Rebuilding the Ram Ways on my Gingery Shaper, version 1.1

By R. G. Sparber

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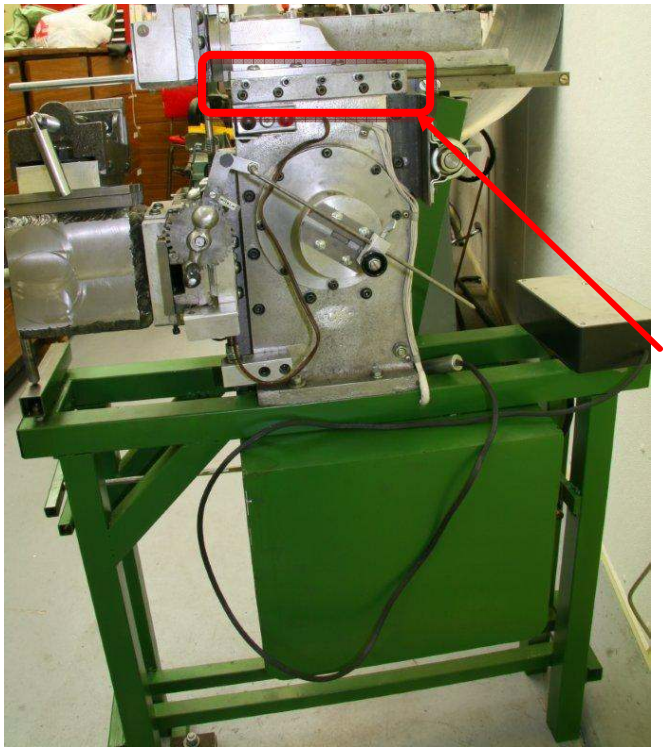
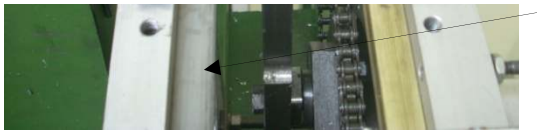


The original Gingery Shaper was designed more than 20 years ago. Many people have built them and along the way figured out improvements. I collected about 60 of these suggestions and implemented them as I was building my shaper. One of the suggestions was to replace the brass and aluminum ram ways with Ultra High Molecular Weight (UHMW) plastic.

This stuff is very slippery yet hard. It has a high quality adhesive backing which makes it easy to install on a clean metal surface.

[1] You are free to copy and distribute this document but not change it.

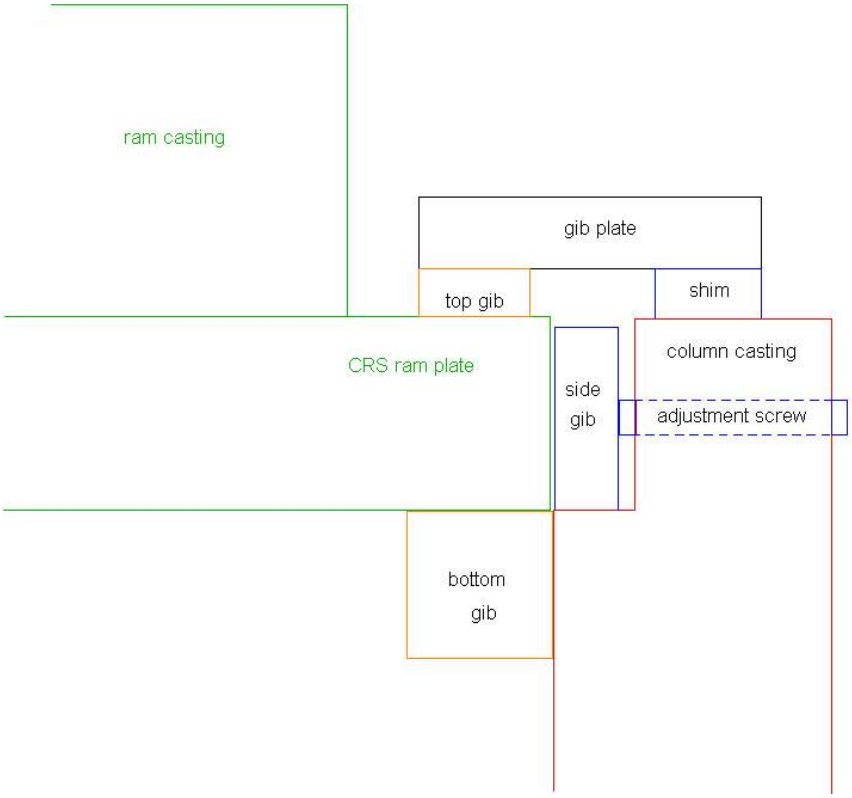


Here you can see my left lower ram ways covered in UHMW plastic. The right one was replaced with a bar of hard brass.

As I investigated the finish I was getting from my shaper, a ripple was evident. The height of these ripples was around 0.0002”. Not terrible but I really wanted to understand the root cause.

After much discussion on line, I decided to rebuild the ram ways and replace the plastic with brass. Sadly, the finish did not improve. I'll talk about that at the end of the article.

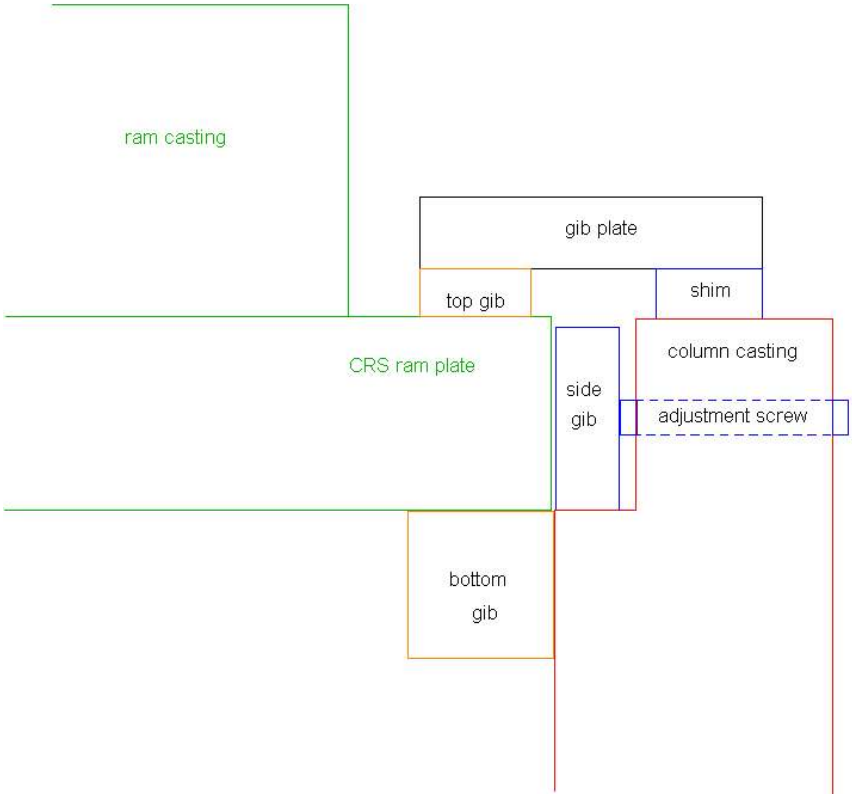
Let Me Count the Ways



You are looking at a front view diagram of the right way. It is designed to snuggly hold edge of the Cold Rolled Steel (CRS) ram plate while permitting it to slide forward and back. A similar arrangement exists on the left side except that the side gib is not used. The edge of the ram plate slides on the aluminum casting.

