An Example of Using a Rotary Table to Machine a Beam for a Steam Engine

By R. G. Sparber

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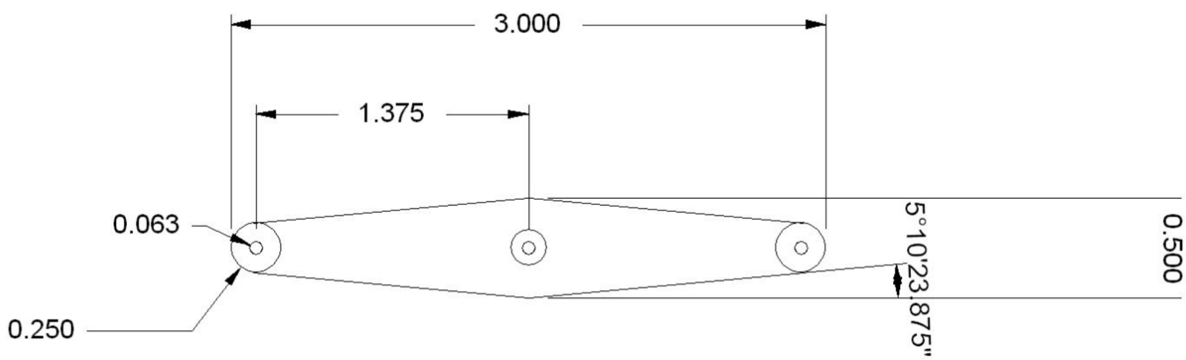


So how did I go from the drawing to the part?

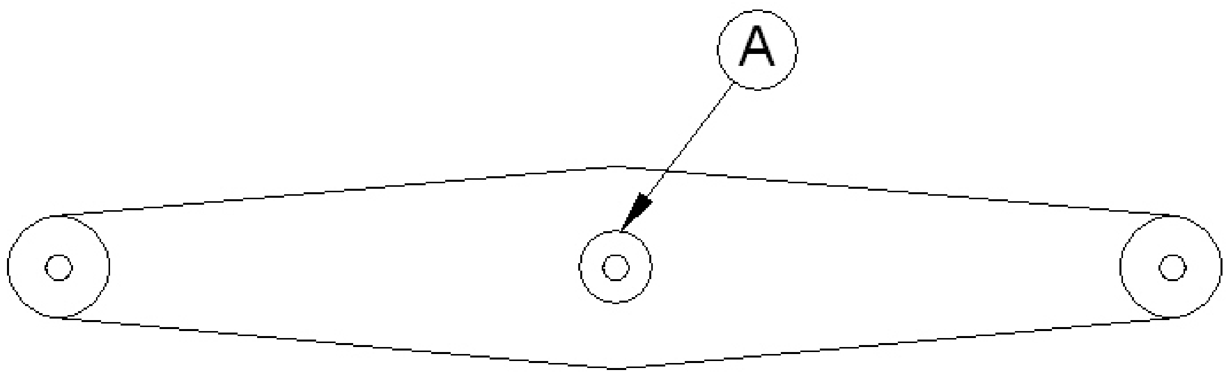
Strategy

I will cut this part using my RF-30 mill/drill and my 8" rotary table with a simple compound on top. The center of rotation of the rotary table will be moved to various points on the part as features are machined.

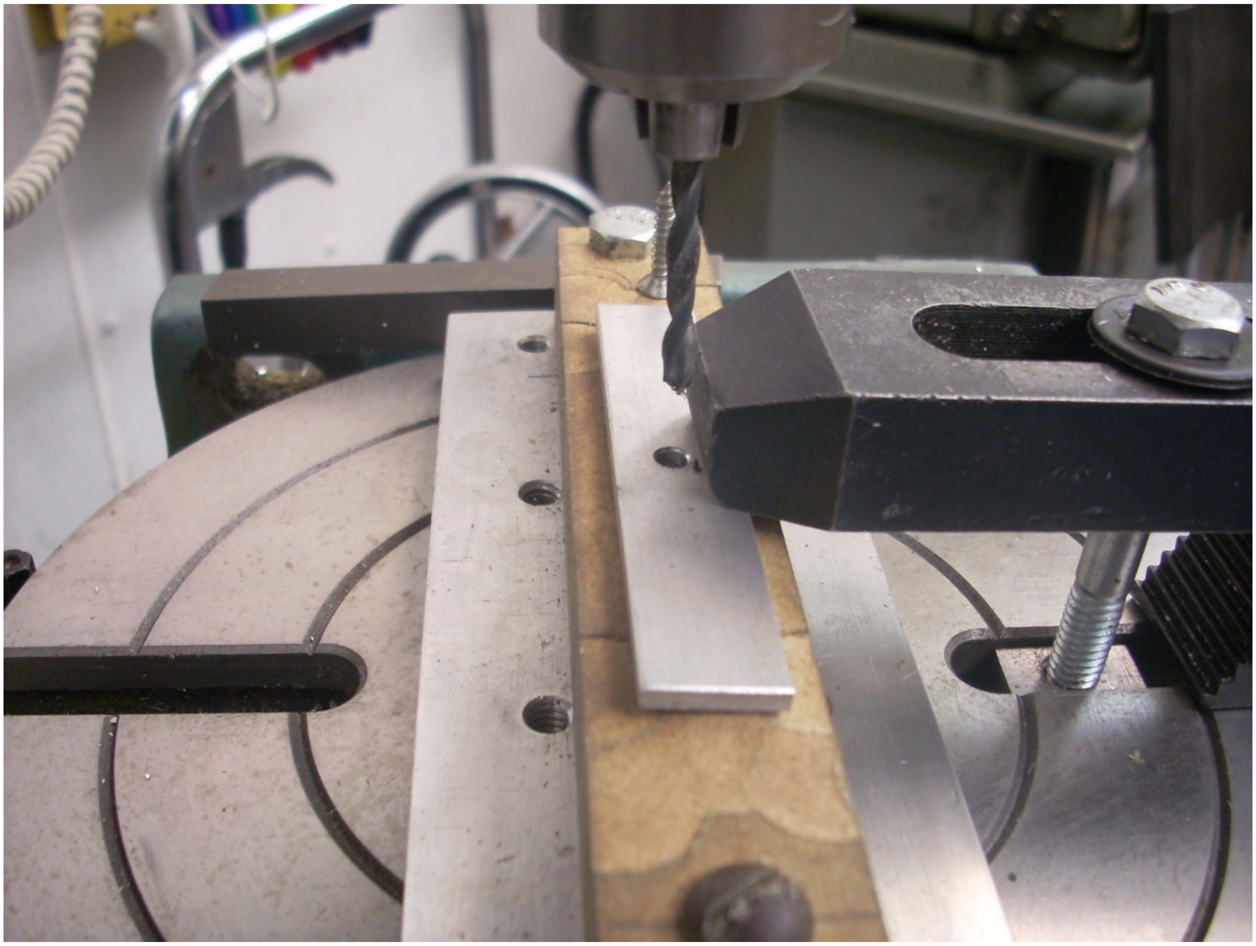
The Procedure

1. Center the rotary table (RT) directly under the spindle's center of rotation and set the absolute zero on the Digital Read-Out (DRO). See http://rick.sparber.org/RTa.pdf for details on the procedure I used.

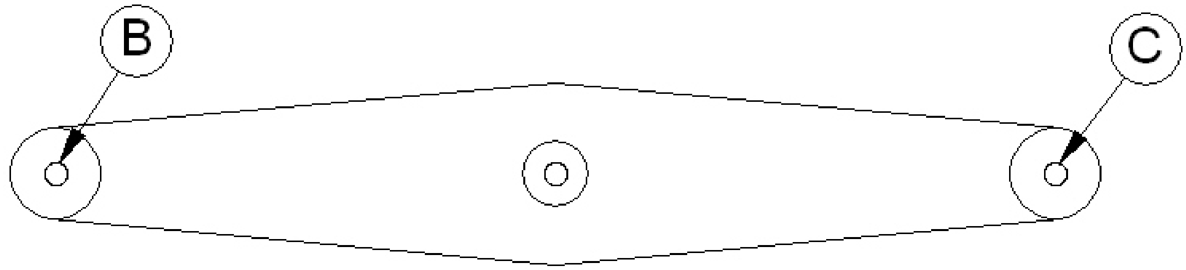
2. Mount the 1/8” x 3.1” x 0.6” piece of aluminum on a bar of Medium Density Fiberboard (MDF) and mount the MDF on my drilled and tapped aluminum base that has been machined square. Note: as I perfected this procedure, I made 4 of these parts on the same block of MDF. You can see a gap between the aluminum bar and the MDF where previous cuts have removed wood. The MDF is solid under the metal that is not cut.
3. Clamp the base on the RT with the approximate center of the bar at the origin. Drill hole “A”. The smaller inner hole is through a rod that fits into hole A.



