

Gary's Laminated Side Escapement Plane

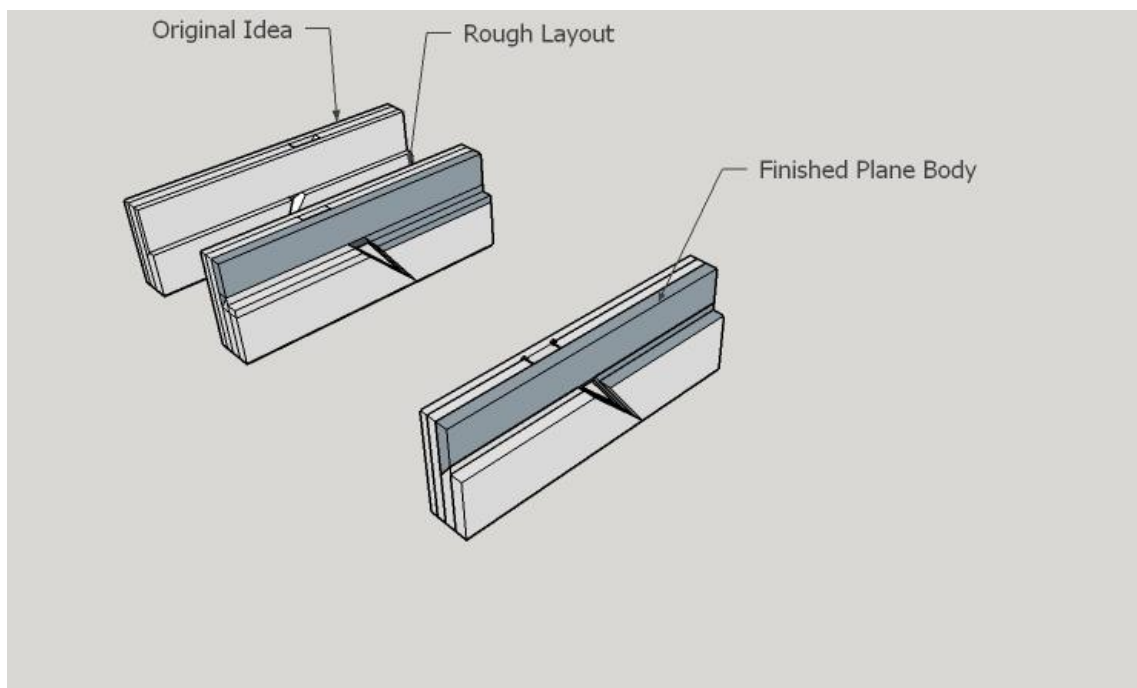
How it was done.

By Gary Mercer.

I wanted to make a side escapement wood plane by using laminations glued together and this is the method I used. I know that the typical method was to drill, saw, and use floats to create the wedge cavity. The prospect of all the layout and steps involved would require me to be a master woodworker, which I am not. The other thing I thought about is that with today's glue being much better than glue 100 years ago that it may work ok.

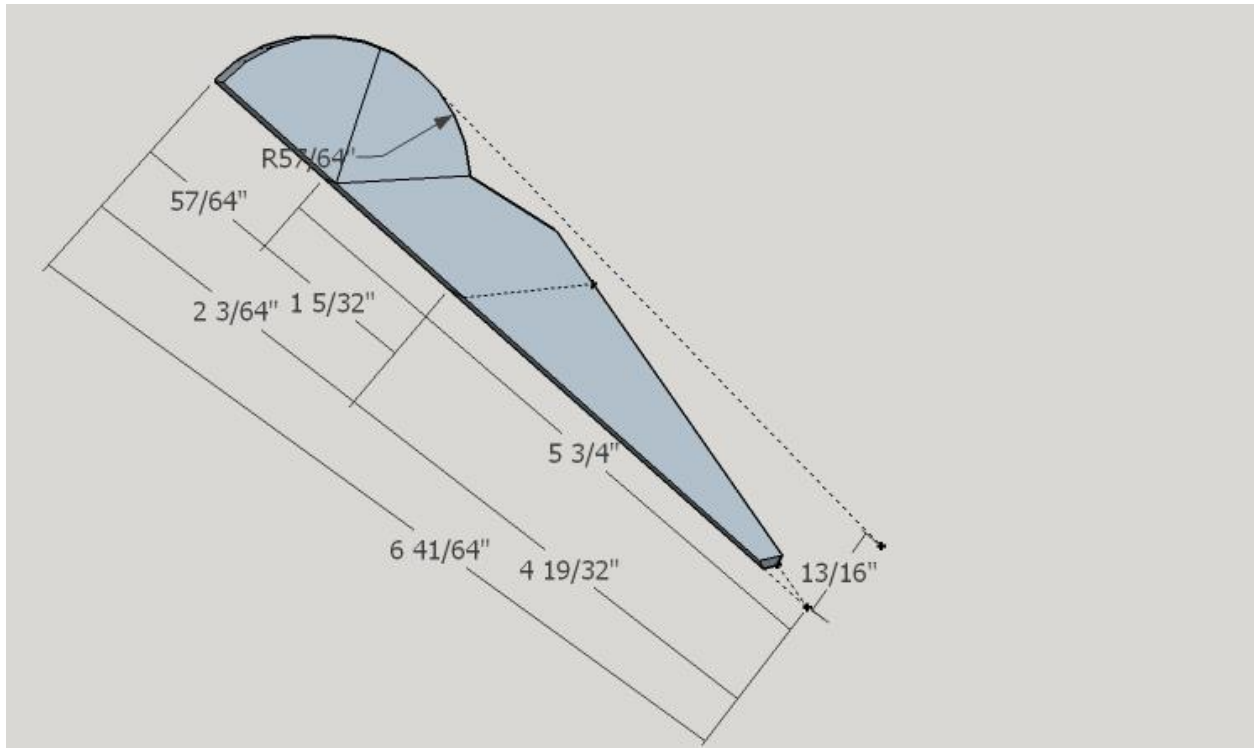
I had acquired an antique hollow escapement plane and fashioned my sketch up plan from it. My original sketch up drawing used basic dimensions and simple angles so I could better see if I could possibly find a way to make one using layers of wood so I could make my cuts using my table saw and a miter saw. It looked possible!

The Rough Layout came next. I started to refine the angles and dimensions to better suit how the plane could be assembled in layers and how it could be cut to the right shapes before gluing it together. In sketch up I created components (parts 1 thru 5) for the finished Plane Body. My thought process is pictured below. I made the Finished Plane Body by re assembling the components as if I was gluing it together and that convinced me it could work.



I decided to use a bed angle 45 degrees and a 10 degree wedge. I know tradition is 55 degree bed and a 12-1/2 degree wedge but I already had a wedge jig for making 10 degree wedges, so there it is!

The next step was to draw the wedge. I again referred to the antique for the shape and length, and this is what I came up with using SketchUp.



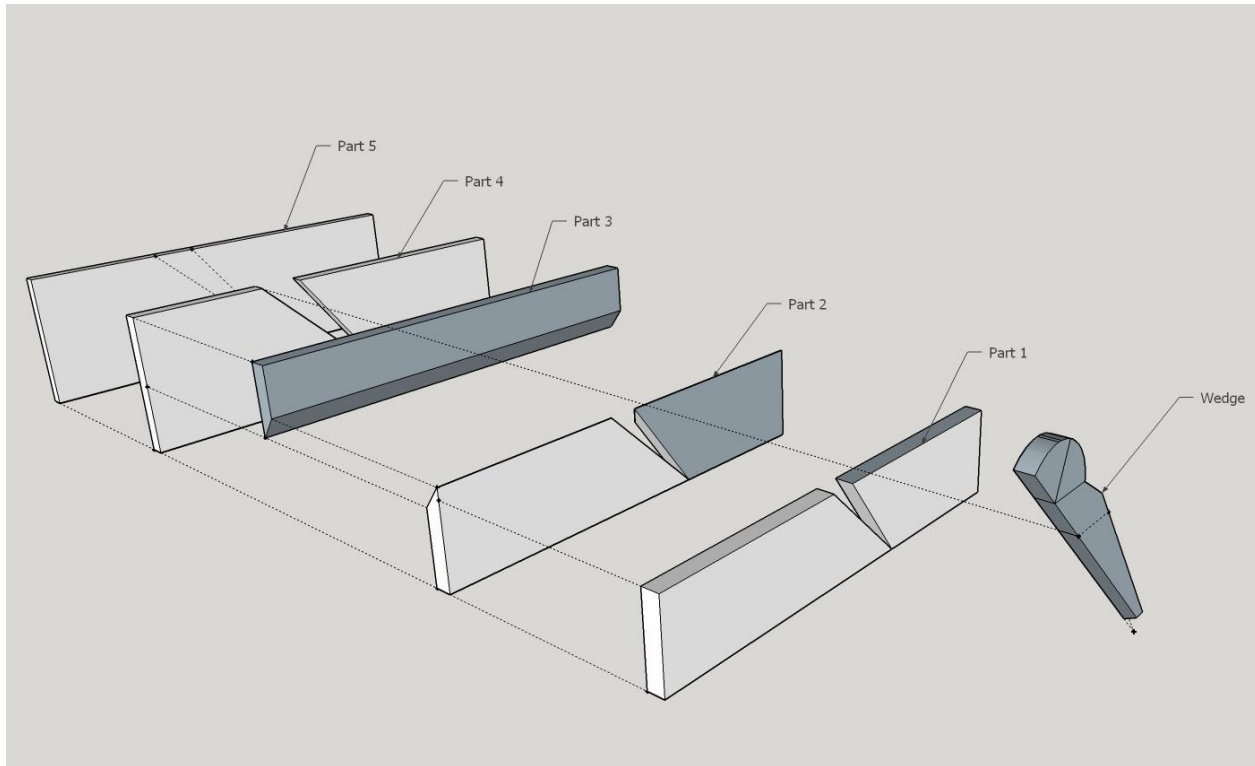
I needed a way to cut a precise 10 degree wedge so I used a jig I had previously made for another project. The Picture below is a staged view of how the wedge is cut using the jig. The cut off to the left of the blade is the actual wedge.



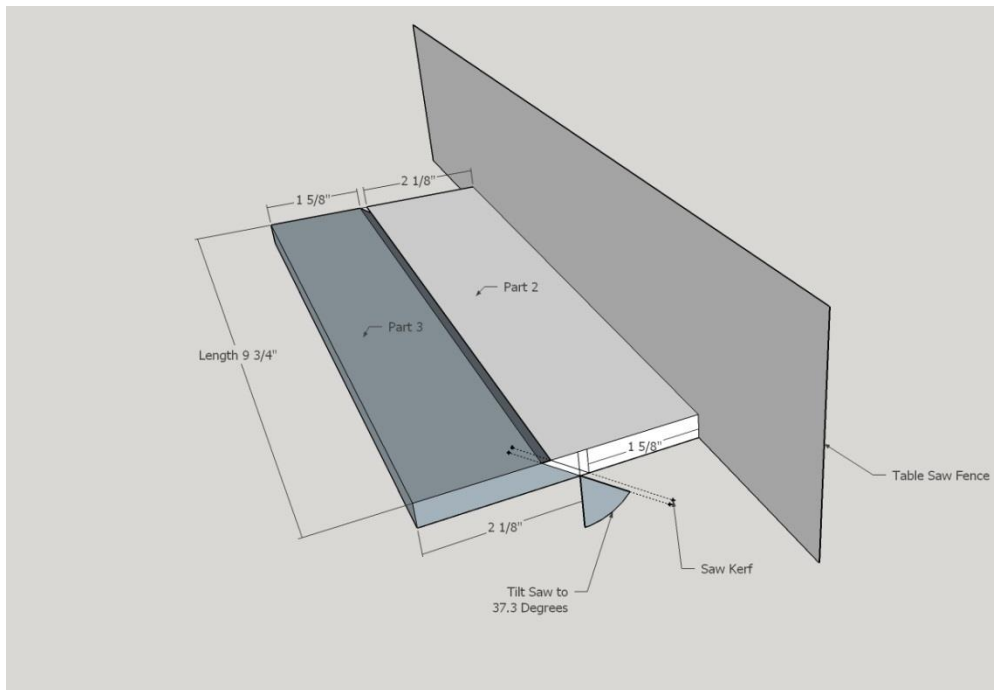
I recycled a piece of quarter sawn hard maple that was large enough, and the wood grain was oriented as to count the grain from bottom to top. I re-sawed the block of wood into pieces (next 2 photos), and then planed them to the right thickness using a bench top planer. I stuck the parts to a carrier board with double sided tape to assure a consistent thickness, and ran them through my planer.



Part 2 and Part 3 are separated from one board before cutting out the wedge pocket. (Print this page to make it easier to follow along)



Shown below is how I separated Parts 2 & 3 on my table saw, from one board.