Starting at the bottom we have the bottom gib. Preventing side to side movement we have the side gib. It is pushed against the ram plate with a series of adjustment screws.

The ram plate is held down withpressure from the top gib.



I really hate shims. Yet you will see some holding up the gib plate. The side gib can be continuously adjusted by turning the adjustment screws. I like that. So initially my rebuild plan included having a series of adjustment screws pushing down on the top gib. This would eliminate those damn shims. In fact, I had my mill/drill all set up to drill my first tap hole. But then it was dinner time so I washed up and left my shop for the night.

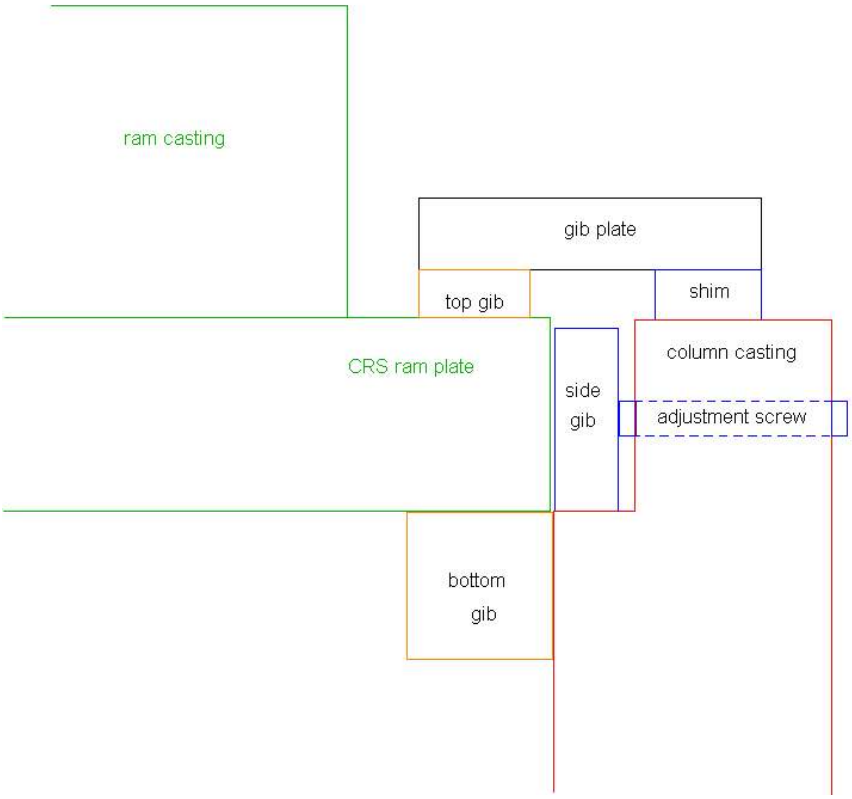
As often happens, the best ideas come after a good night's sleep. In the morning I realized that the force experienced by the side gib was much less than that of the top gib. Rather than having a solid surface pushing down on the ram plate, I would have contact only at the ends of the adjustment screws. The rest would be unsupported, soft brass.

So now I see that those annoying shims provide a valuable service. In combination with hold down bolts passing through the gib plate, I get a very solid yet adjustable support for my top gib.

Let's think about alignment for a minute. It is essential that we assume that the ram plate have parallel sides. Otherwise it would be impossible to snuggly hold it without binding up on the gibs.

My side gib can be adjusted to apply pressure against the right edge of the ram plate. This presses the left edge of the ram plate against a machined step in the left column casting. That is simple enough.

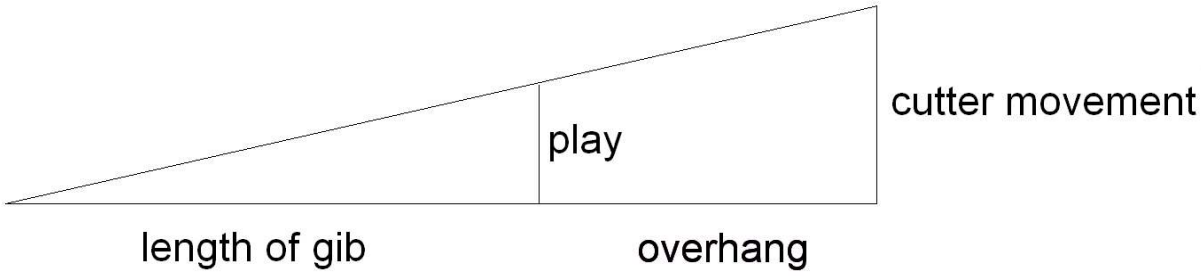
But consider the right and left bottom gibs. They must make contact with my ram plate which, by assumption, is dead flat. If these bottom gibs are not in alignment, I won't get full contact. We will later see how to achieve this degree of alignment.



Similar demands are made on the top gib although I do have those shims to adjust the height. However, front to back error is not solved by playing with the shims.

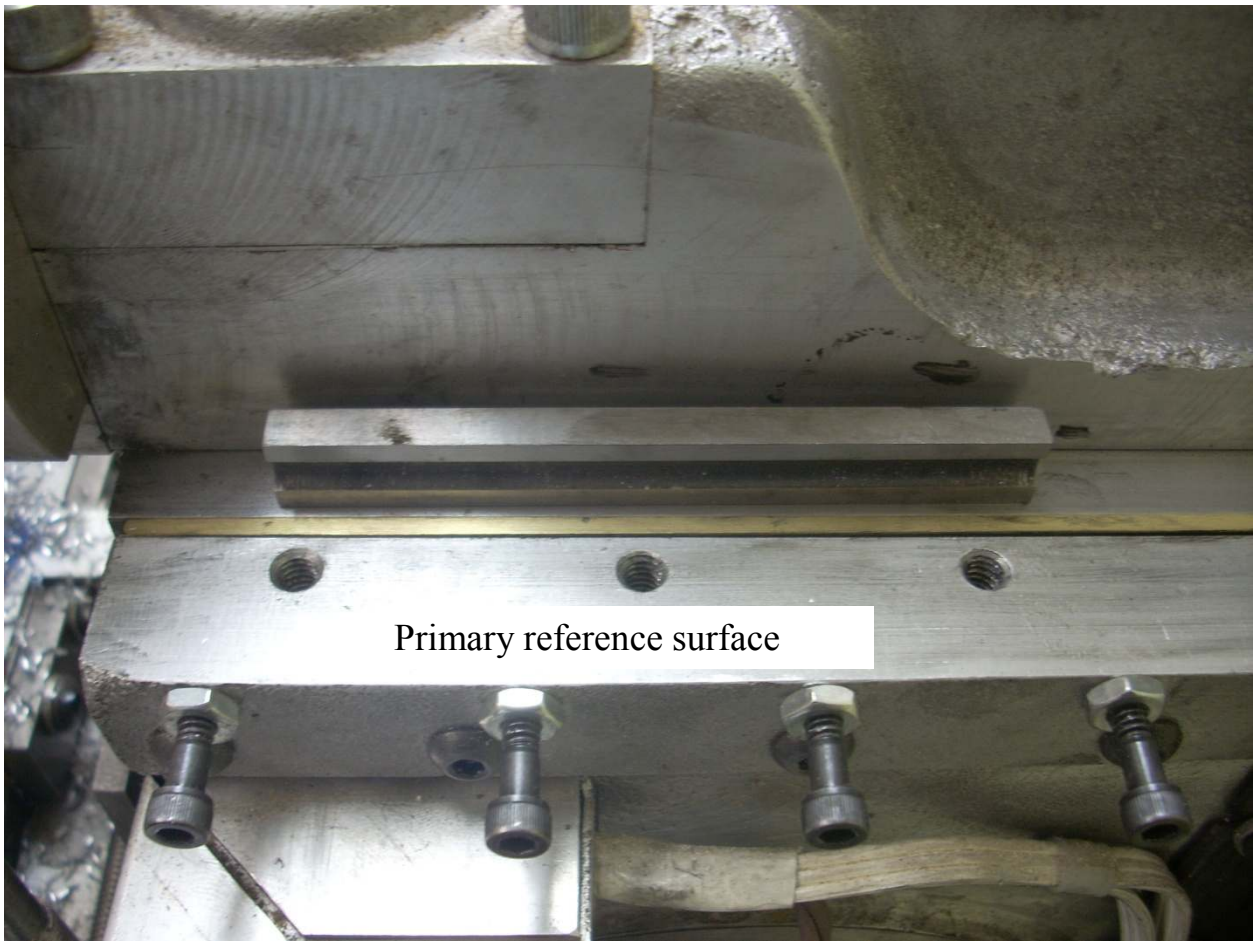
If I made good contact only at the front, then my ram plate would be poorly supported at the back. Only when I have continuous and snug contact between all gibs and the ram plate will I have the support I need.