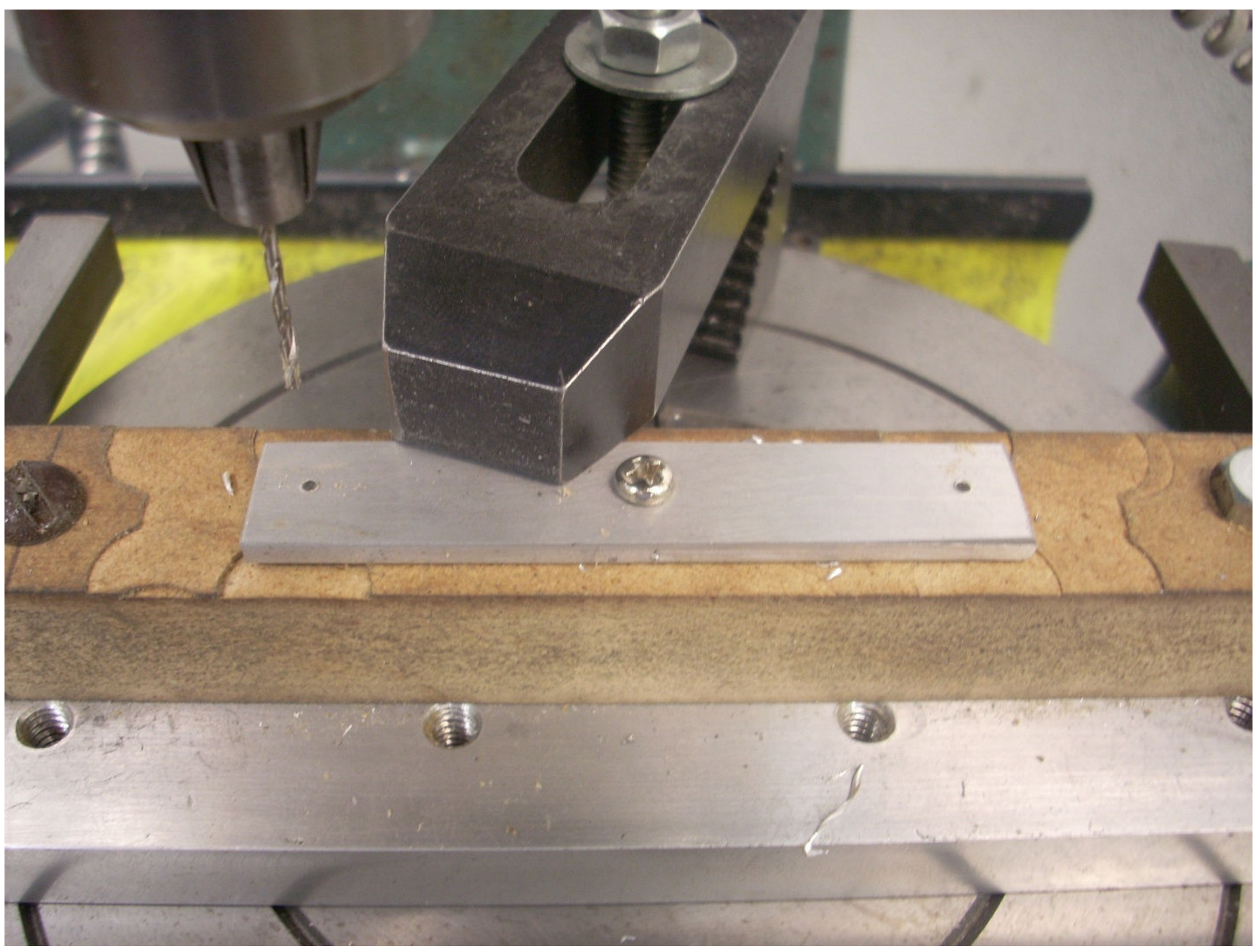
Then run a screw through the hole.


The hole is now at the absolute origin.

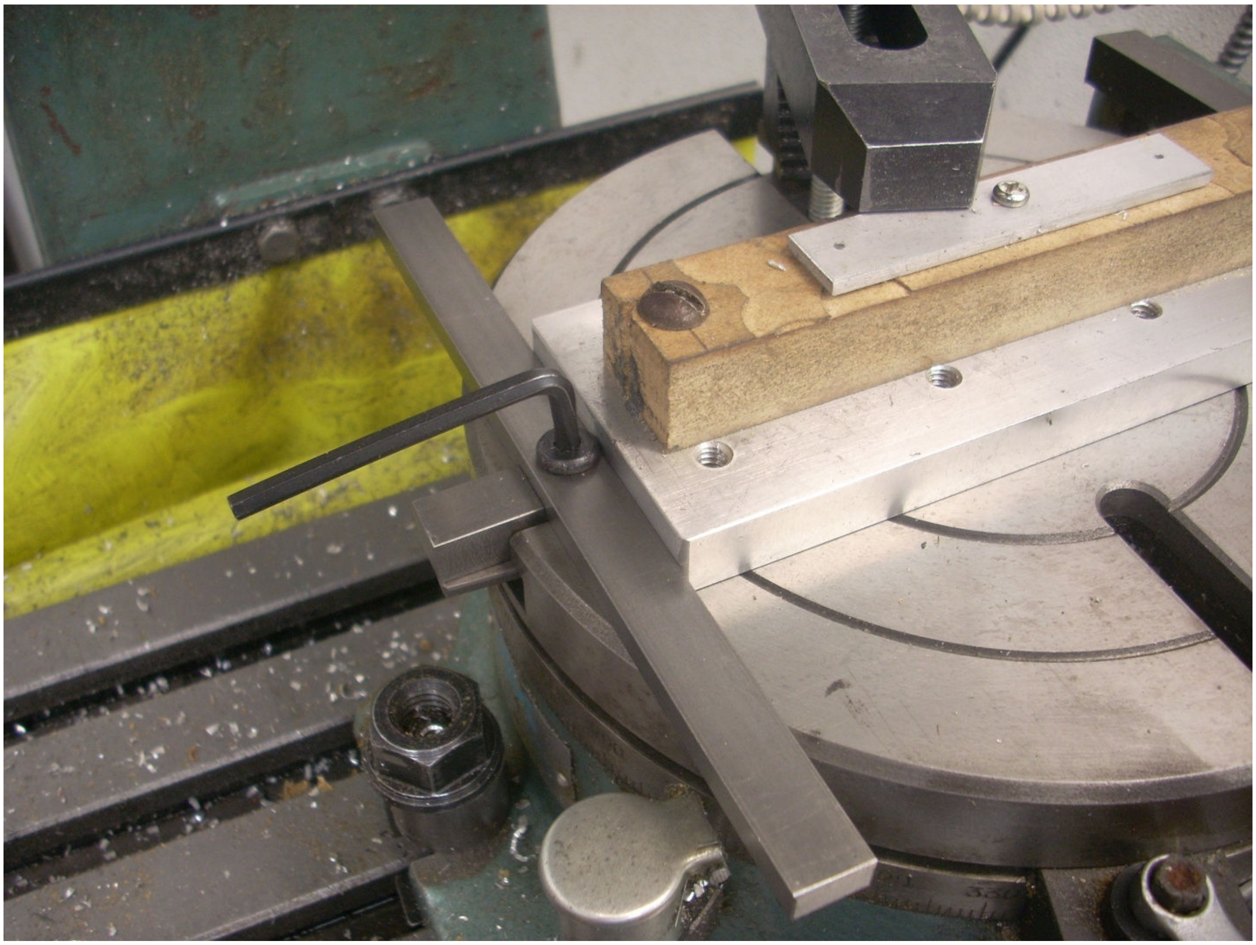
4. Drill holes “B” and “C” 1/16” in diameter.