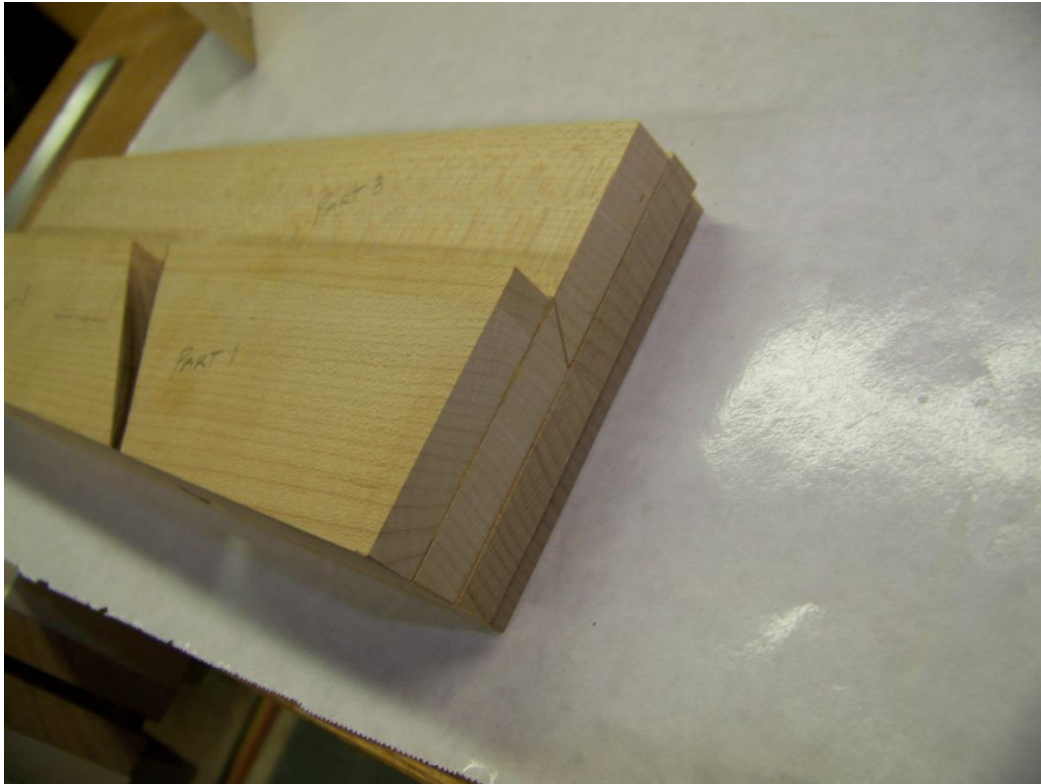


It's time to cut out the wedge pockets. I use a miter saw that I normally use just for 90 and 45 degree angles. I first cut the 45 degree angles on each of the Parts 1, 2 & 4.

Next, I scored a temporary sacrificial table and verified that the saw was set at 55 degrees by checking the score cut. Then I cut the 55 degree angles. (See the following 2 photos).



This is basically how the laminations will go together (next 2 photos).

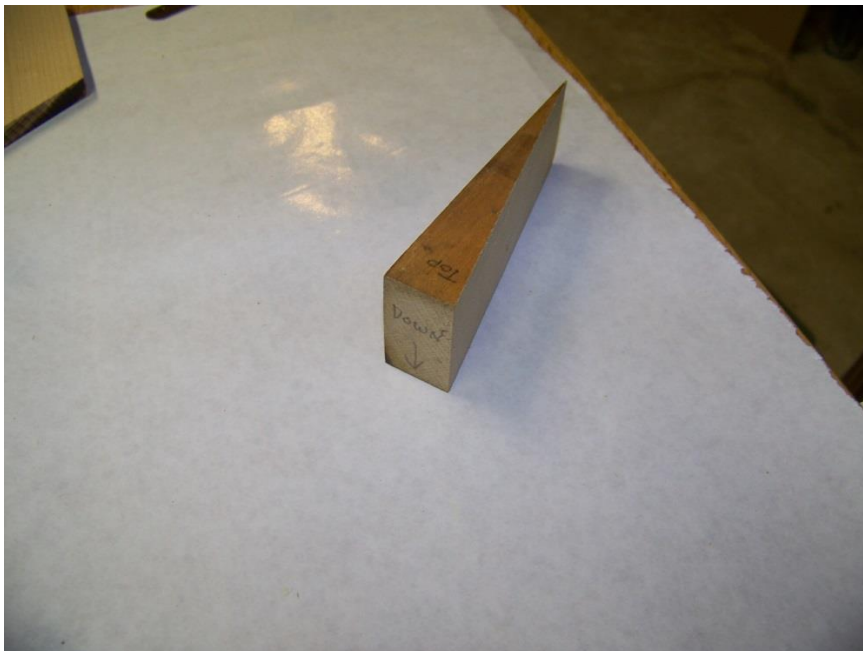


Glue Up Chapter 1 (next Photo)

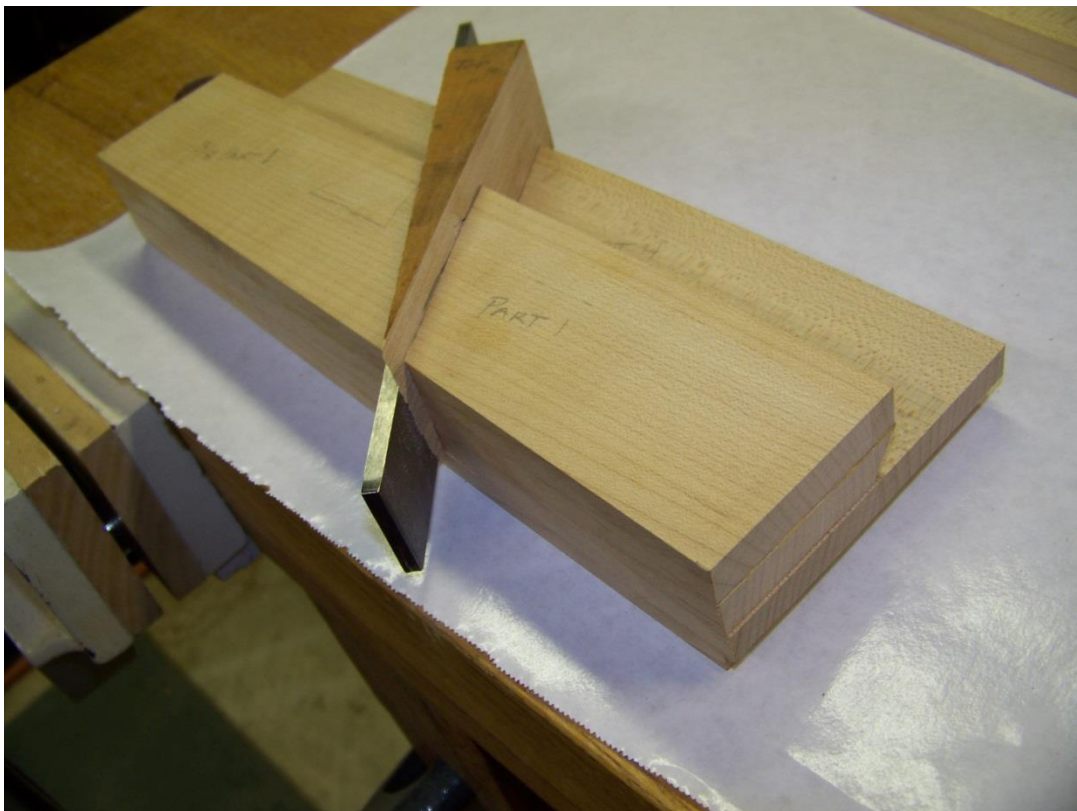
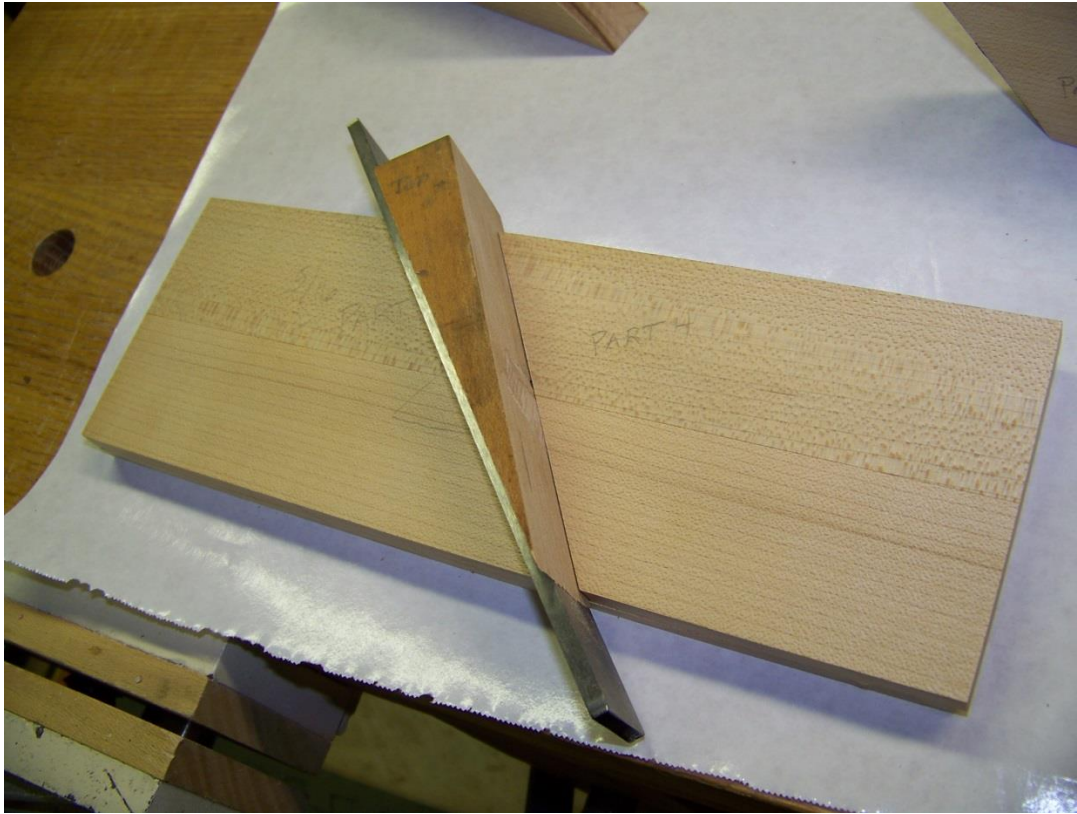
I glued up some of the parts, carefully aligning the bottom edges. Shown below is The Rear of Part 4 glued to Part 5 (bottom of photo). I also glued Parts 1 & 2 (front and rear) to each other (top of photo), being careful to align bottom and the wedge angle edges.



Next I made a temporary wedge (shown below) that was thicker, and square, to check the fit of the parts before gluing any more parts.



Now for a look at how it's going to fit together.



Dry Fit: So far, so good!

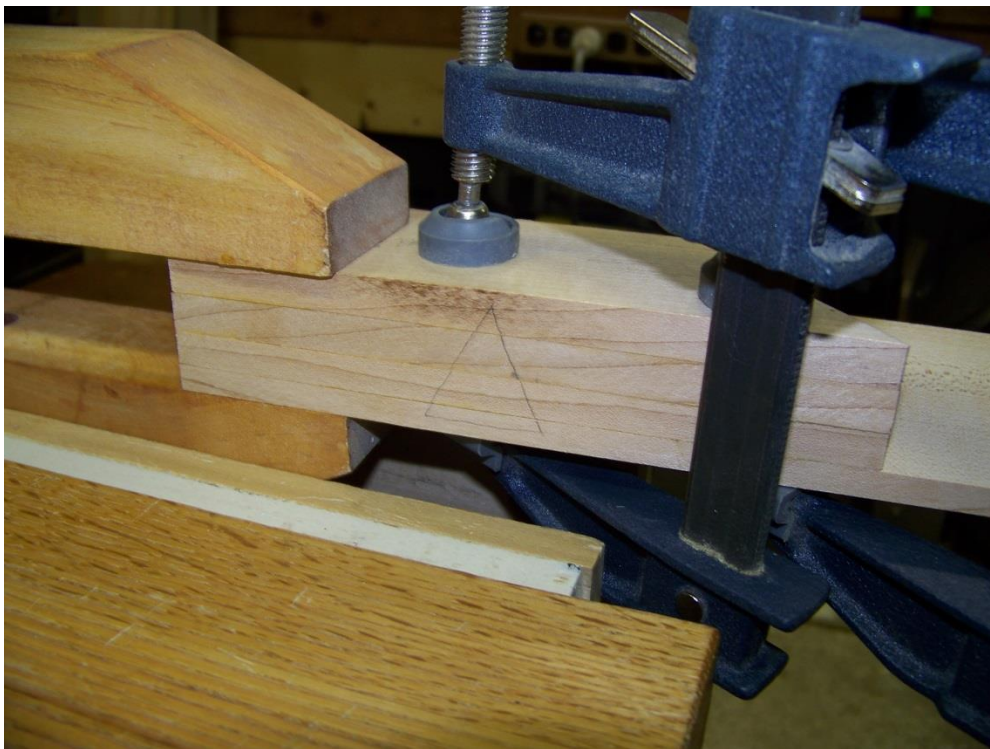


Glue Up Chapter 2 (next 3 Photos)

I now glue the already combined Part 1 & 2 (rear section) to Part 4 (rear section).