Failure to have this support will lead to unwanted vertical and/or side to side movement of the ram during operation which causes the cutter to randomly move. That causes a poor surface finish and poor accuracy.



Consider the geometry here. Say the back end of my top and bottom gibs are snug on the ram plate but the front end has some play. As the ram moves forward, my cutter will overhang the gib more and more. This will cause the vertical play in the ram plate to be amplified. My vertical cutter movement will always be equal to or greater than the vertical play in my gibs. Now, I've been chasing a surface finish ripple on the order of 0.0001" which equals 100 ***millionths*** of an inch. When my overhang equals my length of gib, a vertical play of 50 ***millionths*** of an inch would cause this problem. Fortunately, we have a way to get mating surfaces to fit nicely. We lap them. I'll say more on this later.

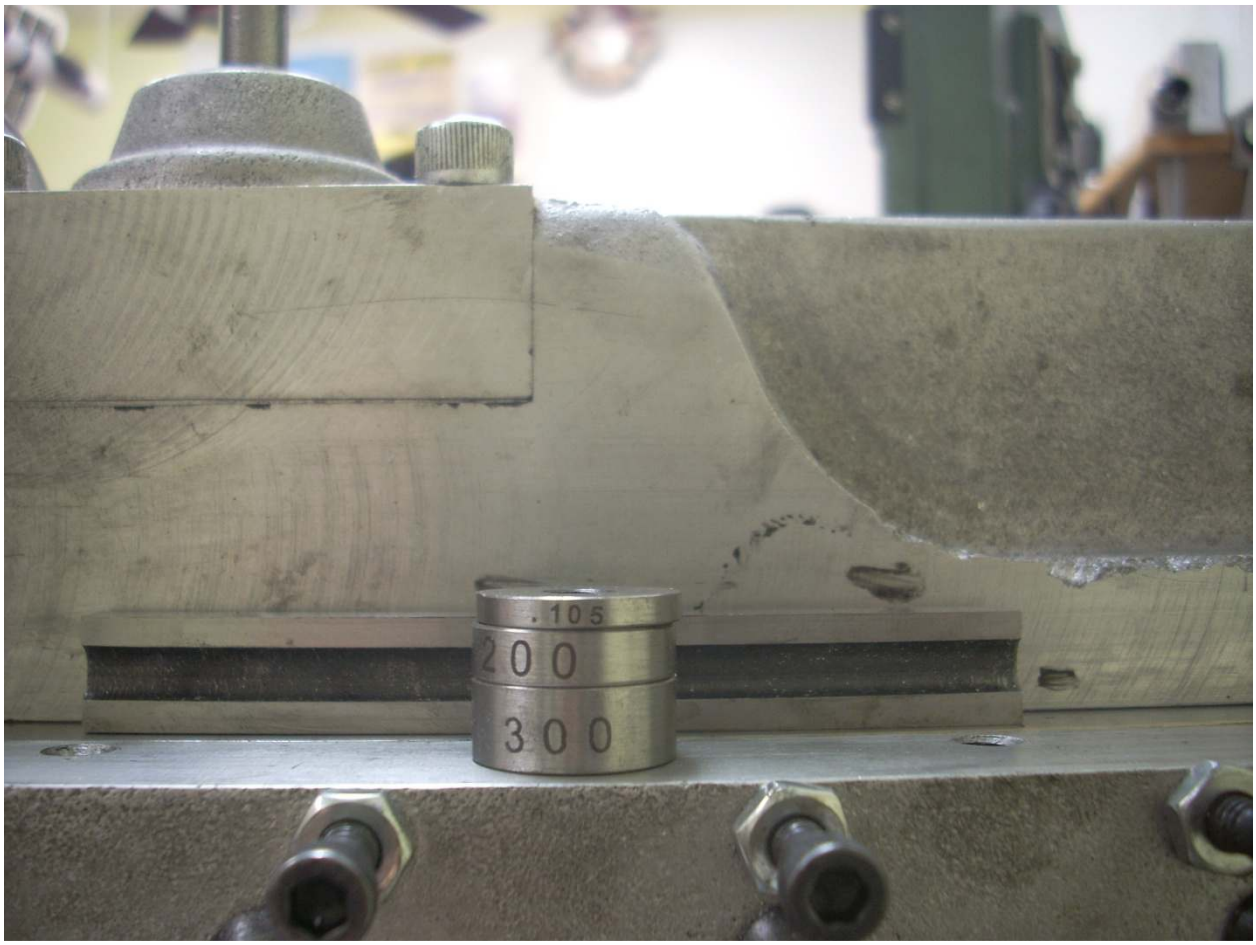
The Rebuild



When I was young, my Dad once told me that any fool could do a job right but it took a lot of skill to fix someone's mistake. His sage advice certainly applies here. During the fabrication of my shaper, I was able to cut multiple surfaces at the same time. This insures that they are in perfect[2] alignment. On a rebuild, I have no such inherent accuracy.

The best I can do is use precision ground surfaces to align new parts to existing reference surfaces. Fortunately, I have easy access to my primary reference surface which can be seen here. My secondary reference surface is the top of the column casting on the left side of the shaper.