These holes are 1.375” from the origin (hole A) so just move the X axis to reach these holes. Press in 1/16” diameter pins into these holes to prevent any motion of the part as I reposition the assembly during this procedure.

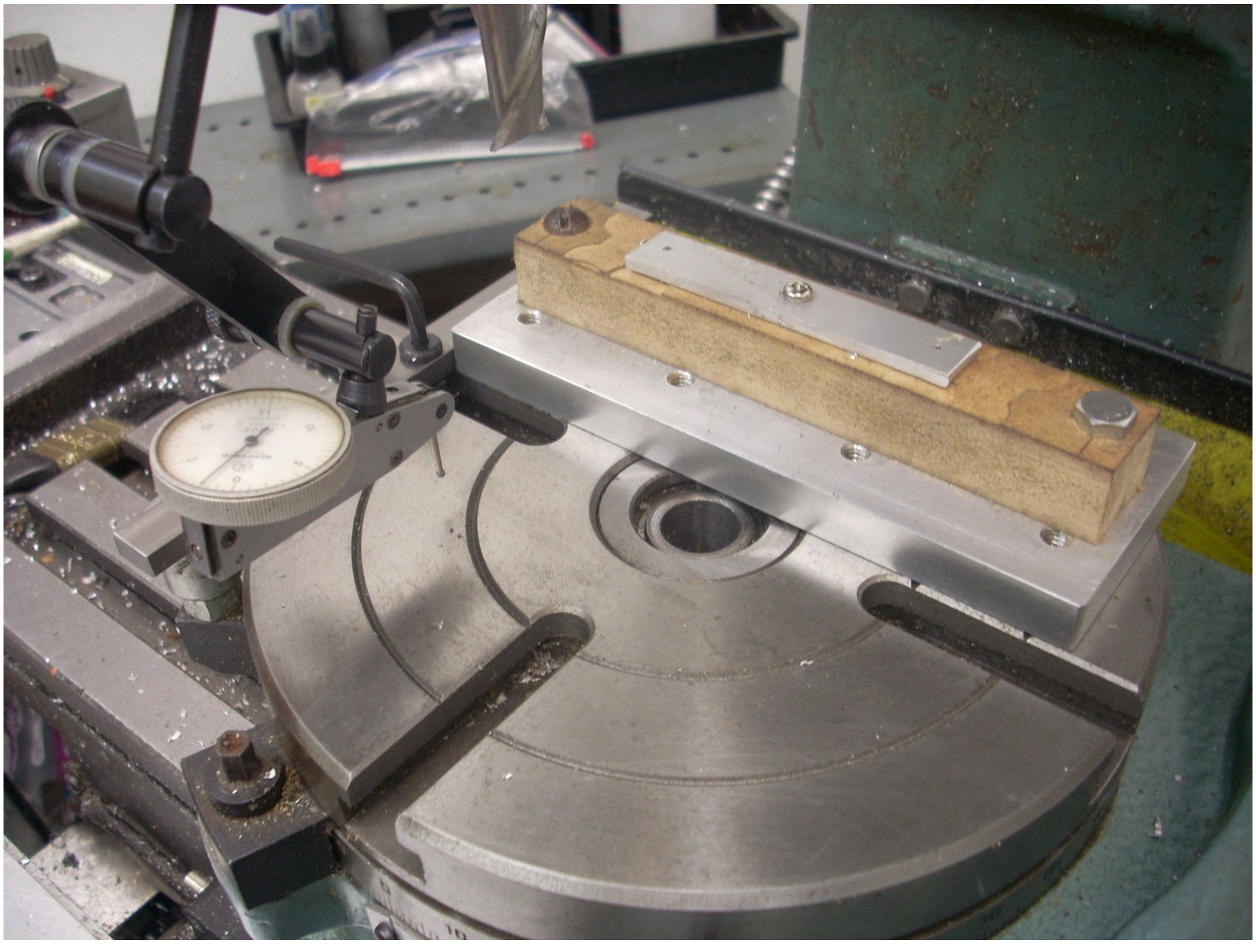


5. Move the part such that the origin is +0.250" along the Y axis. This is done by moving the base towards the front of the mill by 0.250". First I install a fence parallel to the Y axis.

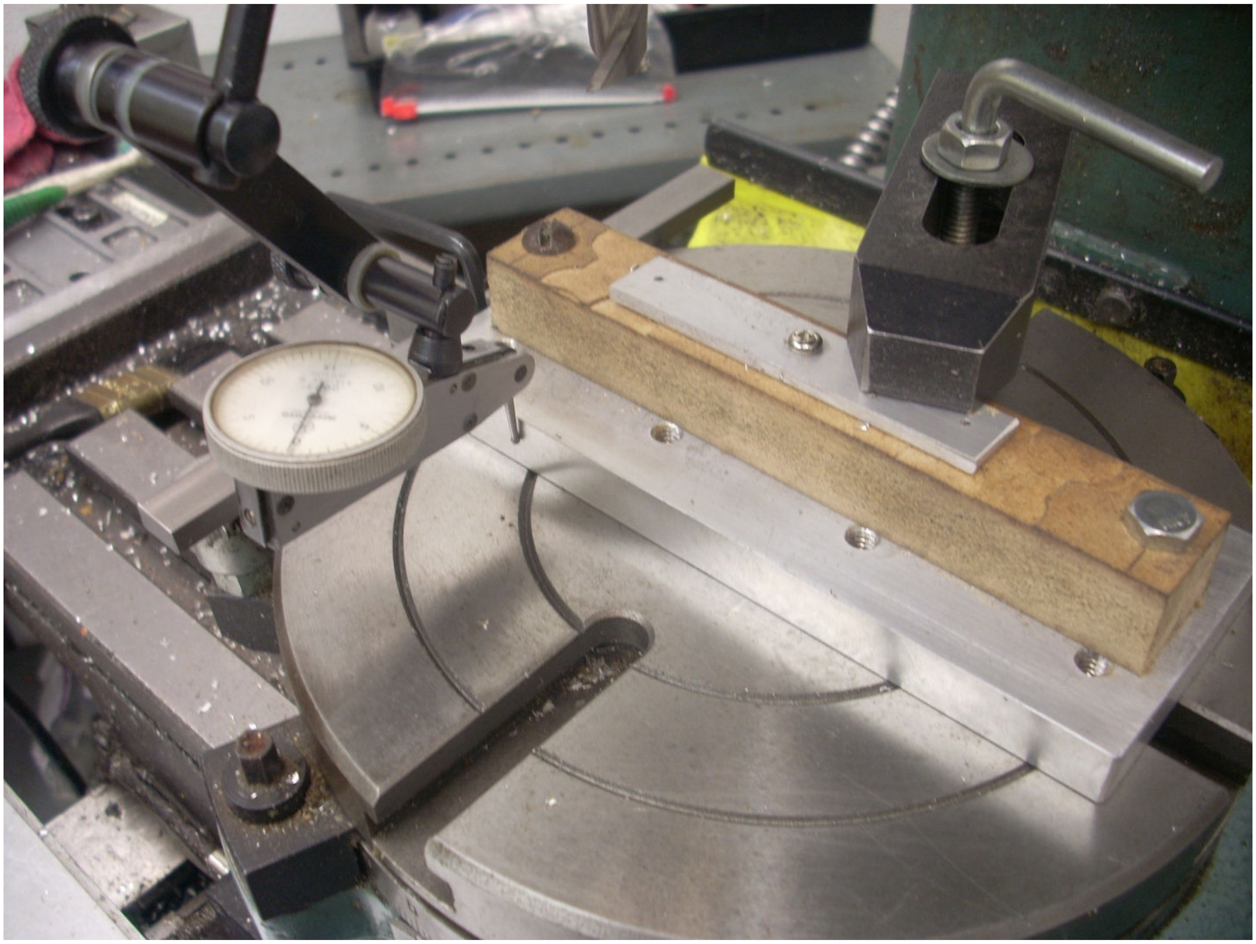


6. Then I use a Dial Test Indicator (DTI) mounted on the spindle to tell me the present location of the base along the Y axis.

