time the main tool required was a metal lathe (Atlas 10" swing screw lathe).

Hand Tools

I used just a few hand tools in making the copy of this cog: three Jorgensen parallel jawed gluing clamps large enough to hold the three wood blocks together until the glue was dry and an adjustable Blue Point hand reamer, 11/16" to ¾", to size the center hole of the gear blank to fit the first jig, a mandrel.

Jig Parts/Construction

Two lathe jigs were built to make the gear; the first held the gear blank centered for turning The second securely held a router to the compound carriage of the lathe to hob (cut) the teeth into the blank (Photo 3).

The center hole of the gear was measured to establish the size of the mandrel to be made. This mandrel took the place of the barrel shaft on which the gear was installed while working inside the organ.

The second fixture was constructed on a base of angle iron that had been bolted to the lathe carriage. Two ½" threaded rods were used to suspend the main plastic part of a Sears Craftsman router plunge attachment. This setup allowed me the flexibility of not only moving the router bit in and out, but also allowed the cutter to be raised and lowered, when needed.

Making the Gear Blank

Using the table saw, I cut three 18" sections off an 8' x 6" x 2 ½" piece of ash. These sections of wood were flipped over and rotated so that the end grain was radiating toward the outer edges (Illustration 2)

After the glue between the three parts had dried and the clamps were removed, I placed the large block of ash between lathe centers, checked for clearance and cut it round (Photo 4).

It was important not to trim the diameter of the block too small while rounding it. The purpose of this step was to simply form the stock into an oversized round gear blank (Photo 5).

After the stock had been removed from the lathe, this 18" turning was taken to the table saw where it was sliced into pieces wider than the original gear (Photo 6).

PHOTO 3. BOTH FIXTURES INSTALLED IN THE LATHE.

At this point in its fabrication the new gear blank was center drilled to near the required size and reamed to fit the lathe mandrel. Remember, this gear had to be fitted to the original barrel shaft, and the reaming process was a very important step. The blank, fitted snugly on the mandrel, was then placed into the lathe and cut to true it across the face as well as both sides. It was still oversized (PHOTO 7).

The trued blank was removed from the mandrel in order to install the original gear before final shaping of the blank. Both the original gear and the new blank were side by side in the lathe for this process (PHOTO 8). It was also at this point that I marked the new blank to mark the location of the three holes for the wood screws that were used to hold the finished gear to the barrel. They were drilled before the teeth were cut. One of these holes was used to orient the new cog to the original.

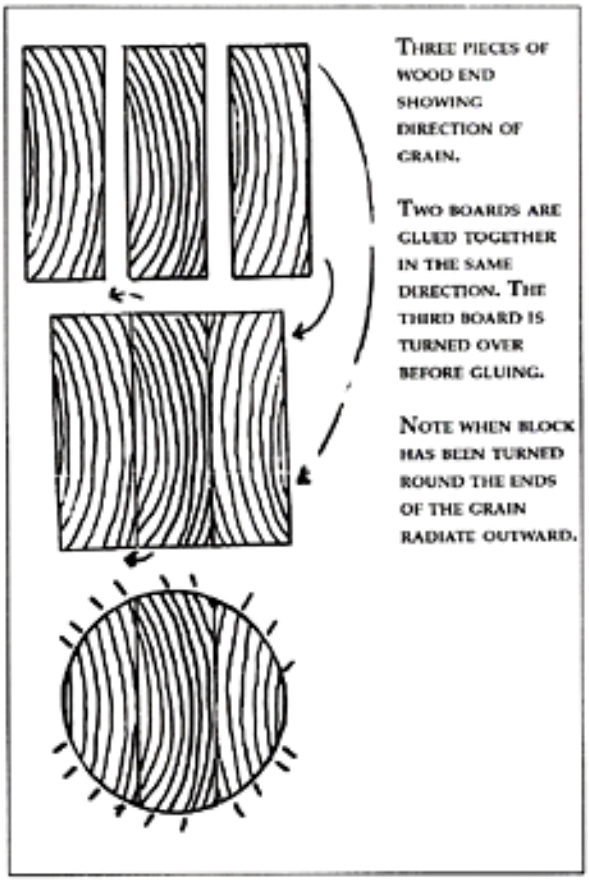

ILLUSTRATION 2. THE THREE SECTIONS OF WOOD WERE FLIPPED OVER AND ROTATED SO THAT THE END GRAIN WAS RADIATING TOWARD THE OUTER EDGES.