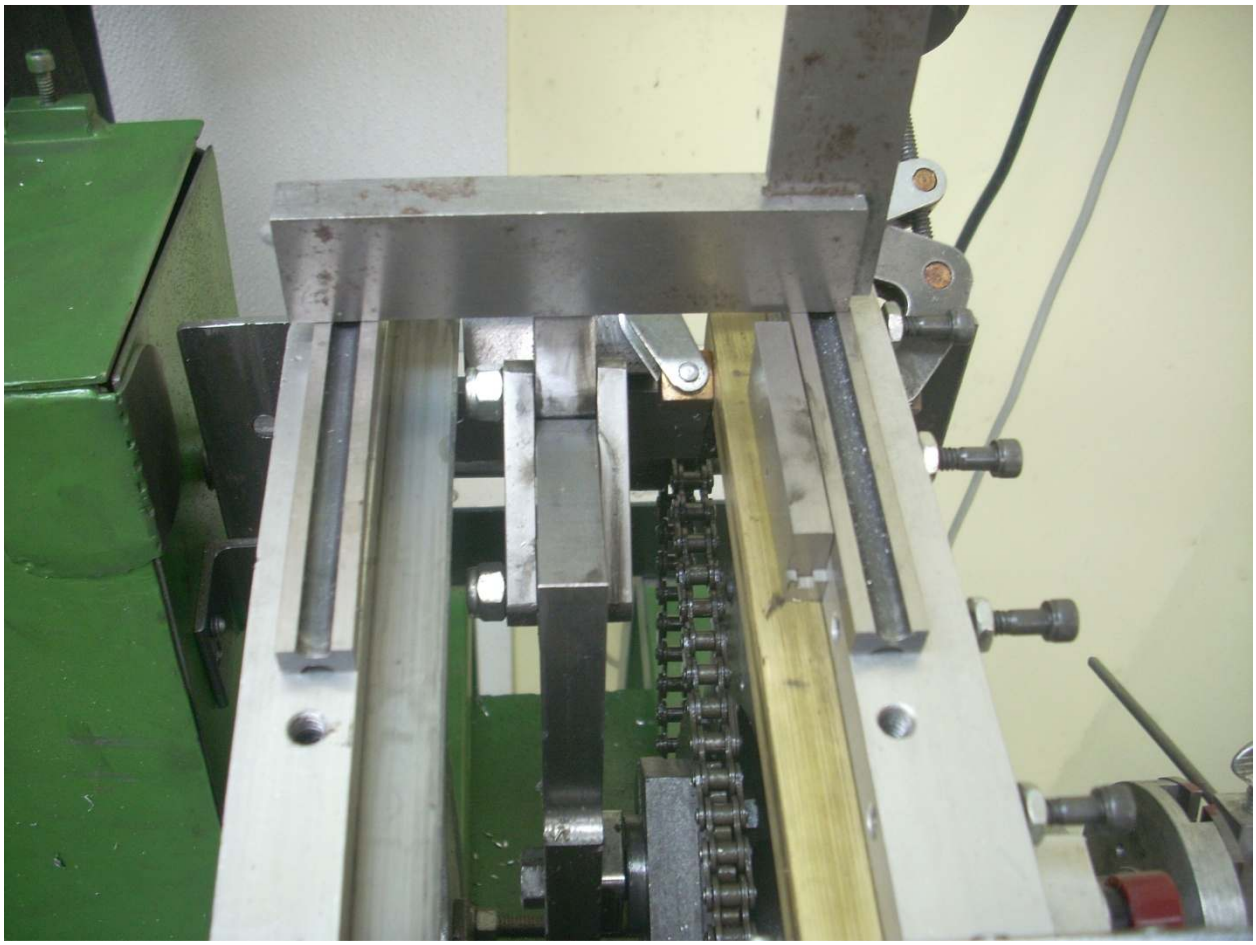
[2] "Perfect" really means to within the accuracy of my mill/drill.



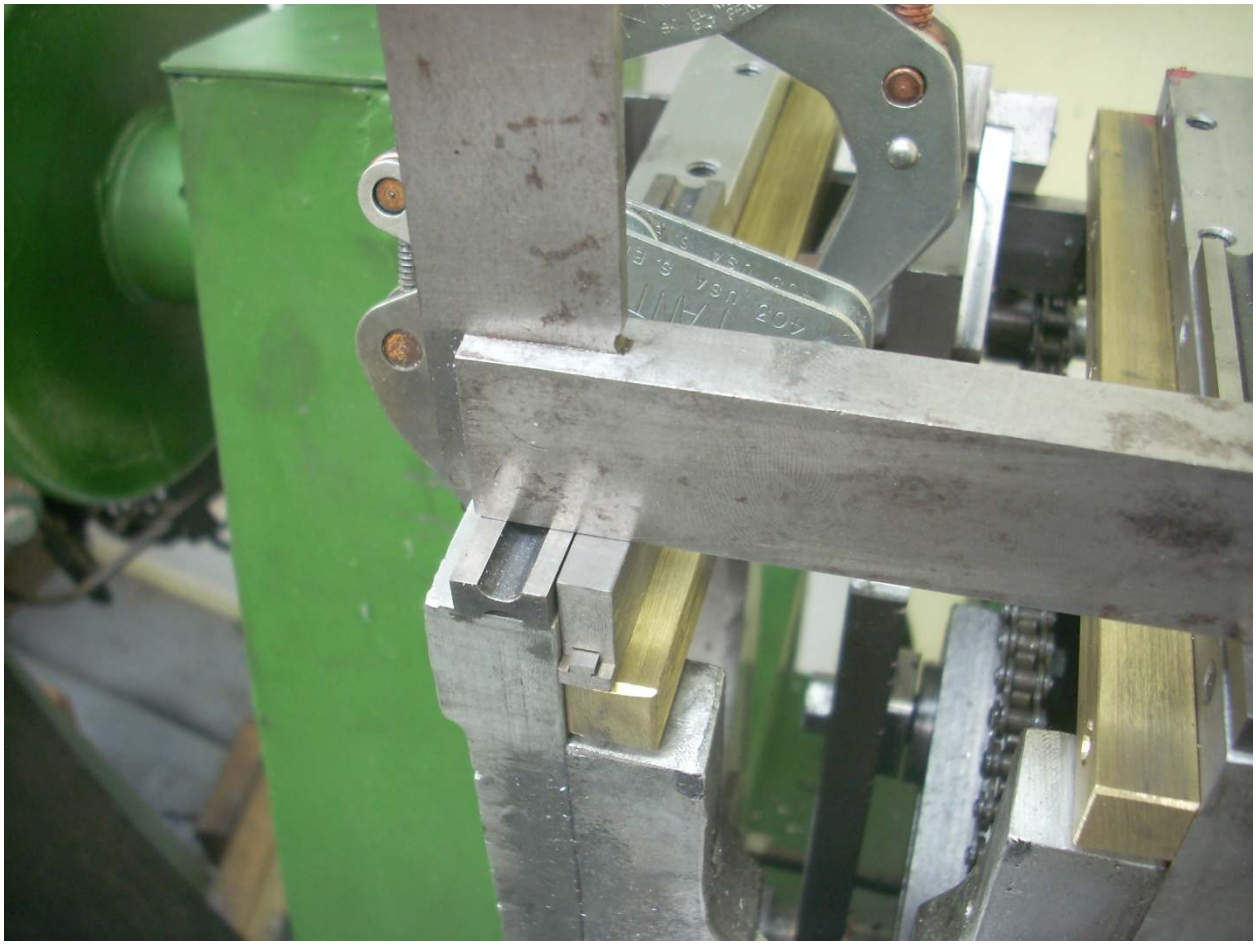
The first thing I want to do is measure the difference in height between my primary reference surface and the top of the ram plate. This gap is roughly equal to the thickness of my UHMW tape which is around 1/16″ thick. That is hard for me to directly measure. But I do have a precision 1/2″ parallel and my trusty spacer blocks. These blocks let me set the height in steps of 0.001″ ± 0.0001″.

I placed a 1-2-3 block on top of my spacer blocks and adjusted the height until the parallel slightly dragged on the bottom of the 1-2-3 block. Then I read off the total height of the spacer blocks and subtracted the height of my parallel. My gap was 0.027″.