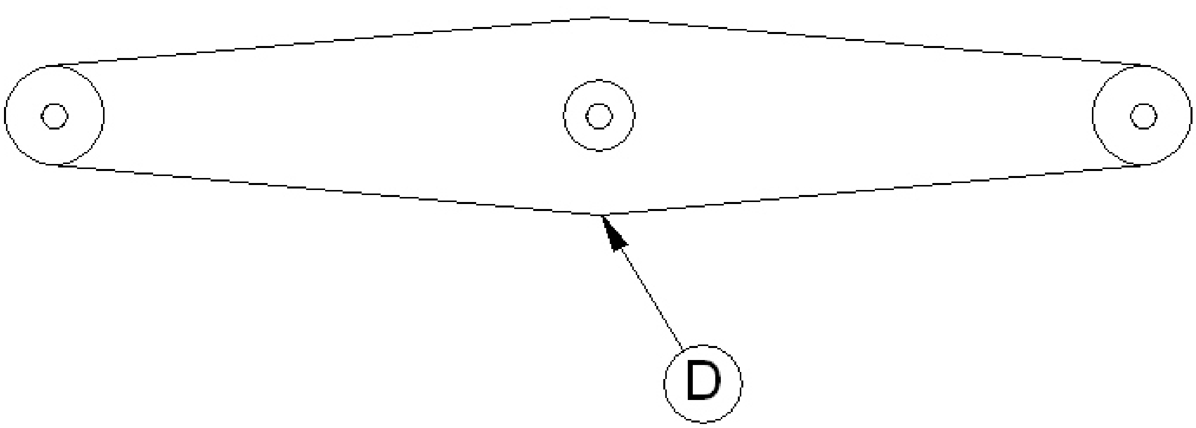
I move the Y axis until the DTI reads 0. I then change to incremental mode on my DRO and set an incremental zero on the Y axis. Next I unclamp the base and move it out of the way. I then move the mill's table 0.250 towards the column.



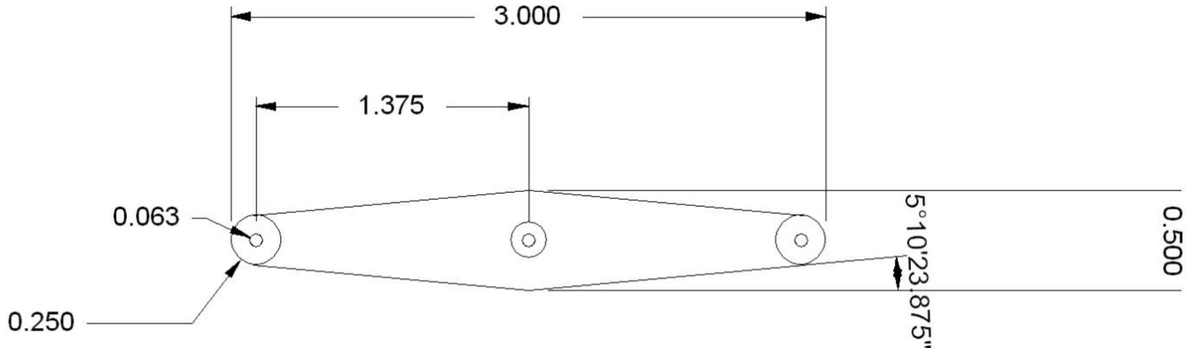
Next the base is slid along the fence until the DTI again reads 0.



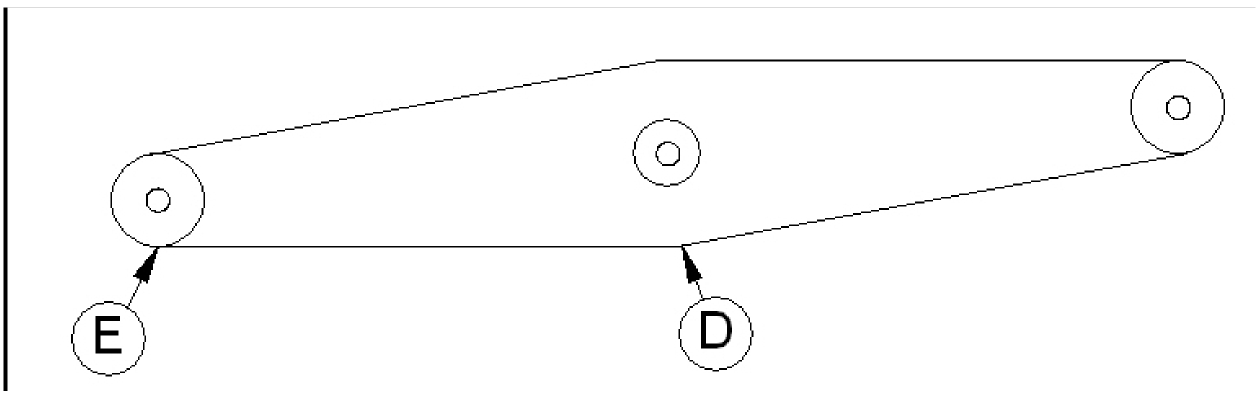
The bar, MDF, and base are again clamped. I have now moved the part exactly 0.250” along the Y axis and made no change in position on the X axis. I now have the center of rotation at point “D”.

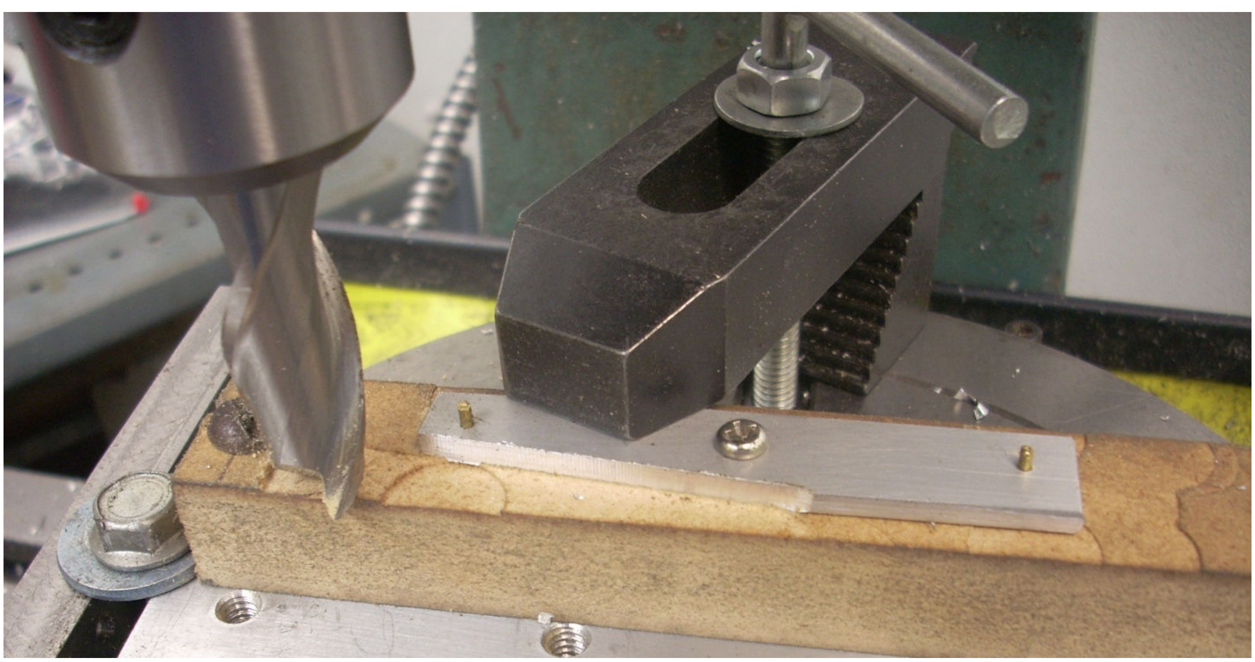


6.