The Main consideration here (in the next 2 photos) is to make it flush with the wedge cut-out, and the bottom (far length edge in the photo). I cleaned up any glue squeeze out, especially in the beveled joint!



Glue Up Chapter 3

I used the blade steel as a spacer, with the wedge just protruding beyond the bottom about 1/16" to provide clearance for wood shavings, then glue Part 4 (front section) to Part 5. Again flush to the bottom.



Here is the fit after the glue dried.



Glue Up Chapter 4 (dry fit)

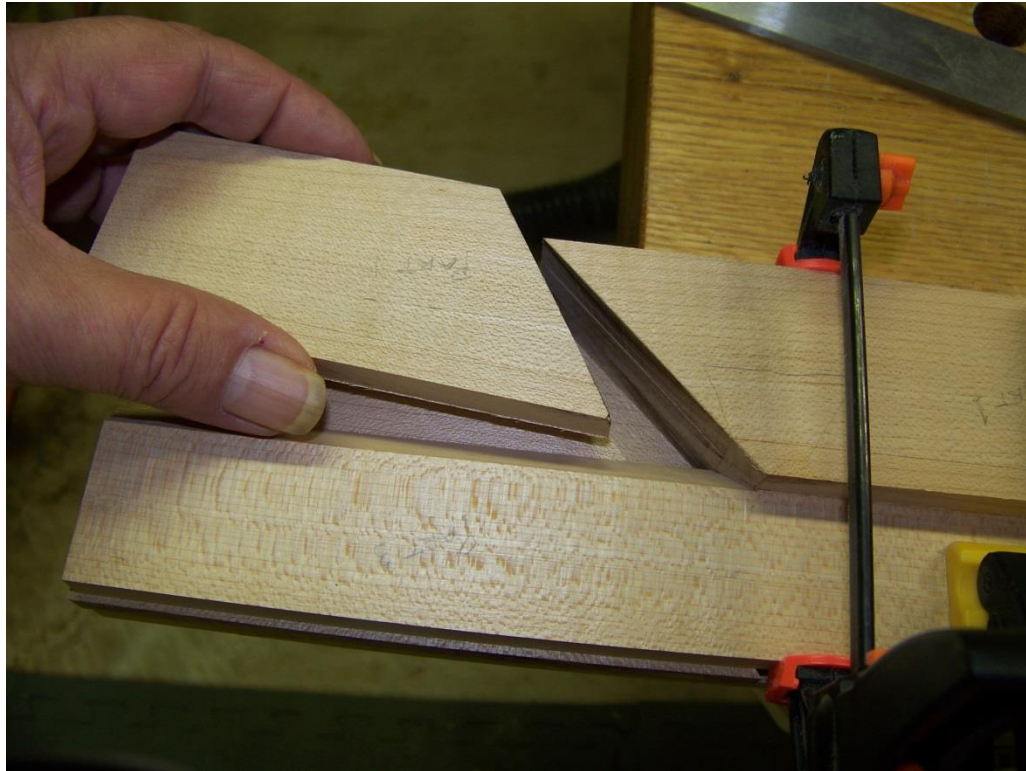
Remember that long beveled (part 3) strip I didn't cut a wedge opening in? It will now be used to align the next phase of the glue up.

Take the strip (Part 3) and dry fit it in place matching bevel against bevel (next 2 photos).

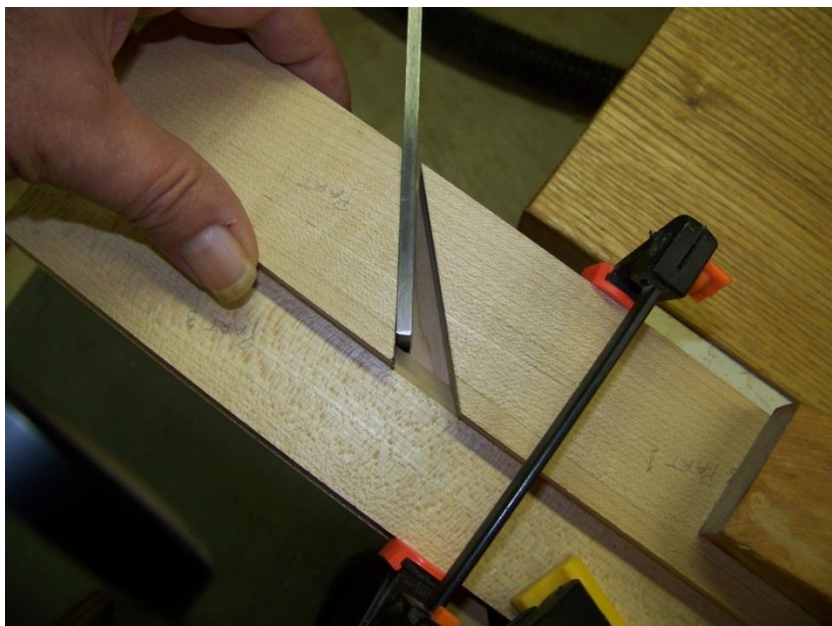


Remember; No glue yet! Part 3 is being used for alignment at this point!

I used a couple of mini-clamps to register Part 3 into the bevel. The next step is to dry fit the already combined Parts 1 & 2 and to check the fit.

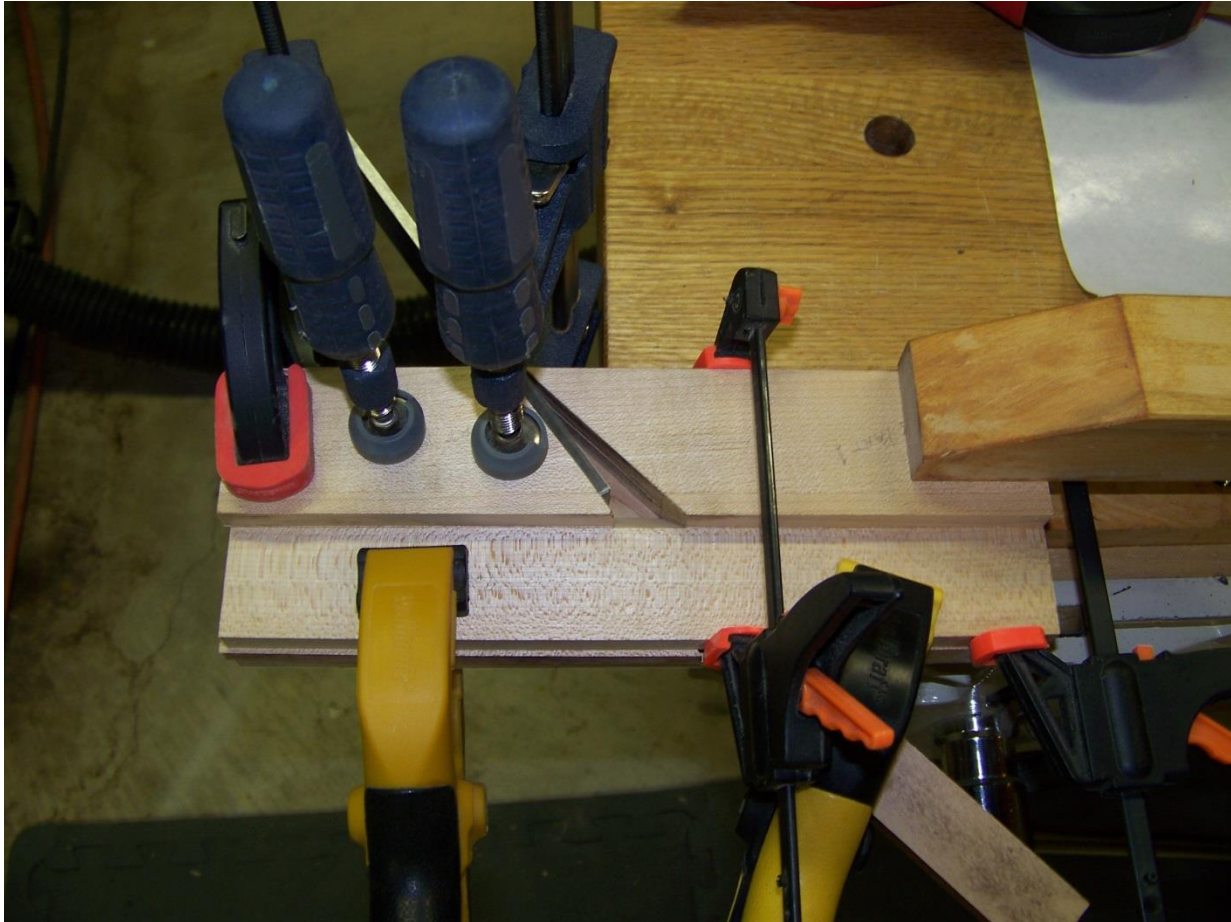


Use the blade steel and wedge to make sure the wedge and bevel edge (on part 3) is a match when the wedge is snug.



Glue Up Chapter 5

Now the combined Parts 1&2 front section can be glued to Part 4 and clamped. Remove Part 3 (the long beveled strip) and set aside. Remove the wedge and blade steel. Clean off any squeeze out especially in the bevel and in the wedge opening. Let the glue set.



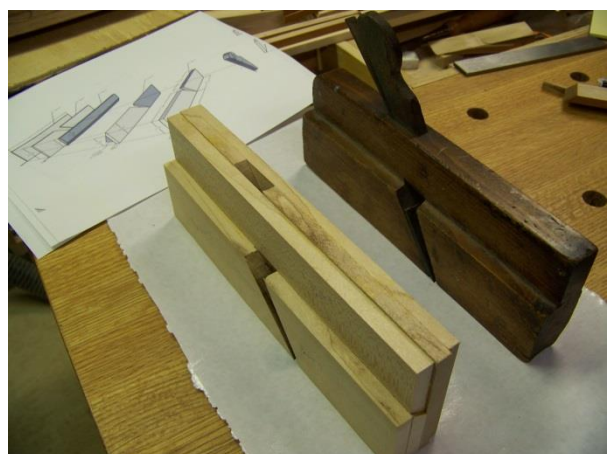
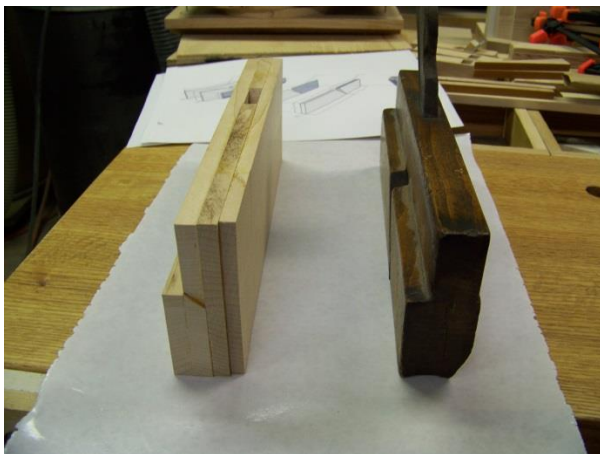
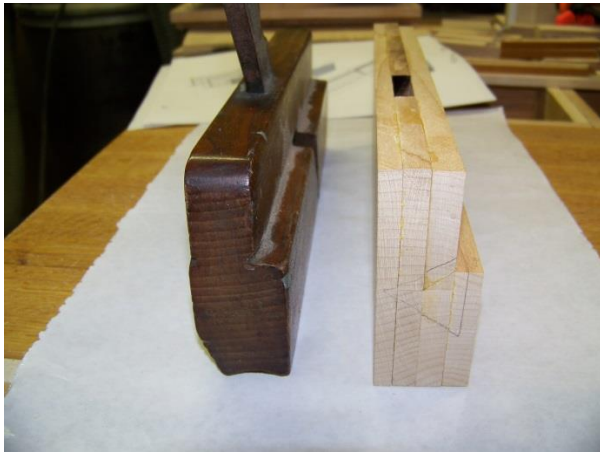
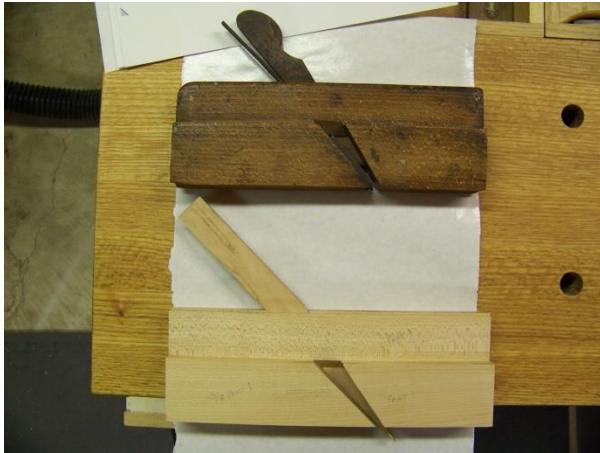
While the glue is drying, you can prepare the long beveled strip (Part 3) for the next step by marking pencil lines where the wedge will be. The pencil lines are marked on the wedge side (wide side) of the part so when you apply glue to the part 3 you can avoid the wedge area. Glue in the wedge area would be difficult to remove.