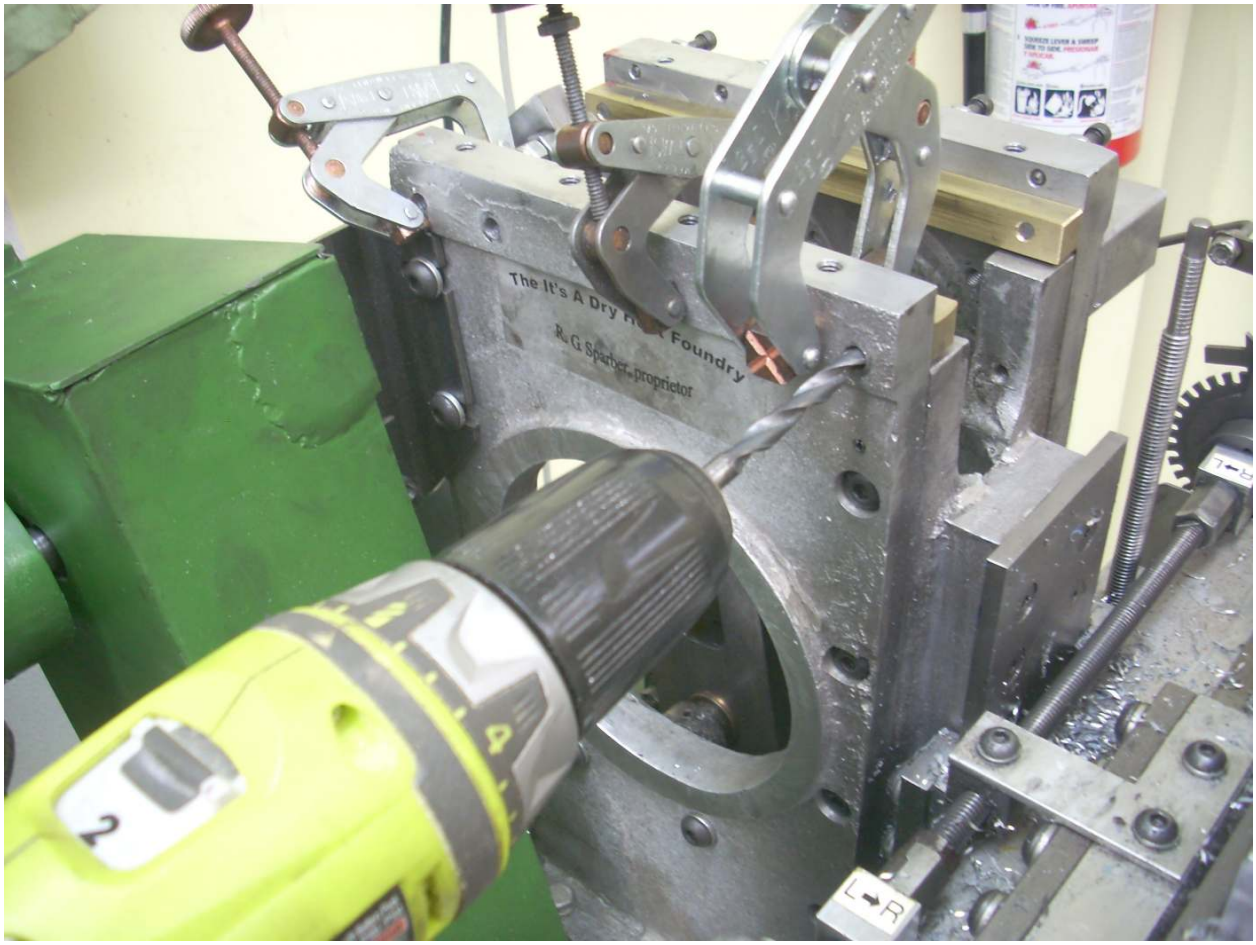
As it turned out, this degree of accuracy was not needed but it was still fun to figure out how to take this measurement.



A better way to take the measurement was with an adjustable parallel. I really didn't care about the size of the gap; I just wanted to set the new gibs to the same position. Here you see my machinist's square resting on a pair of 1/4″ thick parallels. My adjustable parallel were set by resting it on the UHMW plastic of my lower gib. I then adjusted it until I felt a slight drag as it passed under the square. The adjustable parallel was then locked. I then had a reference that was used to set the top of both bottom gibs. It was used at the front and the back of the gibs.

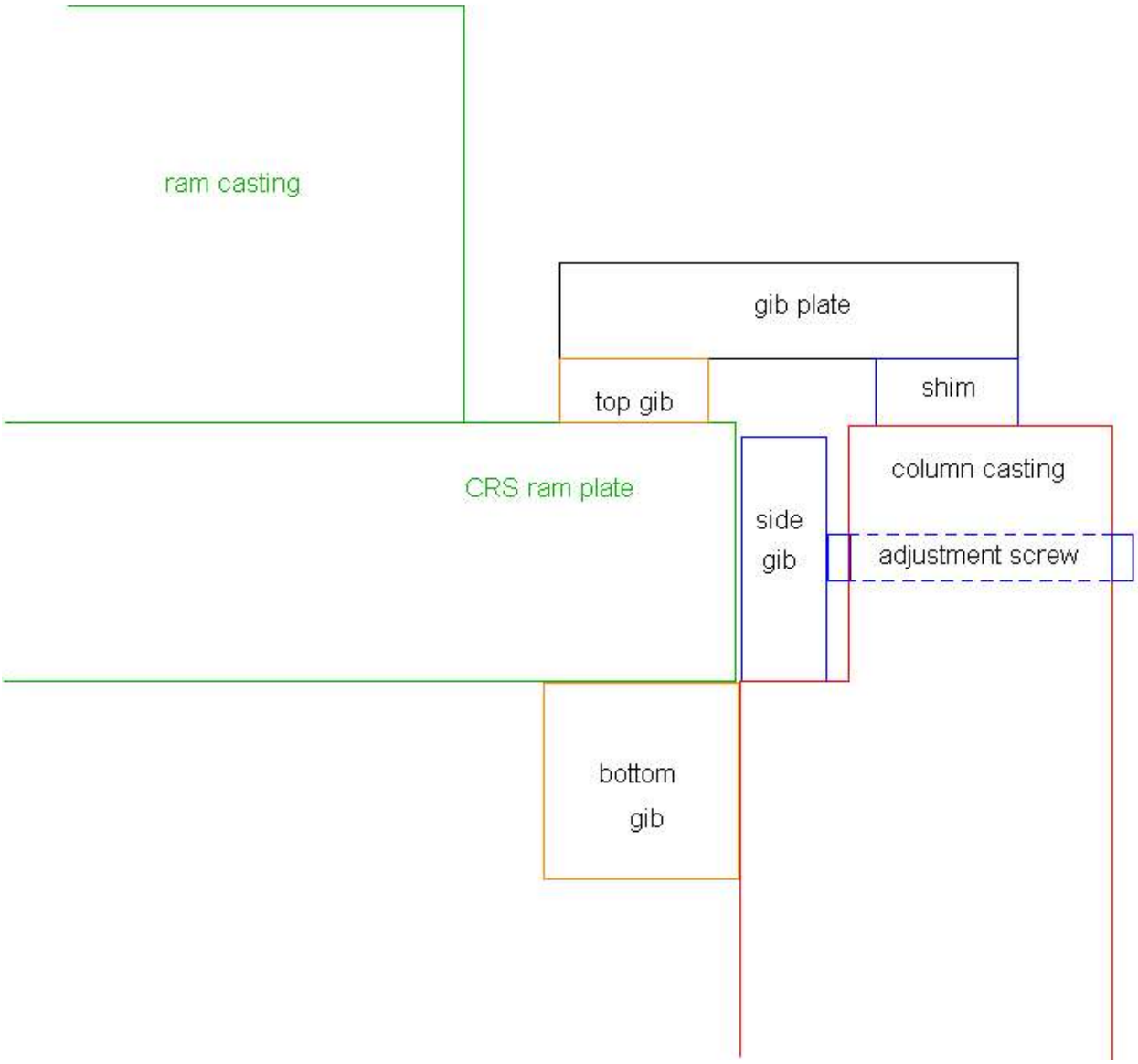


I used three “Kant-Twist” clamps on each side to hold the brass bar into position.