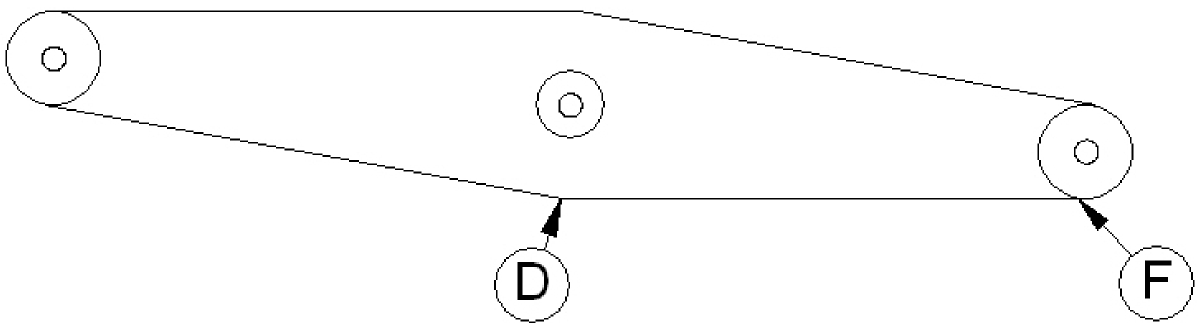
I must rotate the part -5° 10’ 24” in order to get line E-D parallel to the X axis.

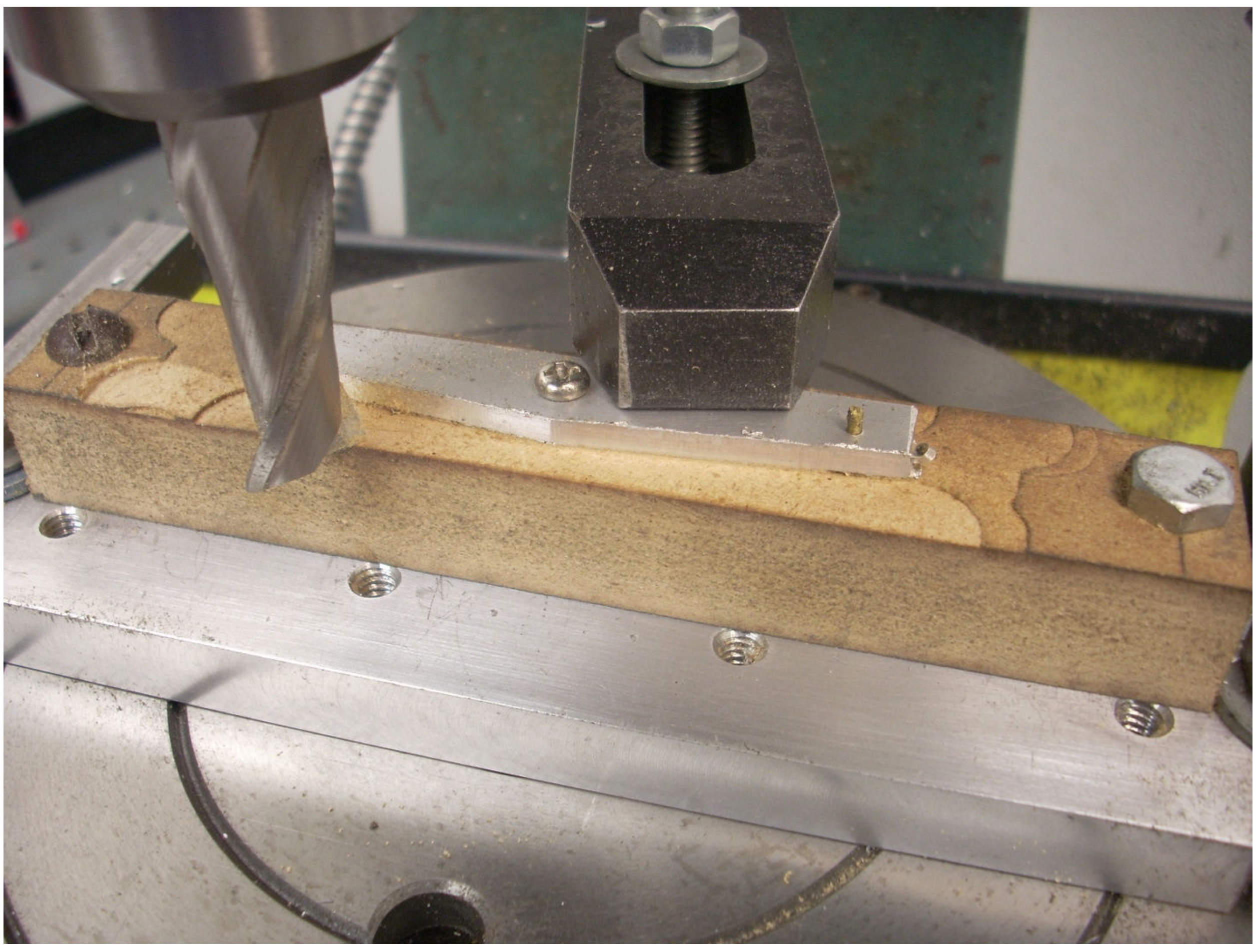




7. Using the proper tool offset, cut line E-D.

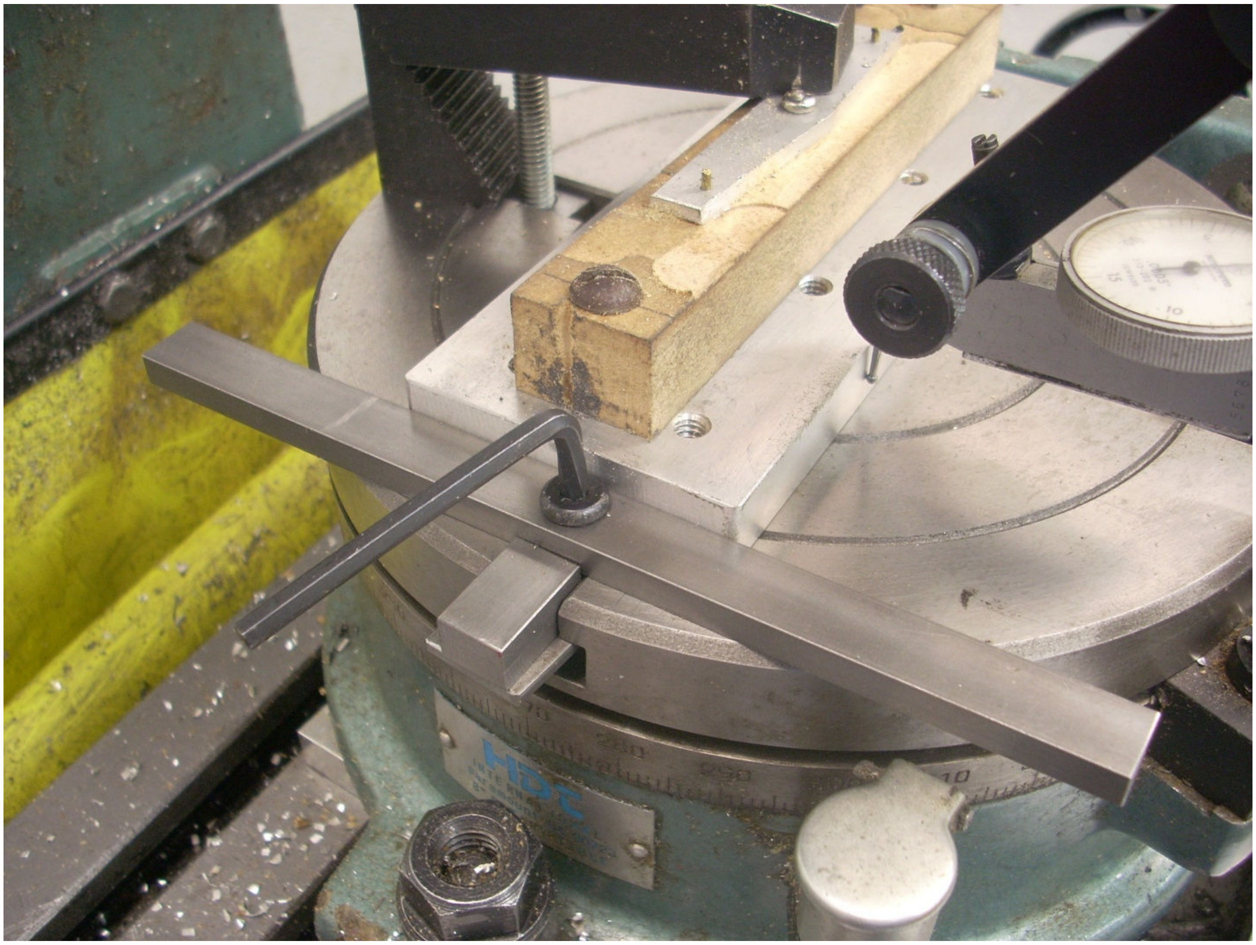
8. Now rotate to +5° 10’ 24” and cut line D-F. Remember that “D” is the center of rotation.