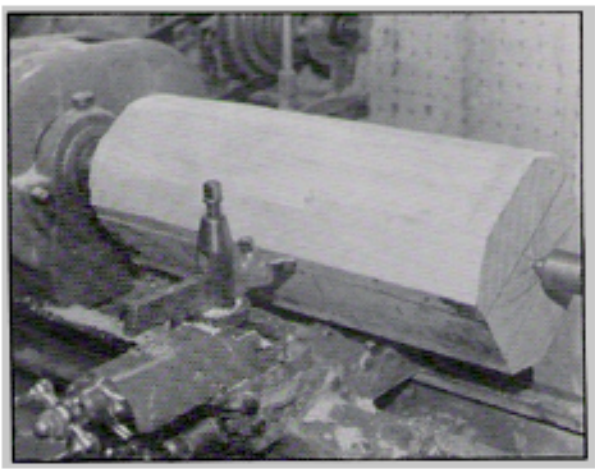

PHOTO 4. THE LARGE BLOCK OF ASH WAS CENTERED IN THE LATHE AND WAS CUT ROUND.

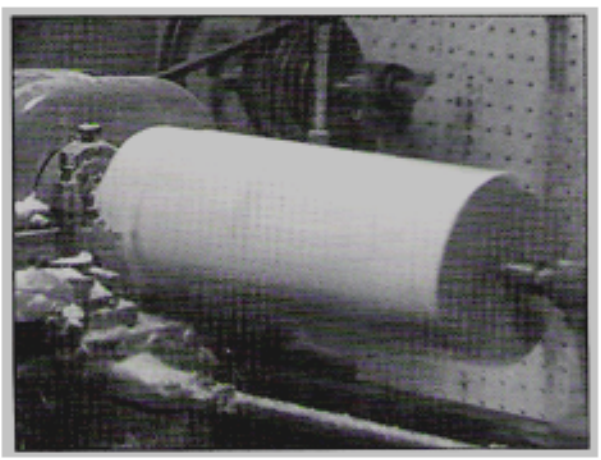

PHOTO 5. TURNING DOWN THE STOCK MAKING IT ROUND.

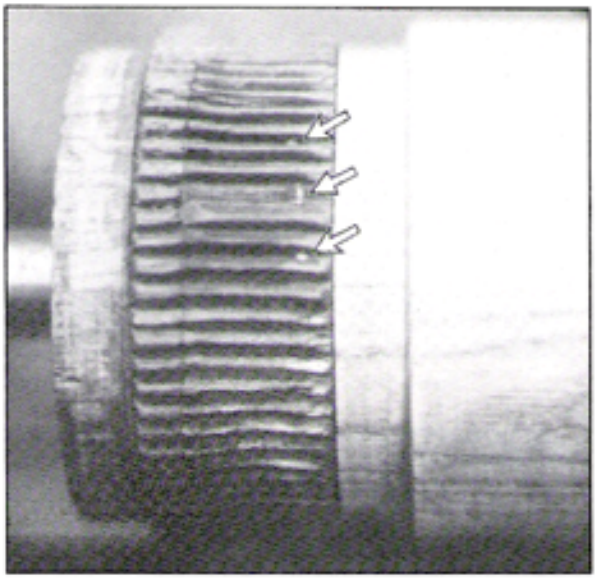

PHOTO 9. THE ORIGINAL GEAR (LEFT) AND NEW GEAR BLANK CUT TO SIZE AND FITTED IN THE LATHE. NOTE THAT THREE OF THE FIVE NAILS USED IN A PREVIOUS REPAIR ARE VISIBLE.

BE CAREFUL when rotating the gear blank in setting up the next cut. THE ROUTER IS STILL ON AND THE BIT IS TURNING. KEEP YOUR HANDS AWAY FROM THE ROTATING ROUTER BIT.