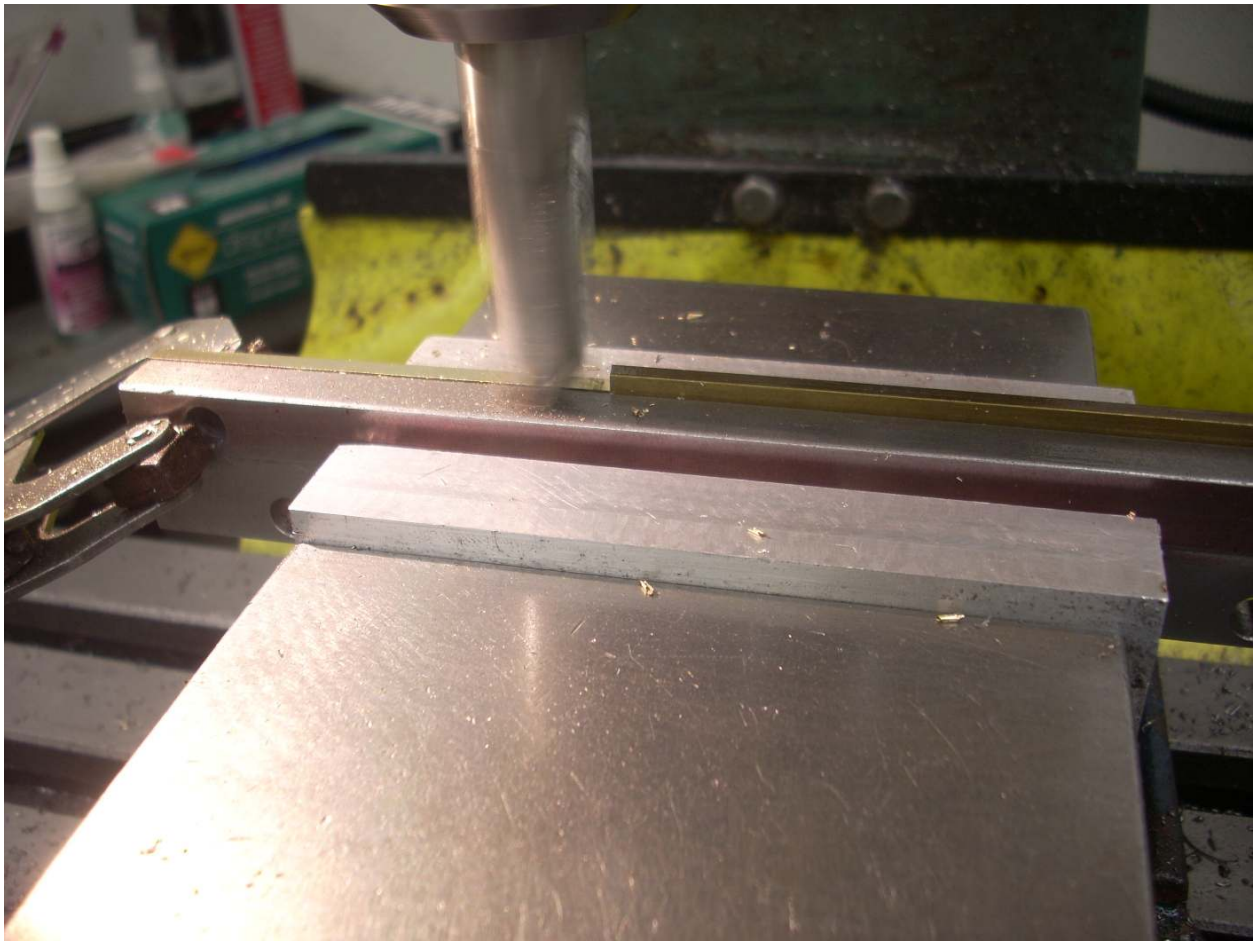
I already had the holes through my side column casting so it is a simple matter to match drill. The side column holes had been drilled with an F drill and I needed to drill and tap ¼-20 into the brass bars. The trick is to again use an F drill but only go into the brass bar enough to cut a cone. Before unclamping the bar, I used some red nail polish to indicate the correct position of the bar with respect to the casting. With match drilling, there will be only one right way to put the bar back on. Other ways may seem right but will bind.

Each bar was unclamped and a #7 drill used to finish each hole. Then I ran a spiral tap to finish the job. The bar was deburred and remounted. With all screws loosely fitted, I then tightened them all up. No measuring, just precision.