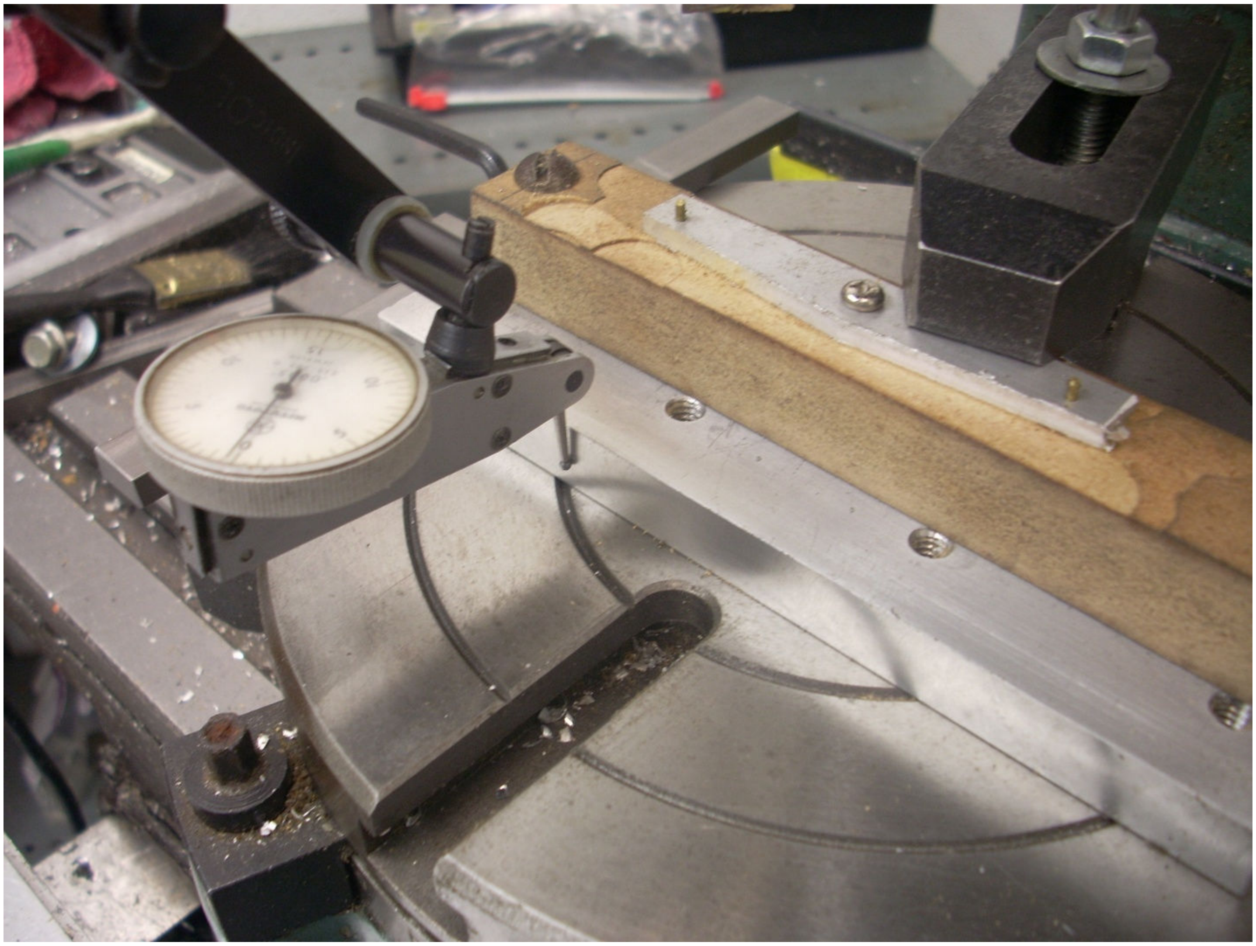


9. Rotate back to 0°.

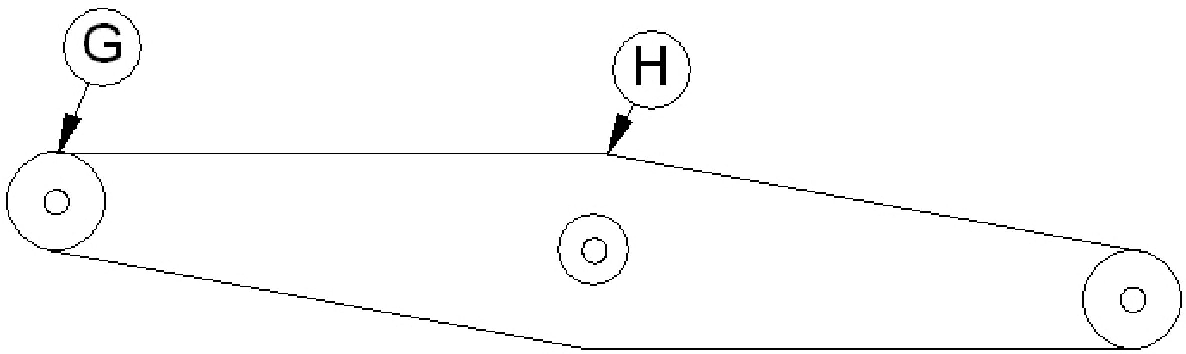
10. In order to cut the far side, I must move my center of rotation 0.500” from its present location along the Y axis.