Glue Up Chapter 6

I waited an hour or so then, I applied glue to the wide side of Part 3, being careful to avoid putting glue on the wedge area. I also put glue on the bevel edge, and placed into final position on the plane body. I used a couple of spring clamps to hold the part against the plane body while I put 4 mini-clamps on the edges to force the part deep into the bevel. Now I added more clamps to get some squeeze out. I used a $\frac{1}{4}$ " chisel to clean up any squeeze out glue inside the wedge pocket area. Using spring clamps worked out nice. I was able to move them easily as I cleaned off the excess glue, and then return them quickly to continue with the clamping pressure.



This is the result of my laminated plane body, compared with the antique.



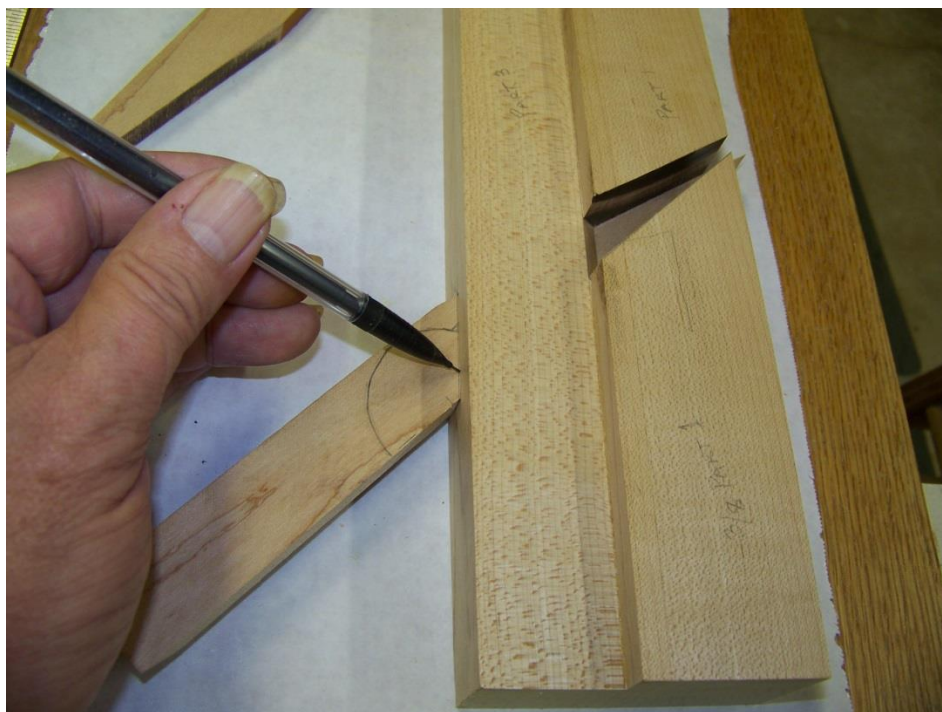
In this photo, note that the combined Parts 2&3 protrude slightly beyond the base line. That is because it is more important to have had it lined up with the long beveled strip, and the wedge pocket when it was glued. A couple of strokes with a smoothing plane will take care of the sole..



It took about six strokes with my bailey #4 smoothing plane to clean up the sole and make it square with the solid side (not the wedge side). I then used my table saw (solid side face down) to make the top parallel with the bottom (next 2 photos).



I Begin laying out the wedge using 2 lines marked onto the wedge (next 2 photos). The first layout line is with the blade steel inserted from the bottom (because it has not been shaped yet) with the wedge inserted, then the second layout line is without the blade steel.



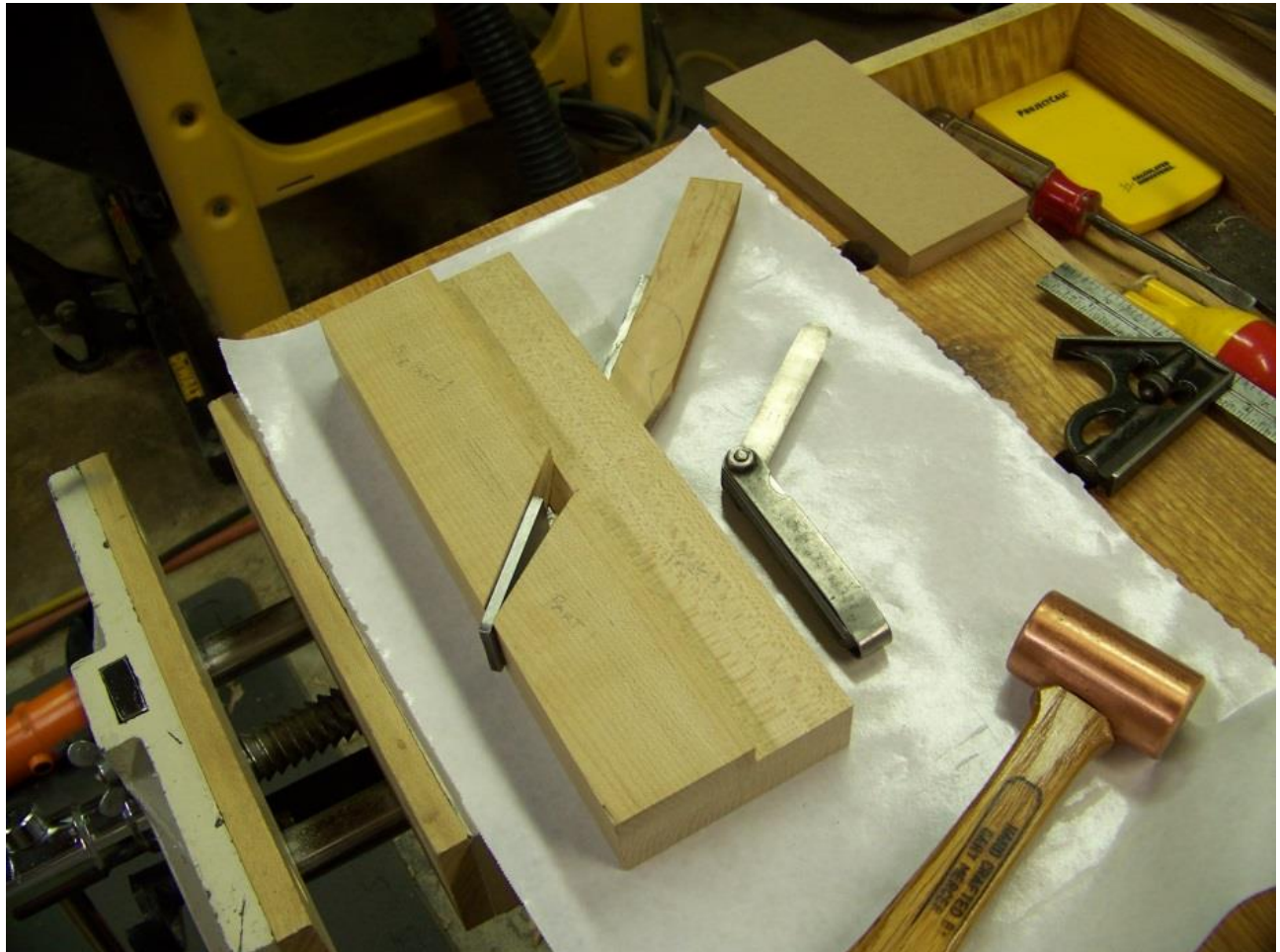
I marked a center point for the arc (next photo) about 1/8" from the upper layout line and drew the large arc, then drew the smaller arc by hand.



After doing the layout on the wedge I decided to wait until after I cut the flag out of the blade steel. I used an angle grinder and a hacksaw for that. Its not perfectly straight but it will do (next Photo).



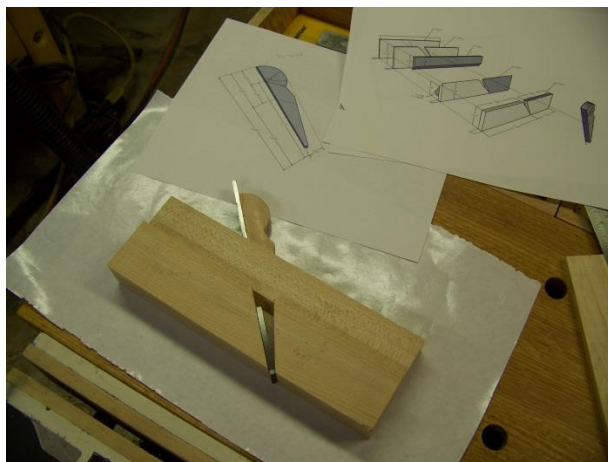
After removing the burrs, I checked the fit (next photo). I am very happy with the clearance (.011") for the mouth opening. The antique has about 1/8". I wanted it to be a tight fit because I have yet to shape the bottom, and I know the clearance will open up as I do that.



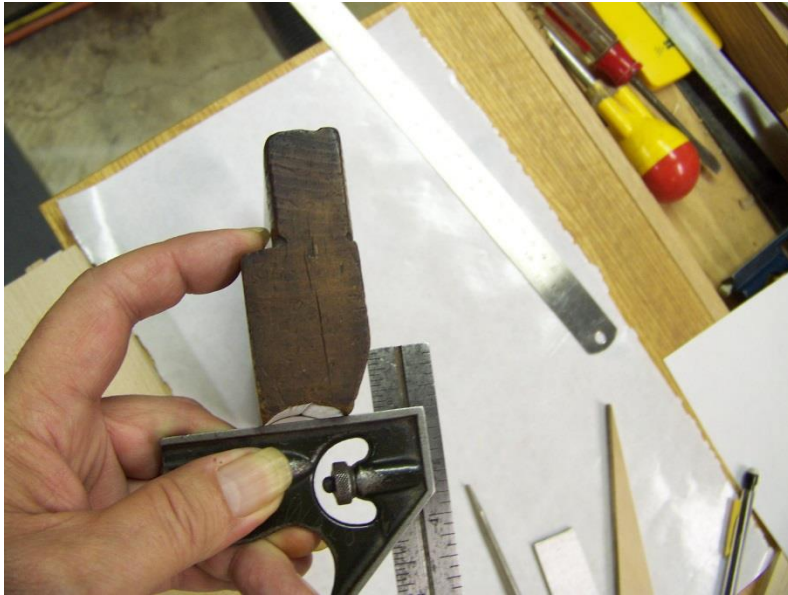
I used a fret saw and a file to shape the upper section of the wedge. The lower part of the wedge will be shaped later (next photo).



The next 2 photos show the progress and comparison of my creation and the antique.

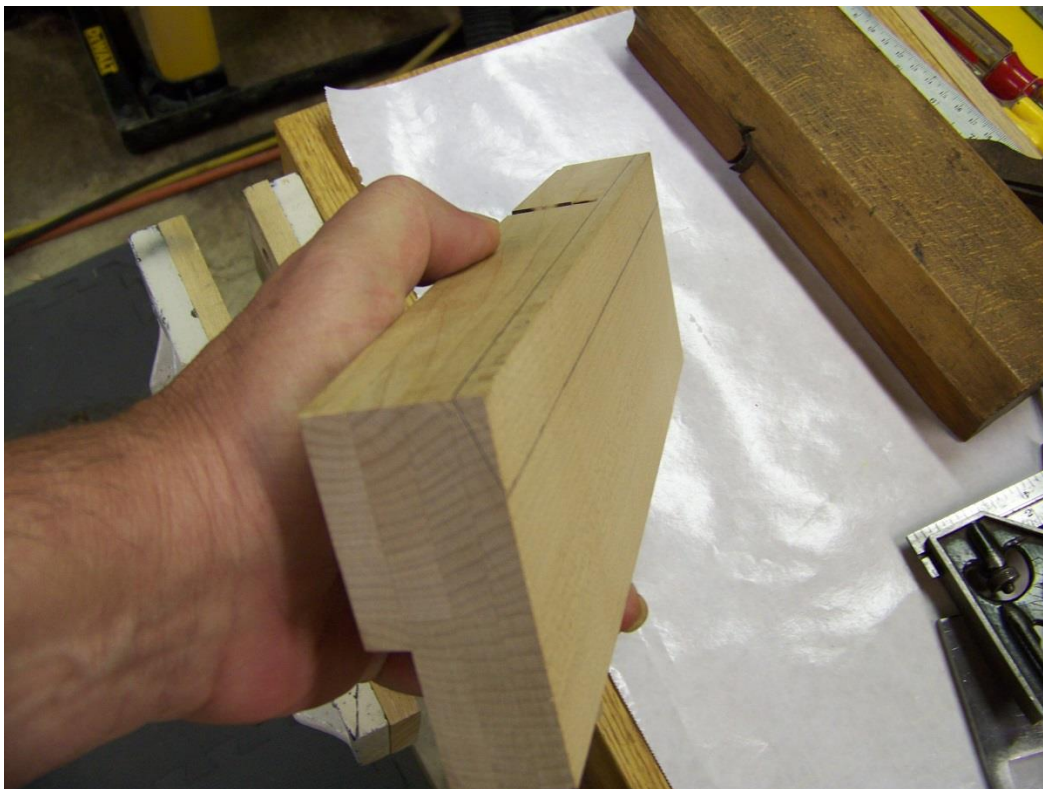


Laying out the sole began by measuring the relief angle on the antique. It measured $\frac{3}{4}$ " upward from the the bottom of the sole (next photo).