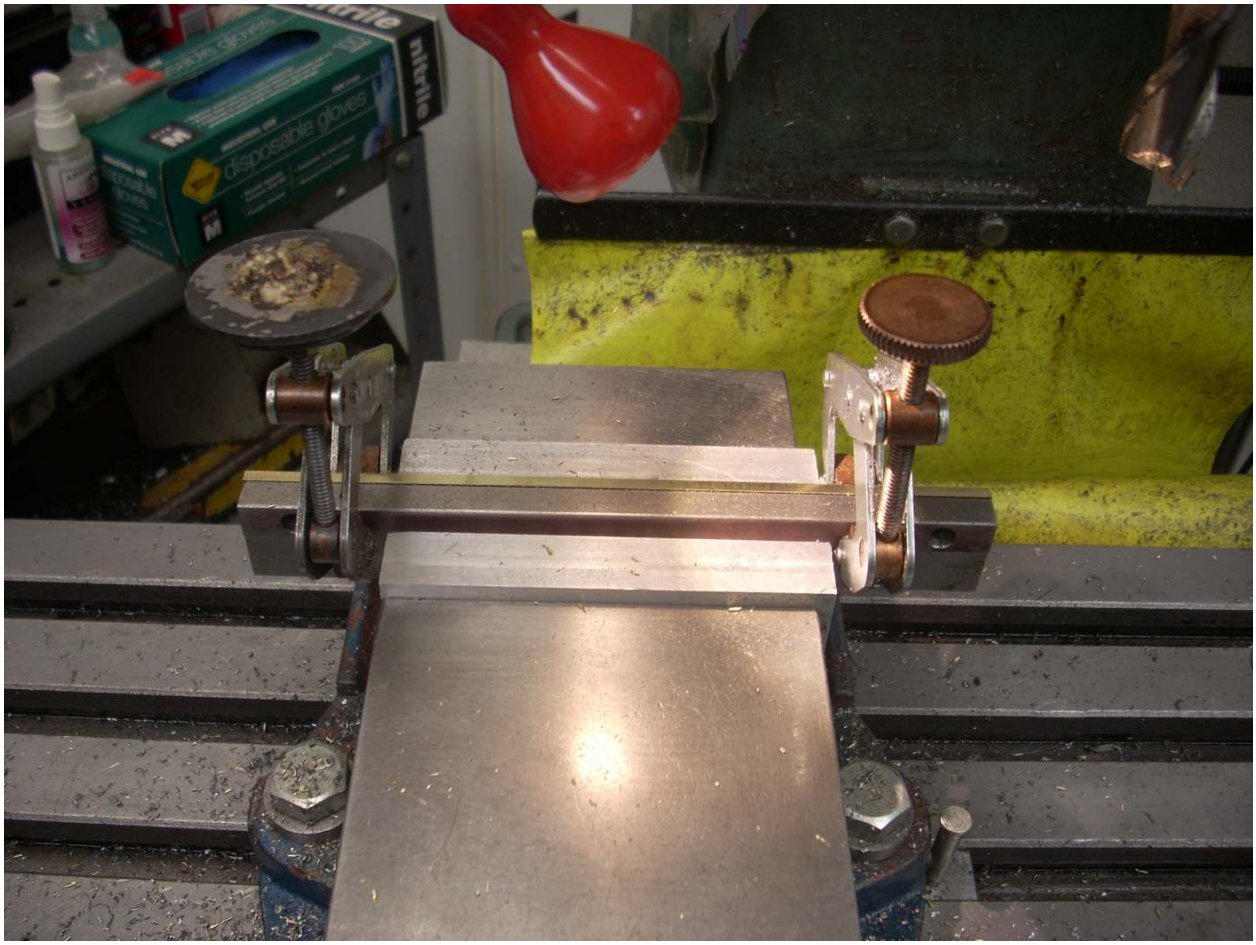


With the new brass bottom gibs installed, I went on to reworking my gib plates. They used to have the UHMW plastic stuck to them but now they must carry the top gibs which are brass. It took me a while to figure out the best way to attach the top gib to its gib plate. There is no need for screws because with the top gib in place, it will not fall out. It might, however, slide out. So I wanted a means to preventing sliding.

The approach I chose was to pin the top gib to the top plate. I drilled two 1/4″ holes in the top plate 1/2″ from each end and along the center line of the top gib. Here I am deburring the top plate using a brace and bit mounted countersink.

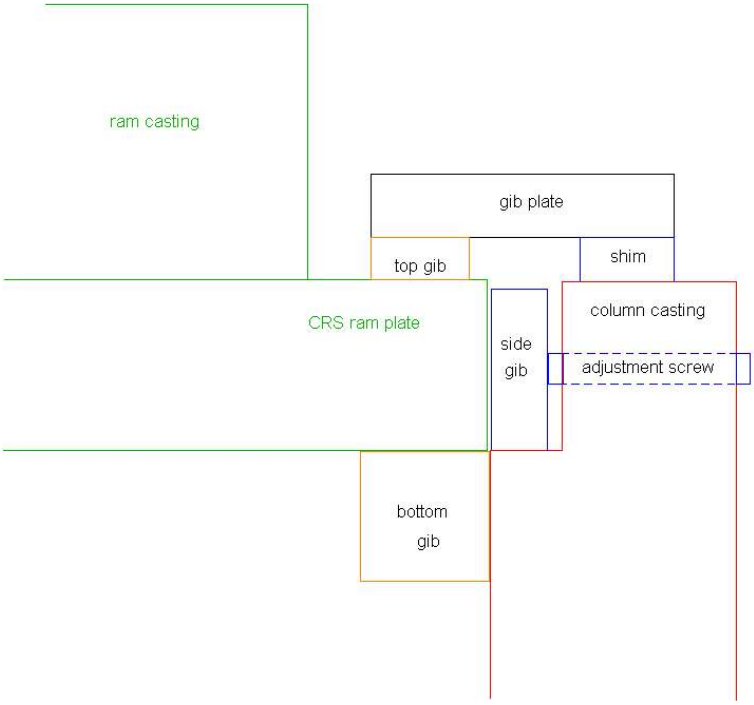


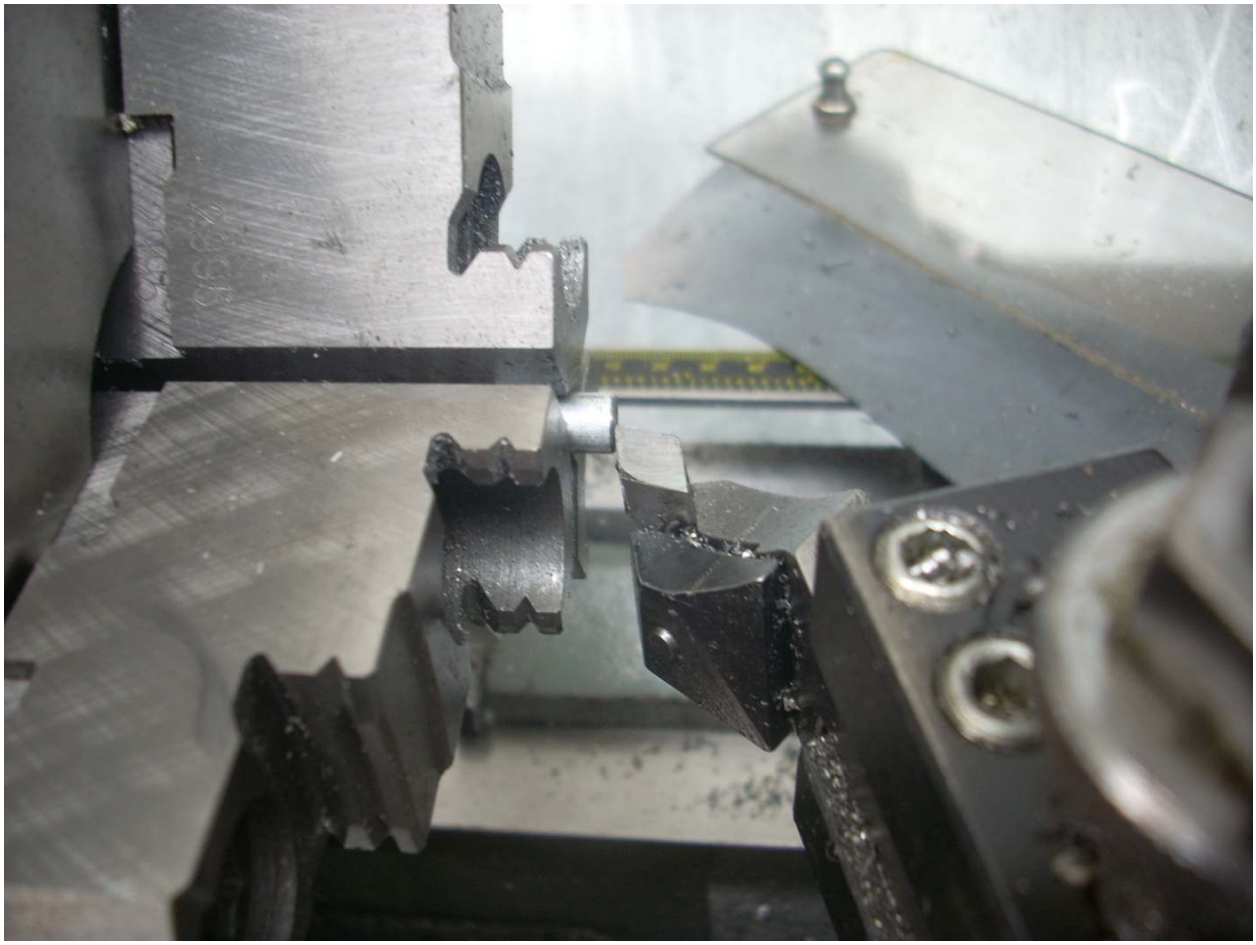
The 1/8″ x 1/2″ brass bar I was using was not perfectly straight. I chose to clamp it to the top plate and then mill it to be 0.01” wider.