CONCLUSION

Though the jigs described were originally assembled for making repairs on a Václav Hrubes 28-key organ (PHOTO 14), I was able to adapt the con-

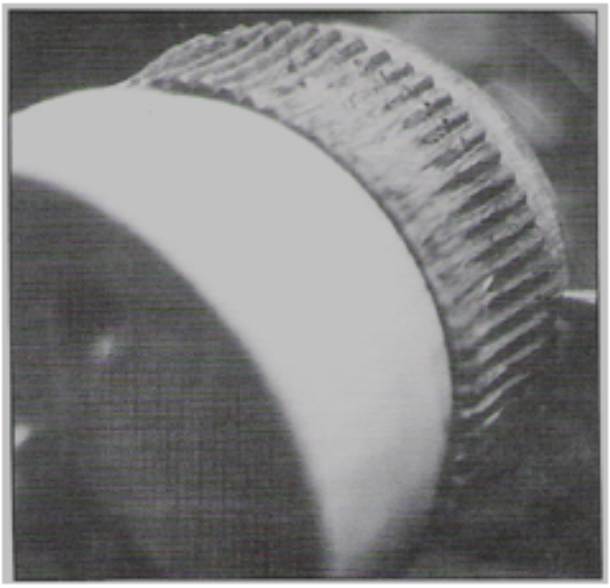

PHOTO 10. SETTING THE DEPTH OF THE HOB CUTTER.

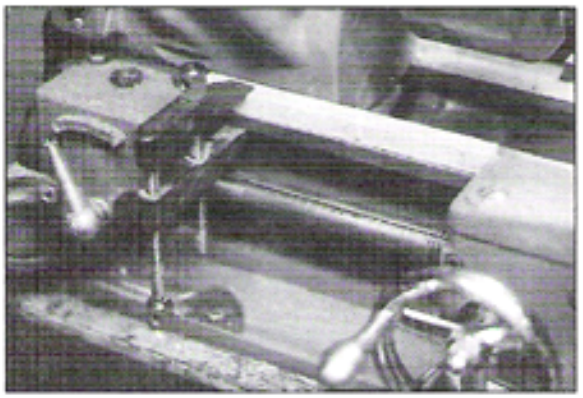

PHOTO 11. INSTALLING THE CARRIAGE STOP AT THE LATHE HEAD STOCK.

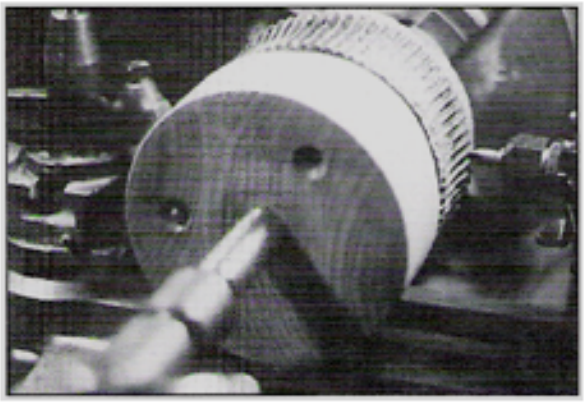

PHOTO 12. A VIEW OF THE COMPLETE TEETH-CUTTING OPERATION.

PHOTO 13. THE GAVIOLI STREET ORGAN WHICH HAS A NEW COG GEAR.

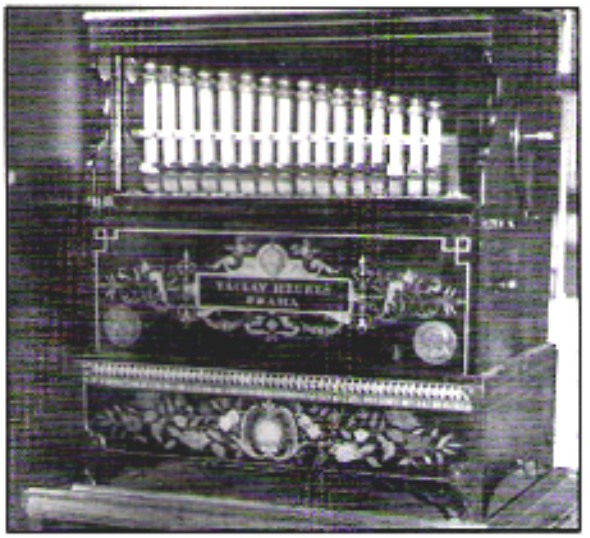

PHOTO 14. THIS IS THE VÁCLAVE HRUBES 28-KEY ORGAN WITH TWO BARRELS, PRAHA, CZECHOSLOVAKIA, FOR WHICH A COG GEAR WAS ORIGINALLY MADE USING THE STEPS IN THIS ARTICLE.

cept to make a gear for this Gavioli nine-tune barrel organ. I believe by keeping this in mind these gear-making steps could also be translated and adapted into designs for many similar parts in other brands and machines (PHOTO 15).