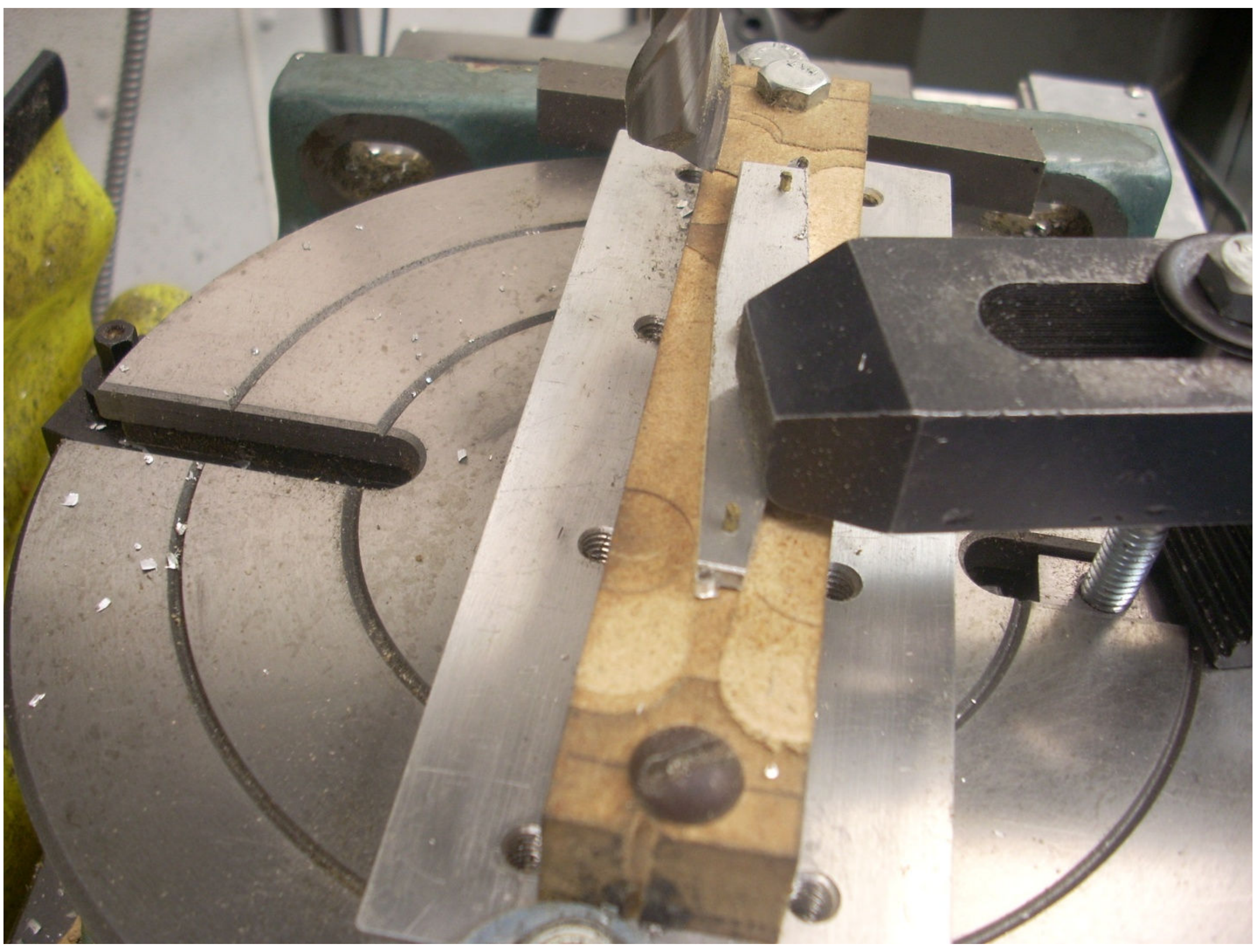


I set up my fence parallel to the Y axis, zero my DTI on the edge parallel to the X axis, set my DRO’s incremental Y zero, and unclamp the assembly. I can then slide the assembly towards the column about ¾”. I then use the Y axis feed to move the table 0.500” towards the front of the mill. This causes the DTI to move 0.500” towards the assembly. Clamp.