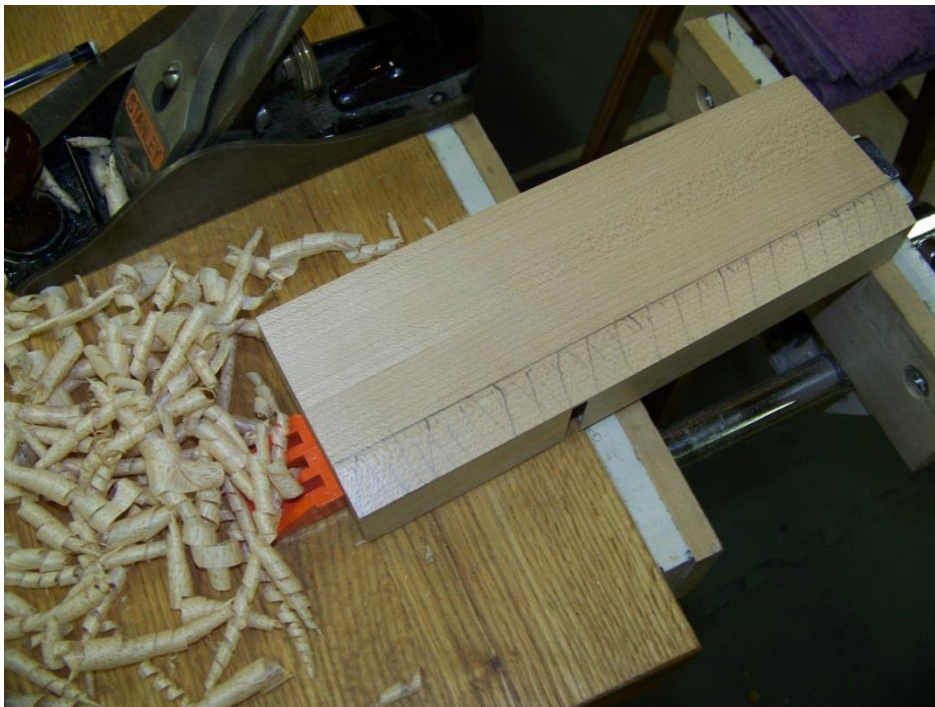


I marked a line on the side, down the length, $\frac{3}{4}$ " from the sole. A second line was marked on the sole, about $\frac{1}{16}$ " for the blade(next photo).

Note: The line on the sole is about $\frac{1}{16}$ " from the edge of the blade pocket.



I used my smoothing plane to create the relief bevel. I marked cross lines to see my progress, as I planed down to the lines (next 2 photos).



At this point, the blade could be sharpened to match the sole profile as is, but I wanted to complete this plane as a round plane to match my hollow antique plane. So I will continue.

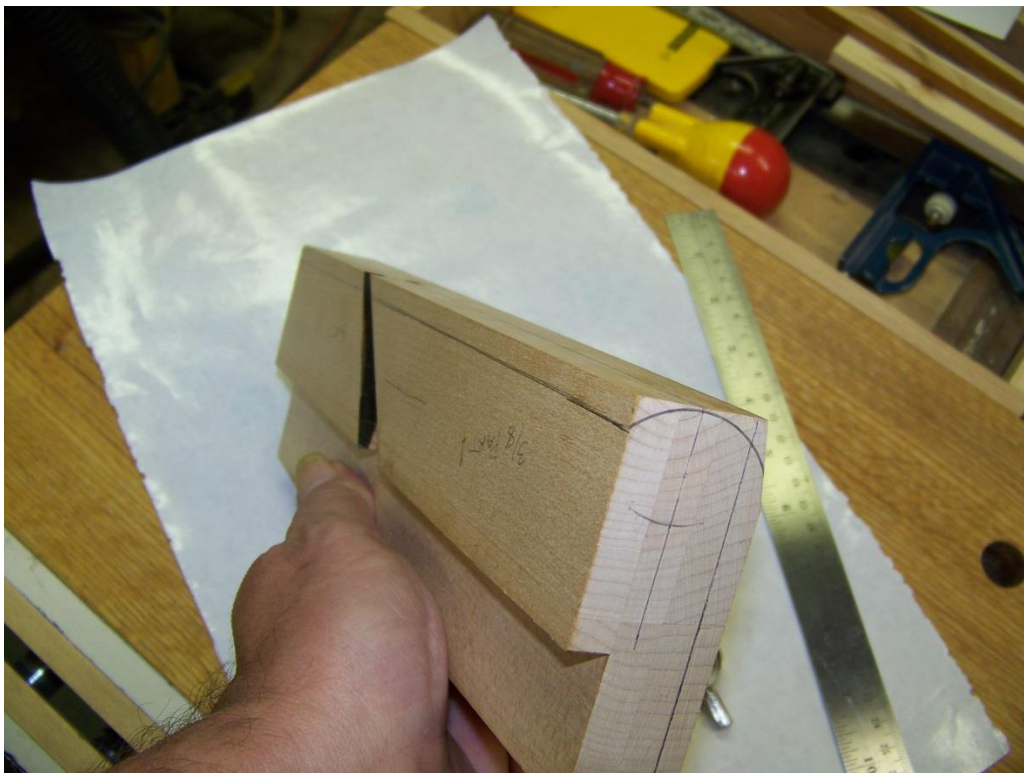
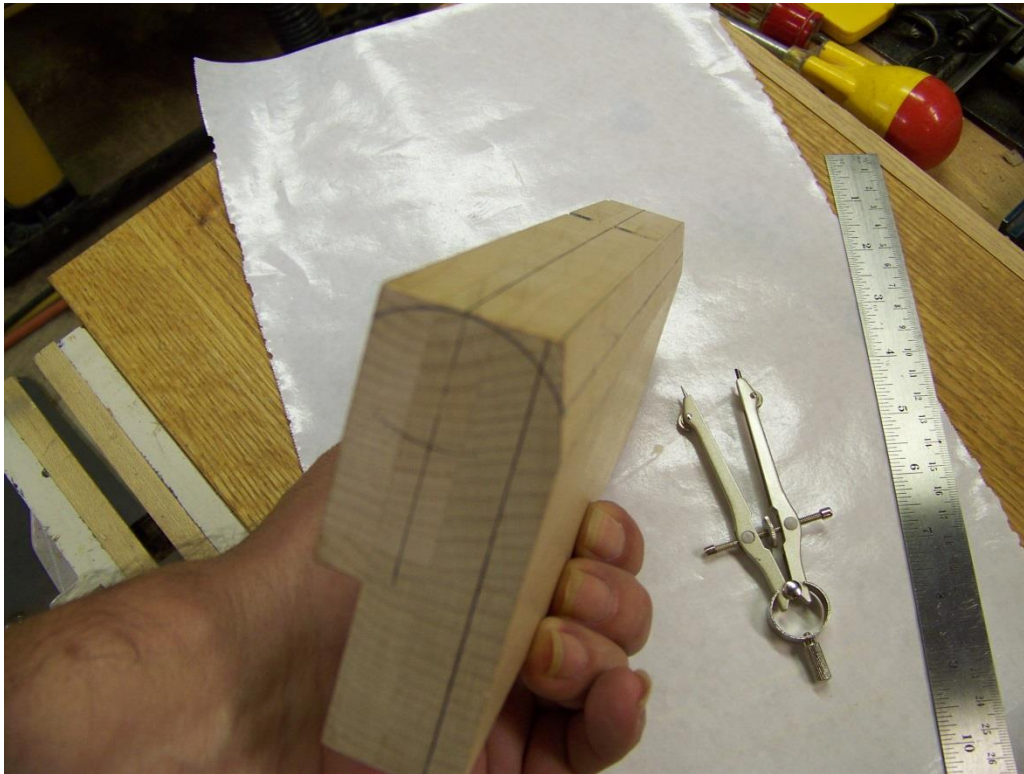
I measured the depth of the blade pocket, and then divided by 2 to find the center of the blade (next 2 photos).



I used the calipers to prick into the wood, so I could set my marking gauge directly, then marked the centerline for the blade. I also marked the centerline onto each end (next 2 photos).



I marked the inside edge of the blade line onto each end of the plane, using my marking gauge. I used a compass to mark the 1" radius, and then extended those lines down the length on each side (next 2 photos).

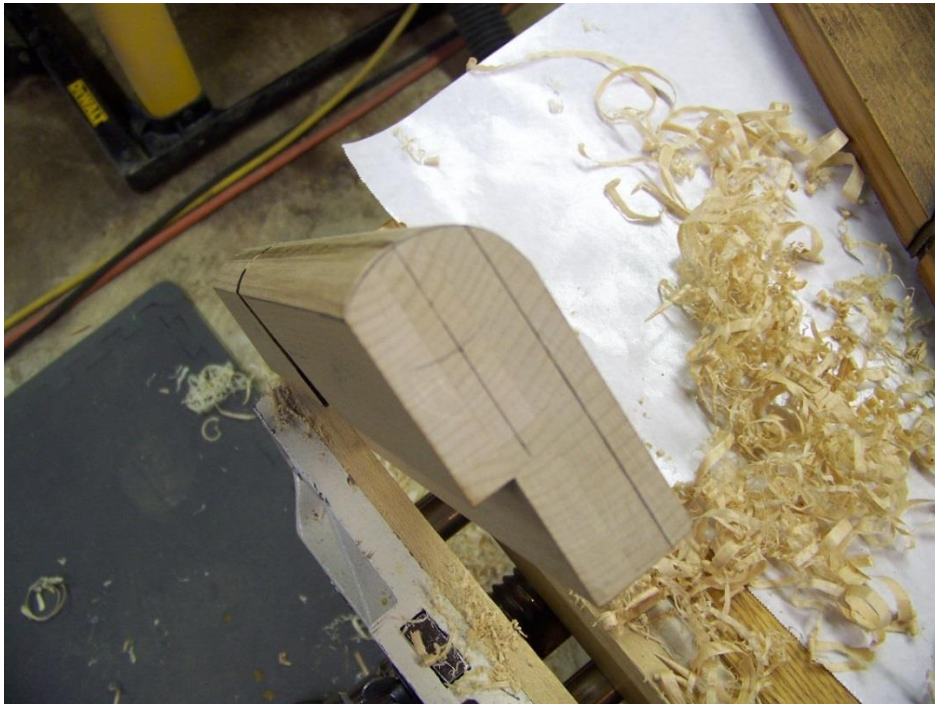


I use the antique to shape the sole (next 2 photos). I can keep track of my progress by pencil marks across the sole, adding more marks as I remove more waste.

Note: This radius could also have been carefully done with my smoothing plane.



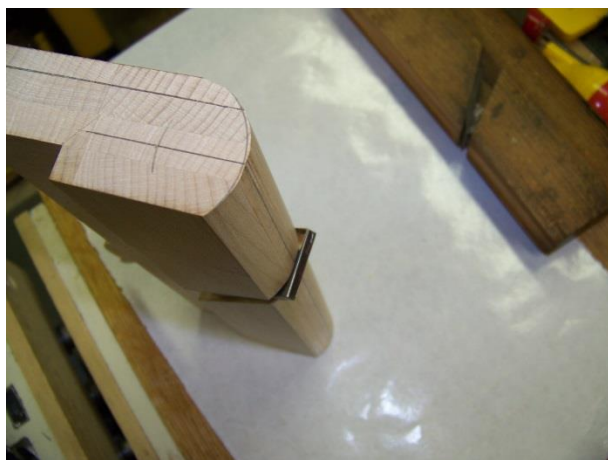
I think I will stop here, leaving the lines.



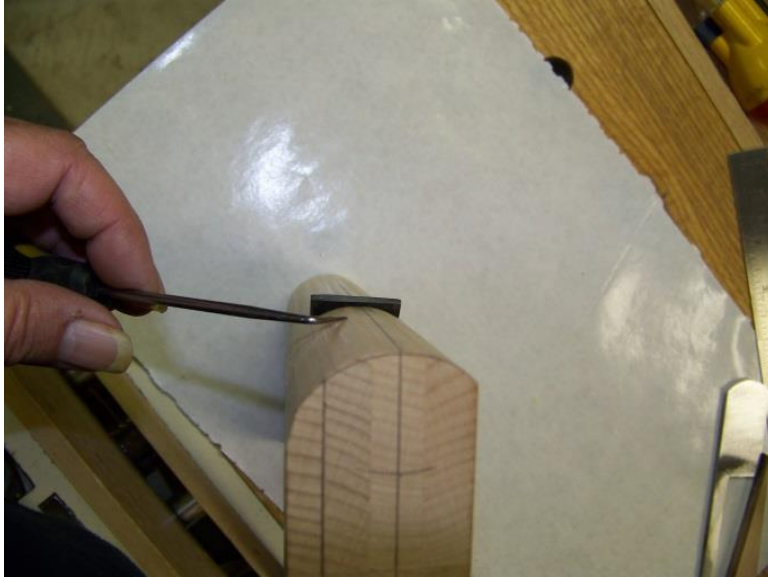
I am satisfied with the fit (next photo).