I felt confident that the new cog I made would fit the Gavioli, that it would run true, and that it would properly operate the organ when installed. In fact, each of the nine tunes pinned on the only barrel of this 1895 Gavioli street organ now play very well.

AUTHOR'S NOTES

In this article I explore one way of solving a task relating to the restoration of a barrel organ. (Further information on different types of these machines is found in *The Barrel Organ*, Arthur W.J.G. Ord-Hume.) As stated before, in restorations I try to use parts made of/with the same design, supplies and materials as were originally used. I don't believe I use them either better or worse, but sometimes differently.

This article is my way of helping the hobbyist/restorer do the cleanest, most concise and safest job of building, restoring or repairing the damage that time or a less patient person has created. Further, I know the methods shown in this article work for making a wooden cog. I have always welcomed constructive critiques of my work and ideas. I feel it would be beneficial to all of the members of the Society if members with differing methods or those interested in restorations would write their ideas and/or adaptations of ideas in the form of articles and submit them to the MBSI Editor for possible inclusion in future editions of *Mechanical Music*.

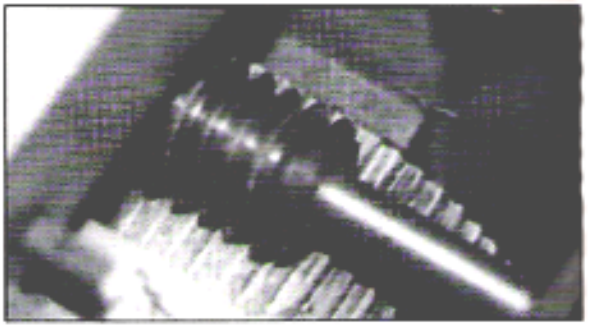

PHOTO 15. BARREL GEAR IN THE ORGAN READY TO PLAY.

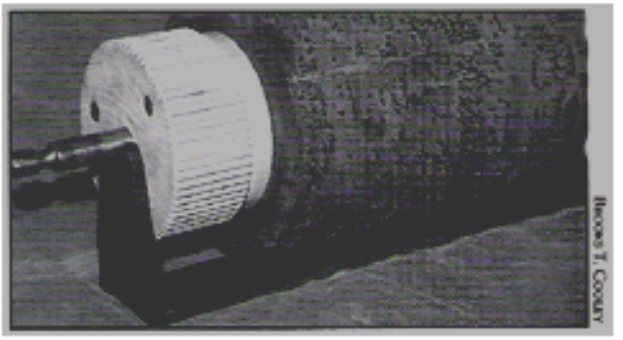

PHOTO 16. THE GEAR WHICH WAS CUT USING THE TECHNIQUES IN THIS ARTICLE.

REFERENCES:
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"Making a Wooden Clockwork," *Fine Woodworking Magazine*, Tunton Press, Vol. 57, pg. 58.
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Related articles by the author: "Jigs, Restoration Aids for the Restorer," Gary G. Stevenson, *Mechanical Music*, Vol. 37, No. 1, 1991; "Jigs II, Restoration Aids for the Restorer," Gary G. Stevenson, *Mechanical Music*, Vol. 39, No. 3, 1992.

GLOSSARY OF TERMS:
Cogwheel: a gearwheel, especially one having teeth of hardwood or metal.
Mandrel: a usually tapered or cylindrical axle, spindle or arbor inserted into a hole in a piece of work to support it during machining.
Hob: a cutting tool used for cutting the teeth of worm wheels or gear wheels.

BIOGRAPHY
THE AUTHOR IS A COLLECTOR AND RESTORER OF ALL TYPES OF MECHANICAL MUSICAL INSTRUMENTS AND A MEMBER OF THE MBSI PUBLICATIONS COMMITTEE. HE EDITED THE MASTER INDEX OF THE MBSI *TECHNICAL BULLETIN*, 1967-1985. THIS IS HIS SEVENTH CONTRIBUTION TO THE *JOURNAL*. GARY AND HIS WIFE ROSE HAVE FOUR CHILDREN AND GARY IS AN ADMINISTRATOR WITH THE ST. LOUIS, MO, PUBLIC SCHOOLS.