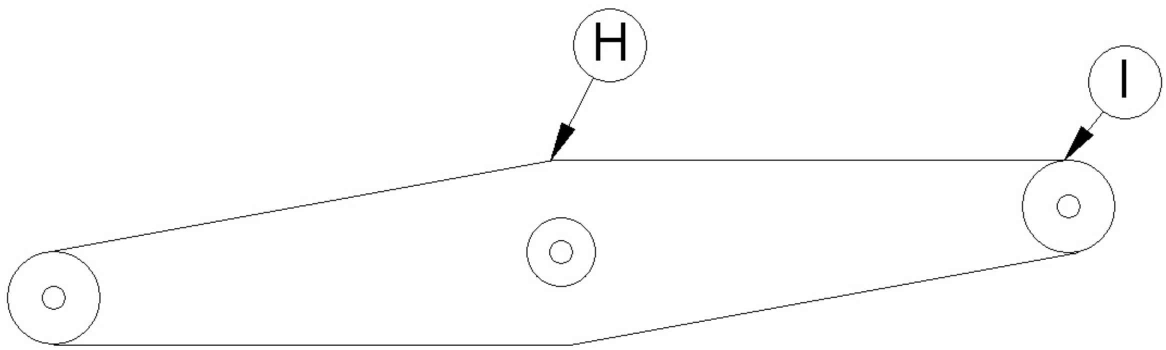


11. Rotate to +5° 10’ 24”. I can now cut line G-H. Note that “H” is now the center of rotation.

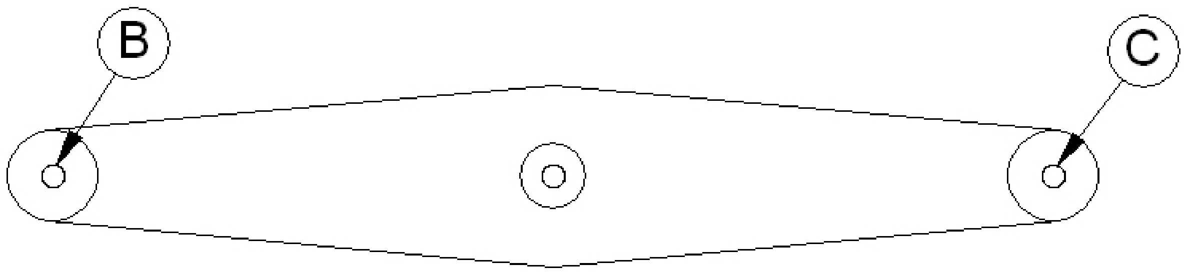




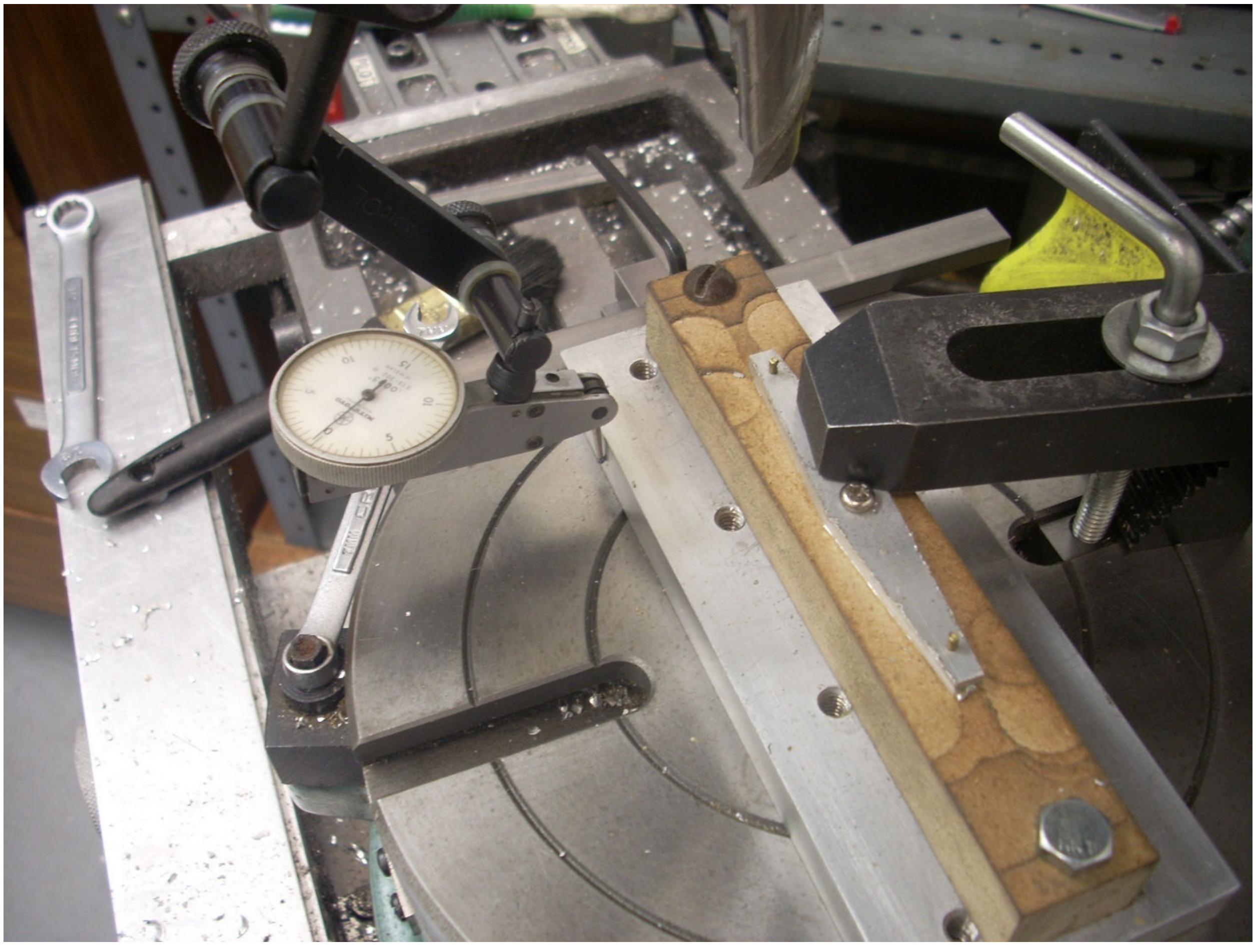
12. Rotate to -5° 10’ 24” and cut H-I



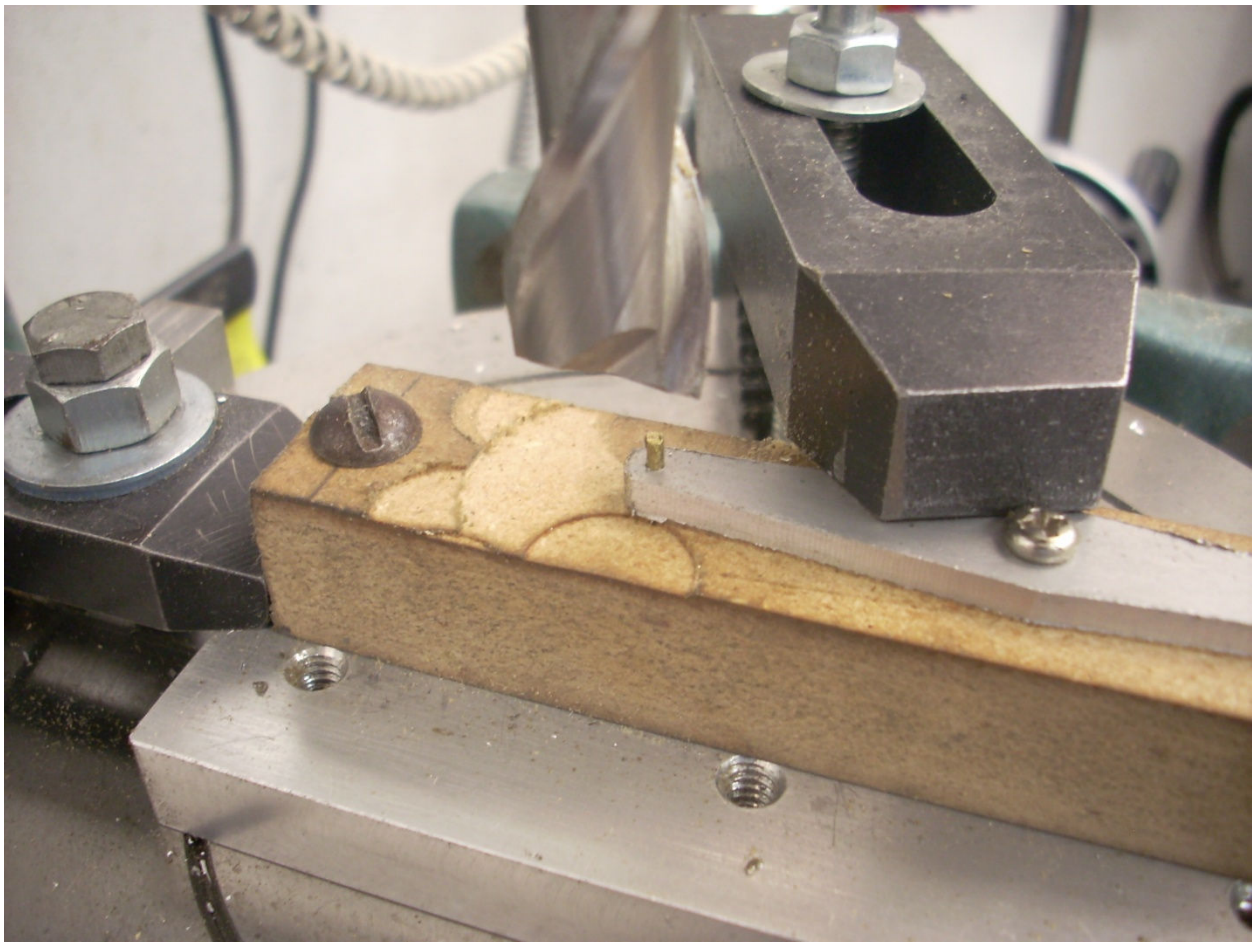
13. Rotate back to 0° in preparation for moving the center of rotation to the center of hole B.



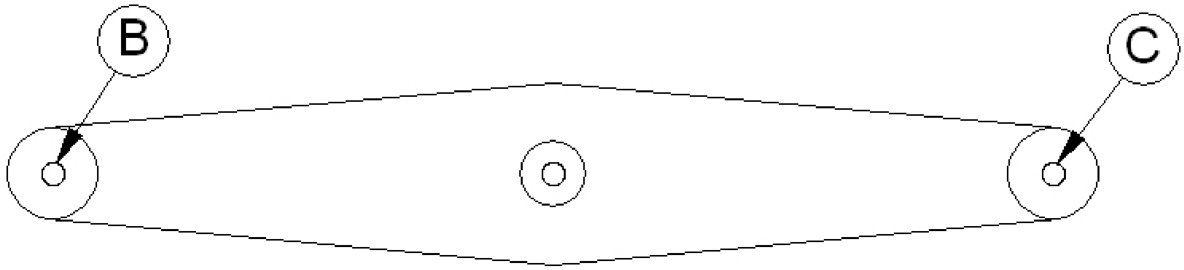
I then use the same procedure with the fence and DTI to move the assemble to this point.



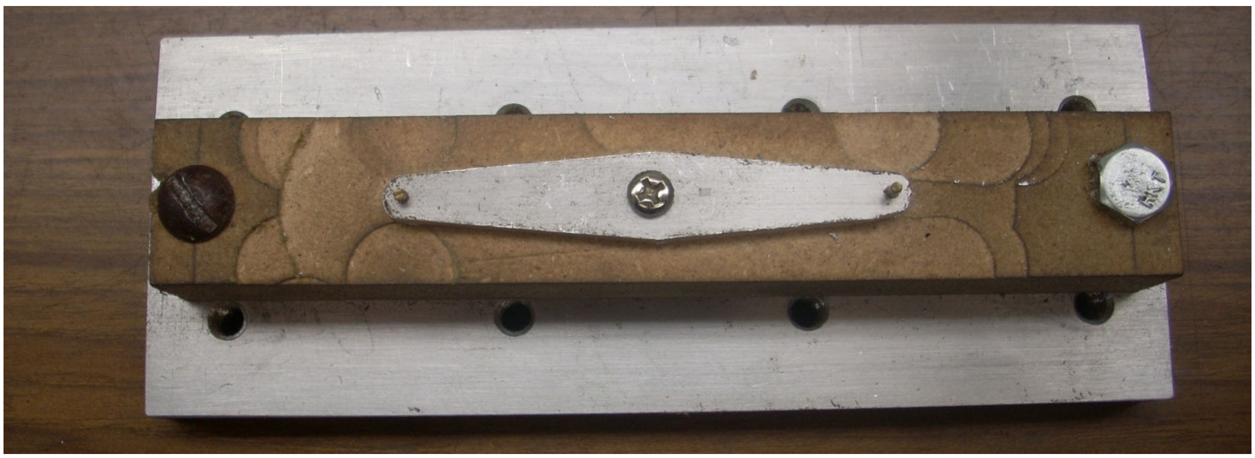
14. Using the correct tool offset, I can now cut the arc on the left end of the part. The total arc is 169° 38’ 12” and is centered along the major axis of the part. This means that I must go half this angle below the center line and half above it: -84° 34’ 20” to +84° 34’ 20”. In other words, from 275° 25’ 40” to 84° 34’ 20” since my rotary table doesn’t display negative angles. I move 0.125” from zero to get the correct radius and took the cut in 3 passes advancing 0.05” per pass so as not to over stress the clamping of the part.



15. I again used the fence and DTI to move me to the center of hole C and cut the right end arc.



Here is the part removed from the mill/drill before being deburred.



16. After deburring, it looked like this.

17. I don't want you to think that I did a perfect job, because I didn't. Some compound movement was off and I did get two defects.

I cut in a bit on the left top edge and didn't cut enough from the right top edge. This tells me I made an error rotating the part back to 0° after cutting the top edge and before I cut my two radii. There sure are a lot of steps to get right. One mistake and it shows.

Acknowledgement

Thanks go out to Larry Gill for finding all of my spelling, grammar, and clarity mistakes.

What next?

I welcome questions and comments which will help to improve this document. All of us are smarter than any one of us.

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