This is how it looks now before shaping the blade (next 3 photos).



I darkened the blade steel with a black marker, and scribed the profile onto the forward part of the steel (next photo).

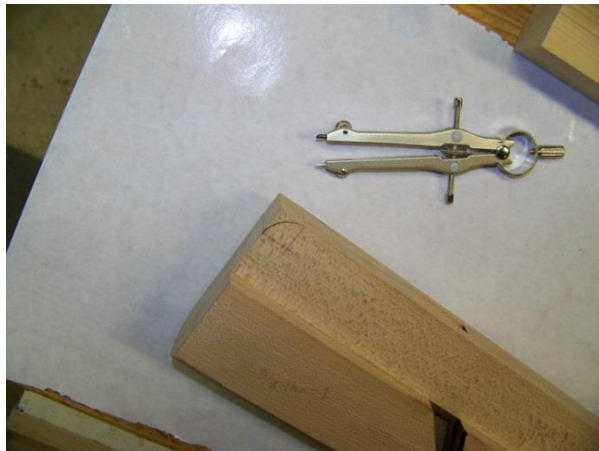


I used a bench grinder to grind the profile at a 25 degree relief bevel.

Note: *The wedge is not completed yet and is protruding beyond the sole, in the next 2 photos.*



To soften the edges, I marked a $\frac{1}{2}$ " radius on the rear of the plane (the same as the antique) and shaped it to that line (next photo).



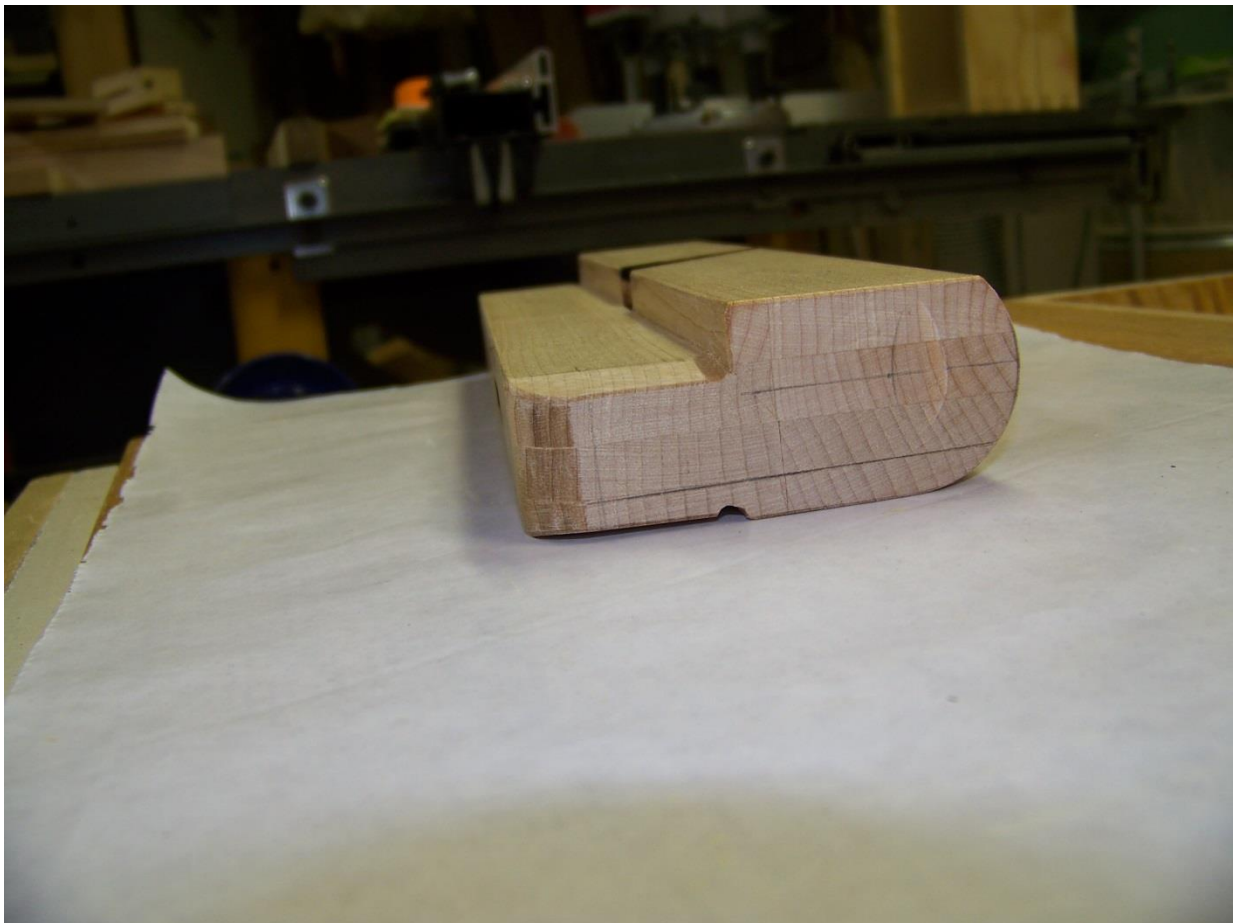
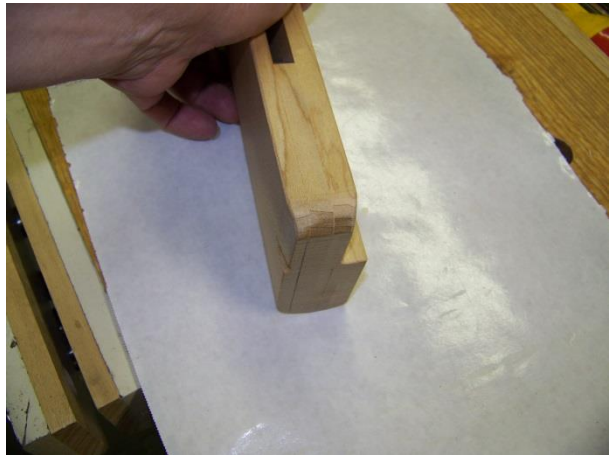
There are bevels on the ends of the antique that extend from the top of the plane to the step. The bevel is about $\frac{1}{16}$ " deep at the front and rear of the plane and taper to the $\frac{1}{2}$ " line (shown in the next photo).



I also carved the nick (next photo) onto both ends of the plane (located the same distance down from the top of the plane).



The next 3 photos show a little more detail of where the bevels and the nicks are located.



The steel that I used was oil hardened by heating it with my bernzomatic propane torch. Working outside, I made a crude oven by using 5 firebricks (1 bottom, 2 sides, 1 rear, 1 top) to surround the steel to help hold the heat. Considering my blade steel was 5/32" thick and it took only about 5 minutes for it to reach critical temperature (dull red). I quickly plunged it into canola oil to cool. I flattened both sides of the blade using a 200 grit diamond flat stone to remove the excess carbon and make it flat and shiny. I layed the blade in the kitchen oven to temper at 400 degrees for 2 hours. The blade should have a light straw color after tempering (next photo).

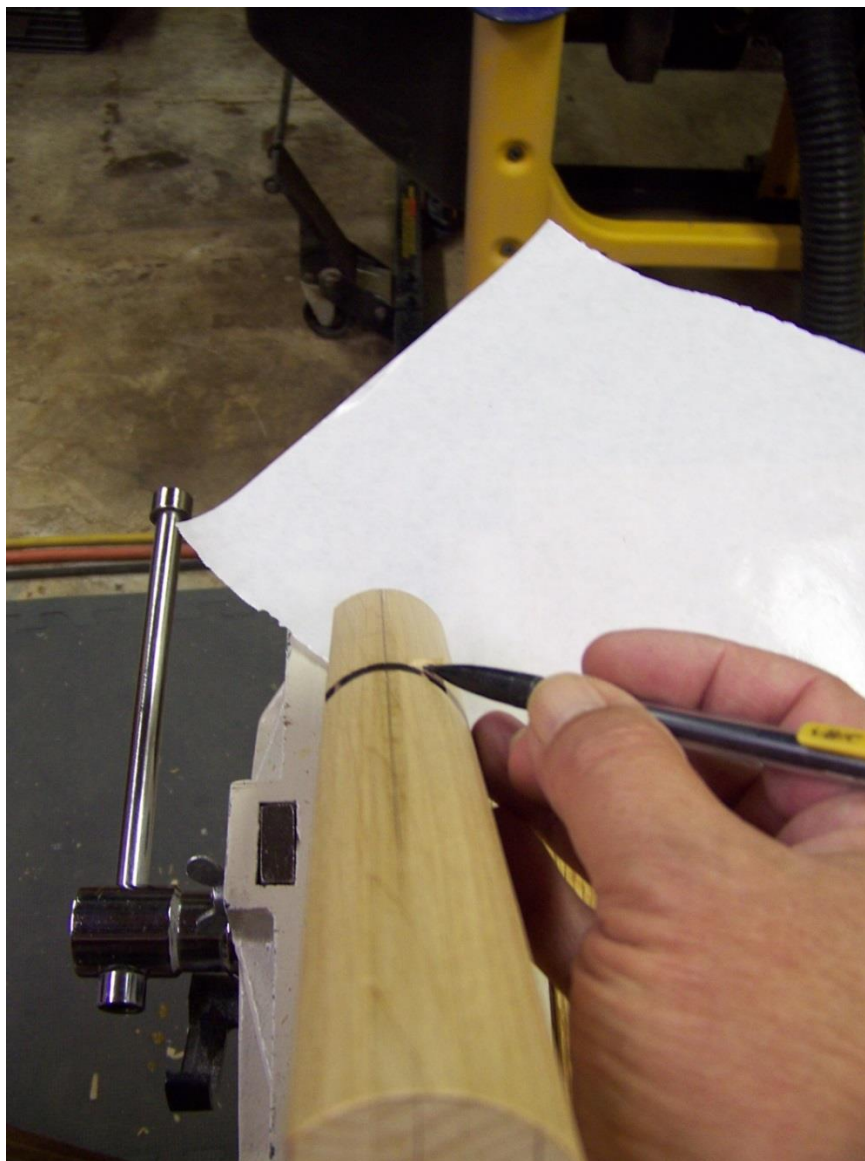


The end of the wedge on the antique ends at about ½" from the sole when it is seated and ready to use, and it worked so well, I decided to copy it's features.

The wedge must lay tight against 3 edges, the 2 angles of the wedge pocket, and the non-escapement side of the plane body. My wedge fit nicely, because of the care taken when I glued the plane body laminations together earlier.

The wedge bottom is shaped so it is parallel with the sole of the plane, with an angle at the bottom to help direct wood shavings out the side.

I began by marking the end of the wedge (the blade and wedge are seated) with a pencil (next photo).



In the next photo the wedge is pictured with the non-escapement side against the wax paper. The face that the scale is against is the blade side of the wedge.

Starting at the end of the wedge there are 4 pencil lines.

The first line is the radius marked from the previous photo.

The second line (drawn vertically, intersecting the radius) shows where the blade is located where it meets the throat opening on the non-escapement side of the plane (I call this the base line). The base line is extended vertically and then marked on the escapement side of the wedge (this is only for reference to mark the third line).

The third line is a vertical line is drawn $\frac{1}{2}$ " from the base line, and then transitions (on the escapement side of the wedge) parallel with the sole of the plane. In other words, the third line is a visible reference (when the wedge is in place against the blade in the plane body) that runs parallel with the sole.

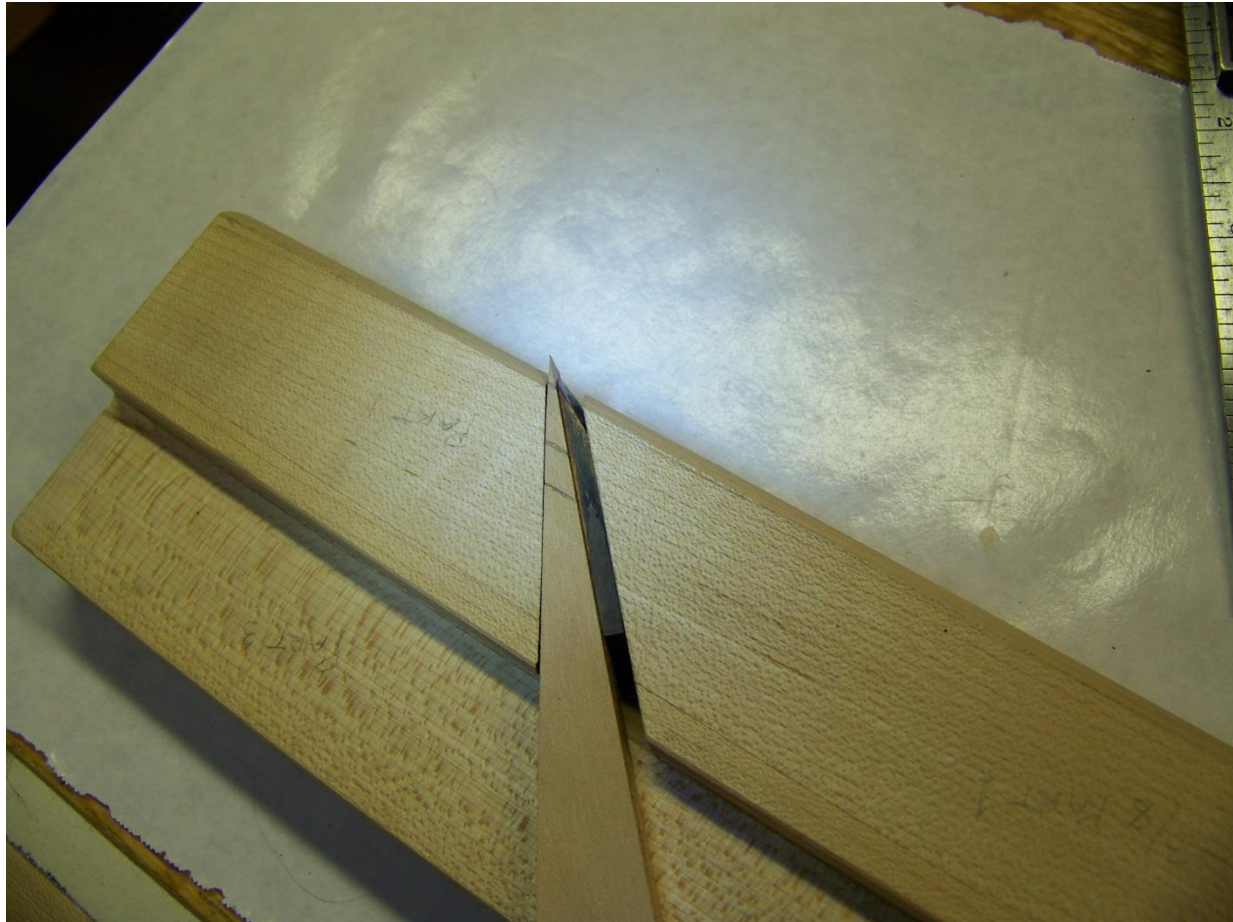
The fourth line intersects with the third line, and is extended at 45 degrees, then transitions (across the escapement side of the wedge) parallel with the sole of the plane.



For Clarity, I layed the wedge on the plane body to show the lines marked parallel with the sole. You can clearly only see in this photo the second, third and fourth lines.

You can barely see the base line at the edge of the blade radius.

The next two lines show where the 45 degree angle cut will be made.



In the next photo, I have the antique wedge next to the new wedge to further clarify how it is layed out.

Note the radius on the tip of the antique.



I cut almost to the line, then made a radius with a file.



My first shavings. Wow! I have not honed the cutting edge yet!



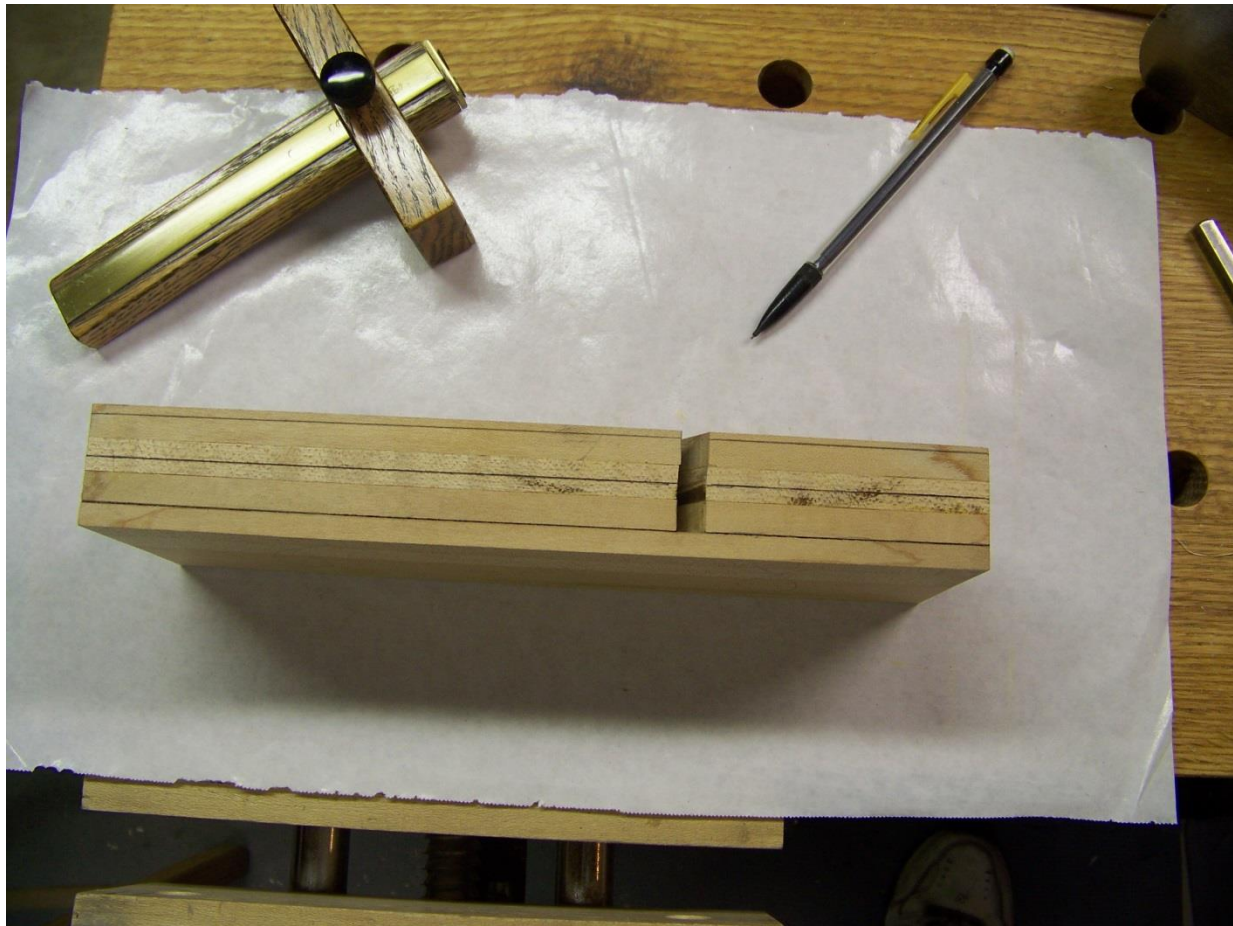
I'm very humbled by the expert craftsman that had the talent to make planes.

Make a Matching Rounding Plane

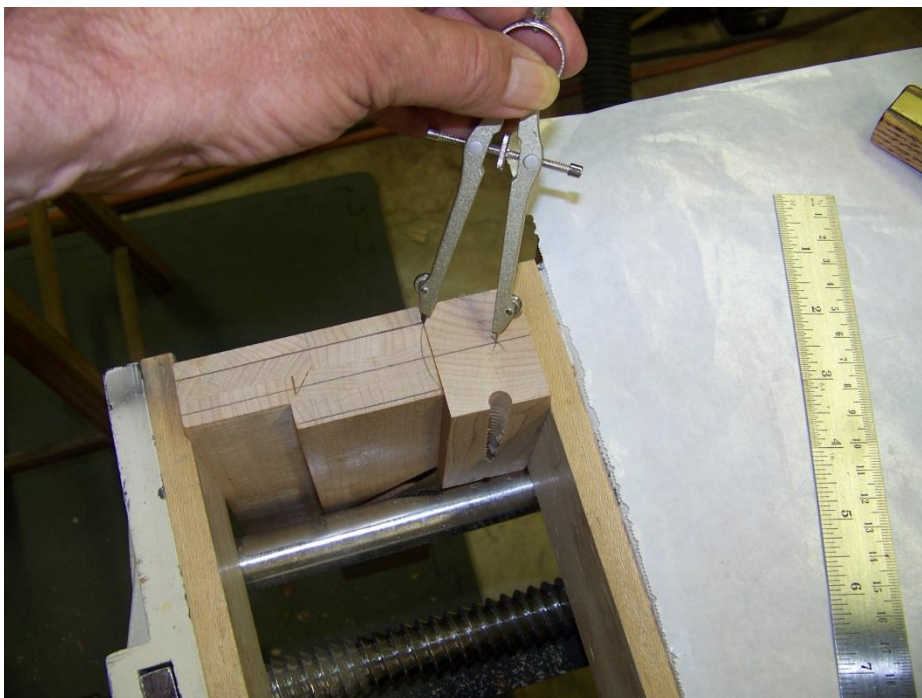
This project went so well, I decided to make a matching round plane. The cutting and assembling of all the parts were done exactly the same as before. The order in which all the parts are glued together is the same. I did one thing different on this plane and that was that I did not plane the relief angle (as on page 23) yet. I decided to do that after forming the sole. I checked to make sure the sole was straight from heel to toe, and that it was square with the non escapement side of the plane body, and then made sure the escapement side was square with the sole.

I used a caliper to determine the depth of the wedge opening (as on pages 24, and 25), and then divide by 2 to mark the center line onto the sole and onto both ends of the plane body. I then marked the blade edge lines onto the sole (next photo) and extended the lines onto each end of the plane.

Note: Mark all the lines from the non escapement side of the plane body.



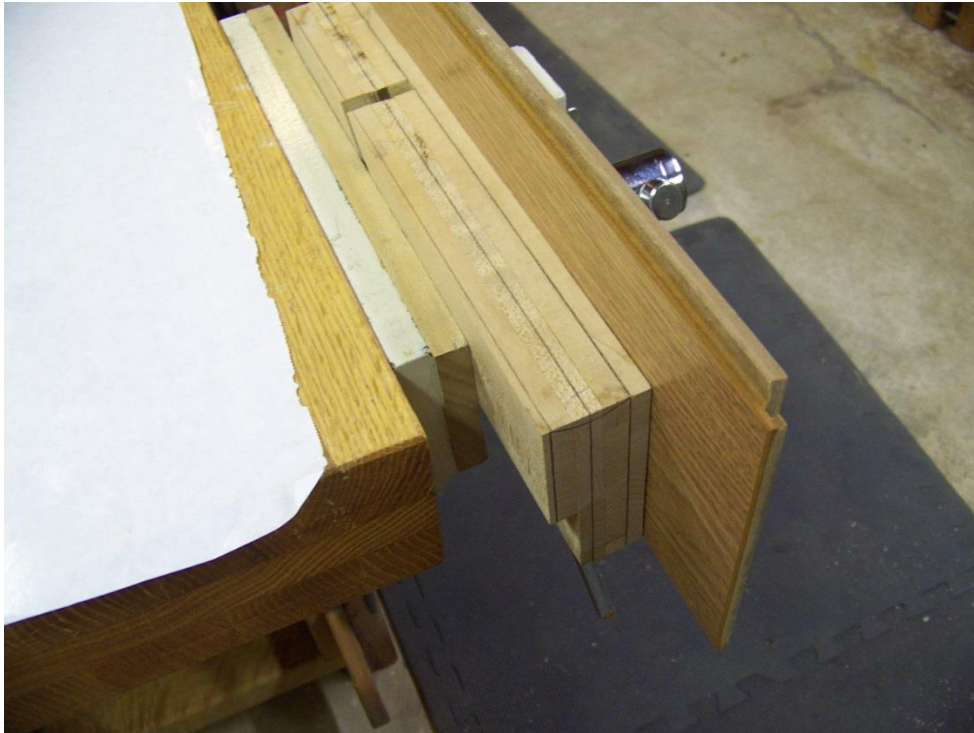
In order to mark the radius onto the ends of the plane, I used a scrap block of wood with a line marked at a right angle. I then clamped the block with the plane (next 2 photos) into the vise to layout the radius. With the compass set to the width of the plane Blade I crossed two lines onto the scrap wood, and then marked the radius line onto each end of the plane.



I put the plane into a state of tension, as if the plane was ready to use by using a piece of keystone, and a test wedge(next photo) that was driven into the wedge opening. I just thought that when I shape the sole, it would come out straighter if it had tension.

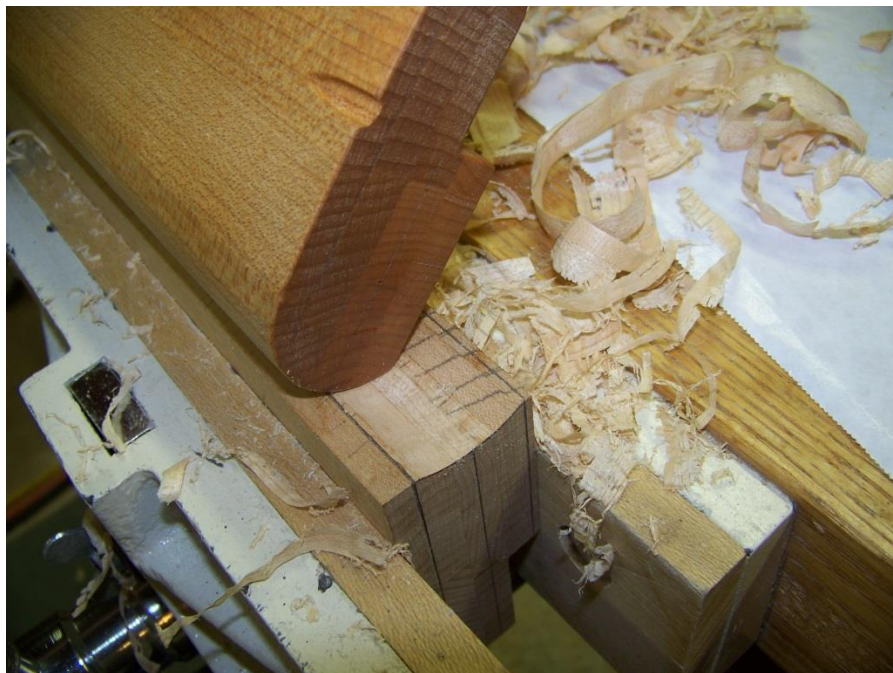


Using a piece of leftover snaplock flooring, I clamped it along with the plane into the vise, so I could use it as a fence to hollow out the sole of the plane (next 2 photos).



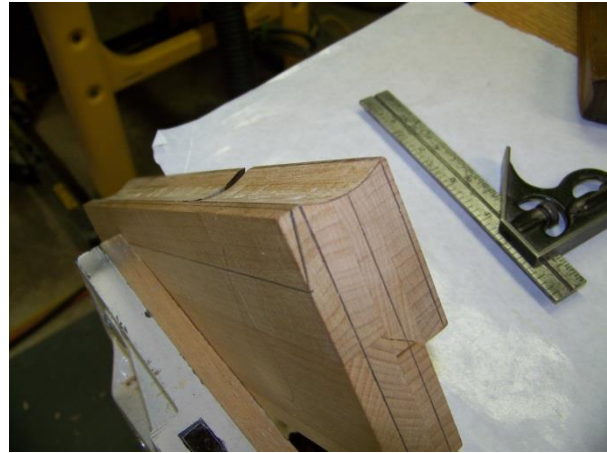
After I had hollowed a bit, I removed the fence and planed up to the layout lines by tilting as I went, checking each end as I went along. The last few stokes are done vertically to define the sole.

Note: I penciled cross lines to better see the areas that were being removed.



The sole is now formed.

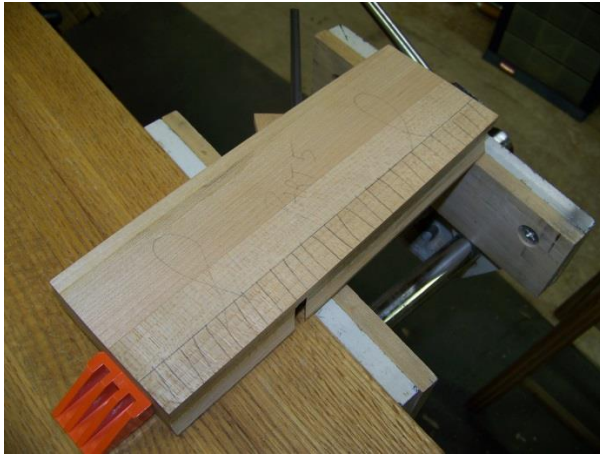
I Marked a line lengthwise, $\frac{3}{4}$ " up from the sole on the side, and then onto the sole (next 3 photos).



Note: the line on the sole is about $\frac{3}{32}$ " from the mouth opening.



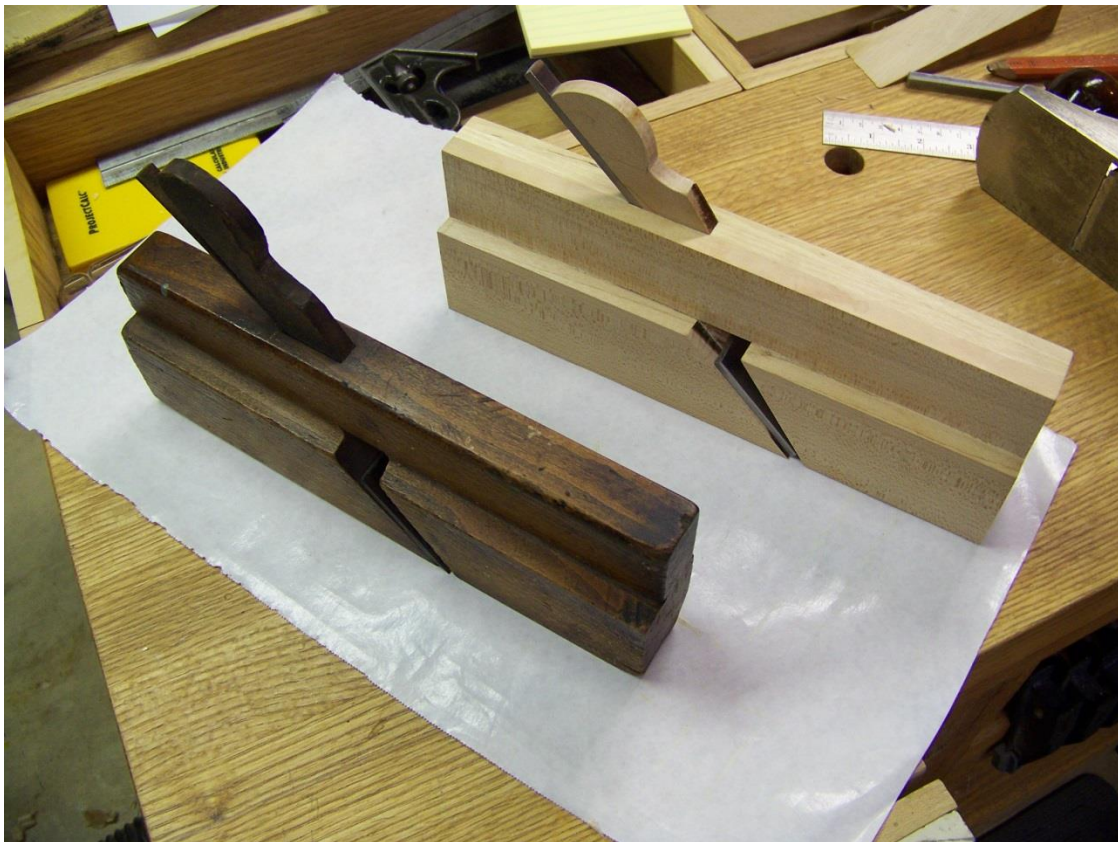
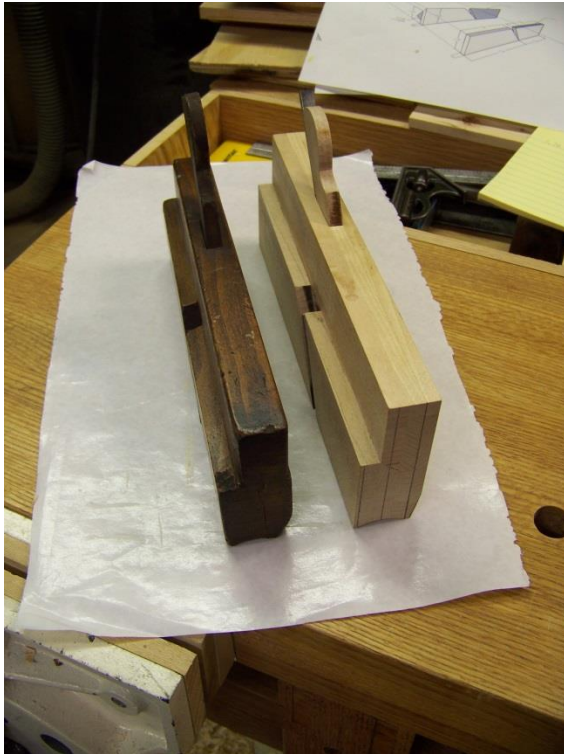
I draw pencil lines to better see where my hand plane is shaving off the wood, and I re-apply the lines as I remove more wood (next 2 photos).



In the photo below you can see that there is about $\frac{3}{32}$ " of sole on each side of the blade steel (the blade steel is shown with the wedge protruding). I have not shaped the blade or the wedge yet.



So here is the comparison with the antique at this point (next 2 photos).



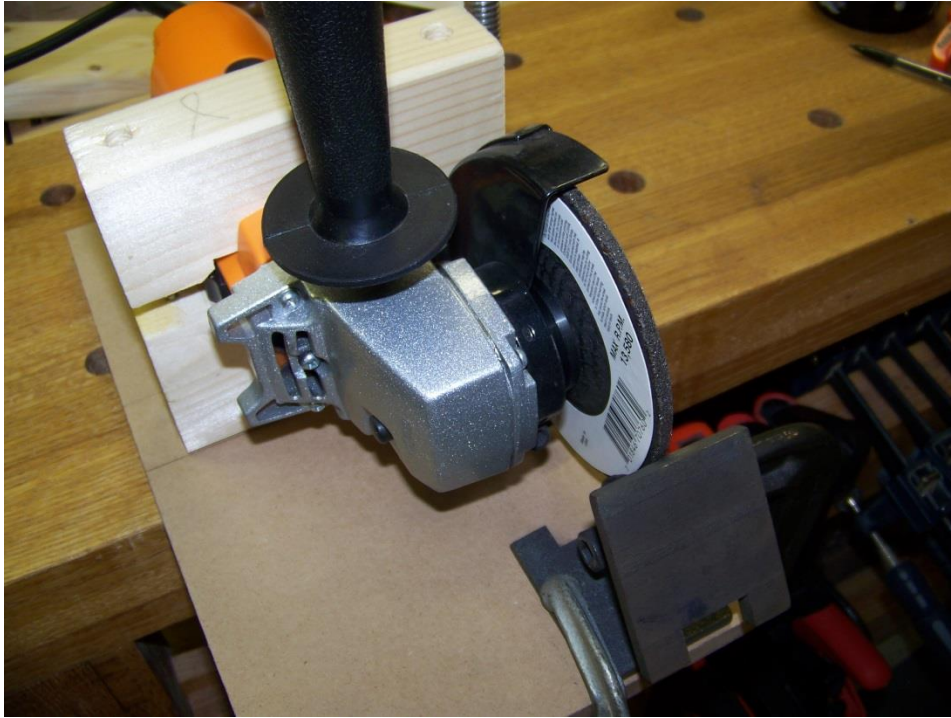
Shown in the next photo is the pair of planes. I have taken the liberty of detailing (the nicks, bevels and rounding the hand hold end) the hollow plane without the benefit of photos.

The round (the upper plane) hollows wood, and the hollow (the lower plane) rounds wood.

Confused yet? The hollow rounds, and the round hollows!



Since I needed a way to grind the convex profile onto the blade, and this is what I came up with (next 2 photos). I clamped an angle grinder in a jig, then cobbled together a steady rest from some old parts, and ground out the profile. It's not perfect but I must say it worked pretty well.



After applying the traditional finish (linseed oil and bees wax), and stamping my name, this is the final result.







My Final Thoughts

I have always admired plane makers, and I always wanted to make hand planes. The main reason I have not, is drilling and then floating to the accuracy required was something that intimidated me. I wanted to come up with an alternative to that. After successfully completing my first laminated plane, it gave me confidence to make the matching plane. The planes that I made in this article work awesome, and may not last two hundred years or plane thousands of board feet like the antiques out there did, but I would like to think that they just might. I have thoughts of making a complete set of hollows and rounds, and then some spring type moulding planes in the future.

I hope this article inspires you to have the confidence to start your own legacy in hand plane making.

Sincerely,

Gary Mercer.

The Tool List I Used:

10" Band Saw, with a homemade re-saw fence

Thickness Planer, and ¾" plywood as a carrier to plane re-sawn wood held with double sided tape

Smoothing Hand Plane,

¼" and 1" chisels,

Tablesaw,

Miter Saw,

Jig to Cut Wedges, with the table saw

Marking Gage,

Measuring Calipers, dial caliper type

Angle Protractor, for checking angles

Clamps, various

Machinist Square, 6" or 12"

Ruler,

Pencil Compass,

5 fire bricks,

Bernzomatic torch, mine is so old they don't make it any more

Kitchen Oven,

Standard Bench Grinder,

4" Angle Grinder,

Fret Saw,

2 Rounding Files,

Flat Stone, diamond or fine stone type

Bench and Vise