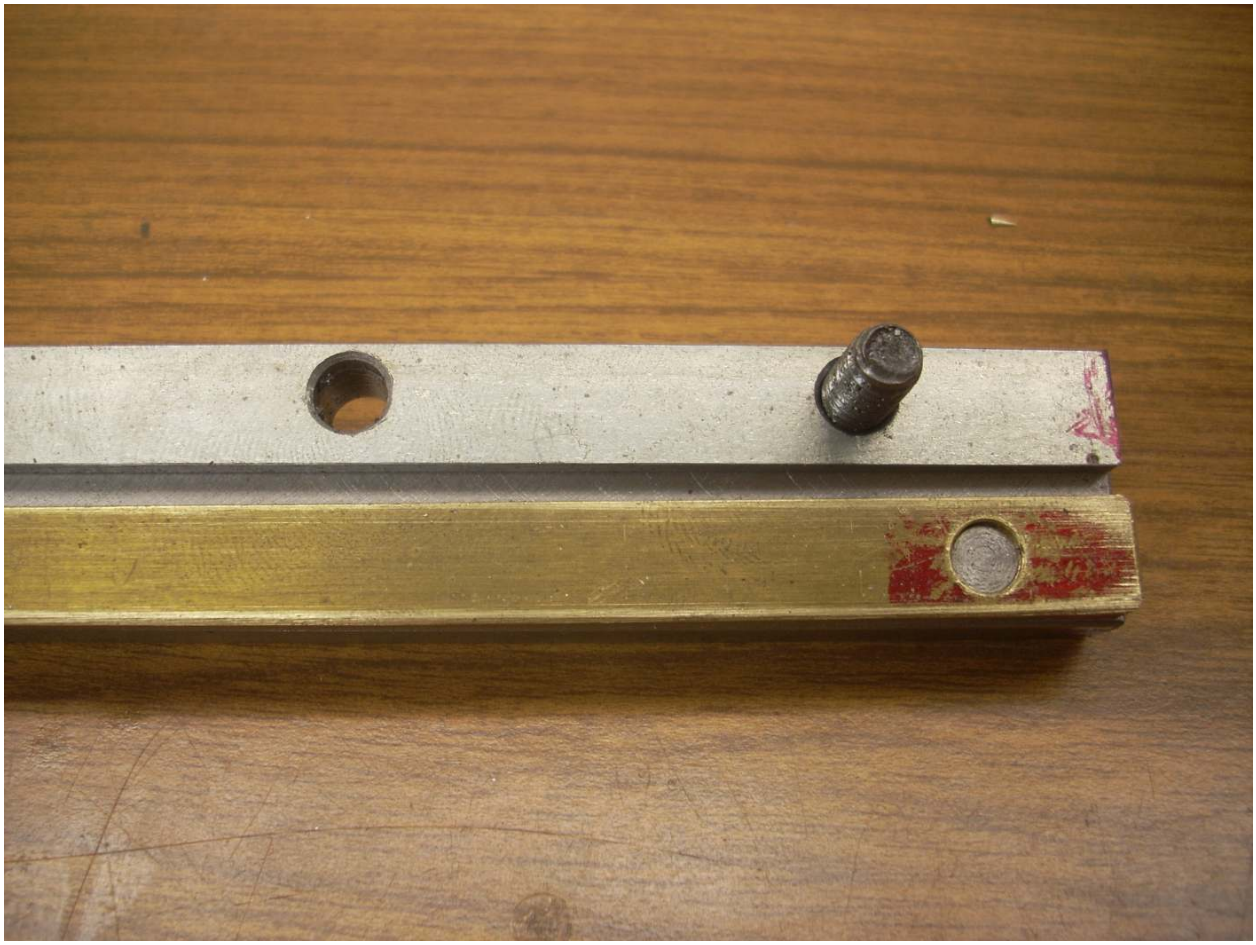
After milling, I clamped the top gib to its gib plate before removing it from the vise.

Then I used my 1/4″ drill to match drill through gib plate and top gib.

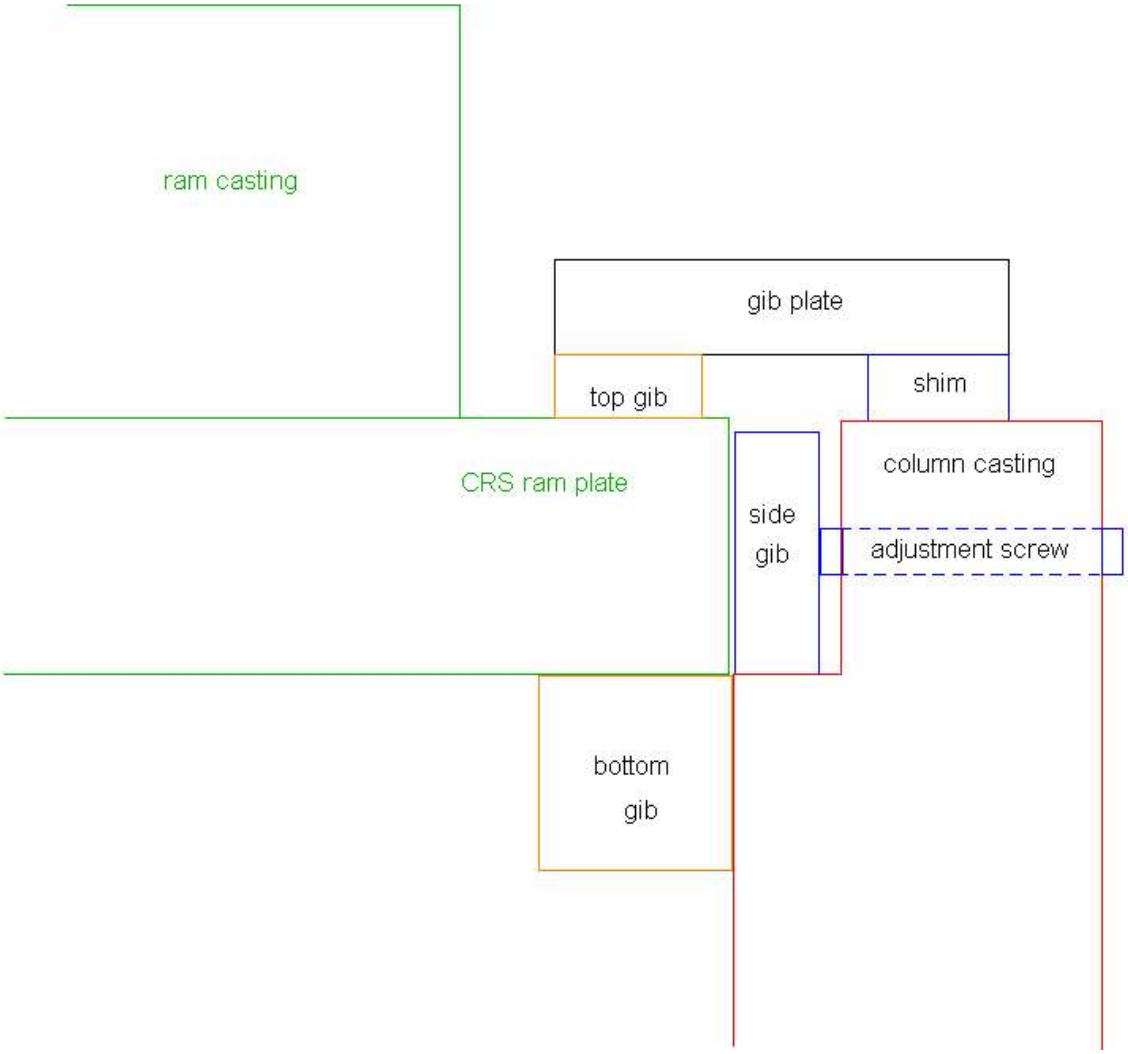




Time for a quick job on my lathe. I needed to cut four pins to press into the holes just drilled. These pins were cut 0.025″ shorter than the thickness of the top plate and top gib. I pressed the pins in such that the top of the pin was flush with the top of the gib plate. This left a gap between pin and ram plate.



Here you see one of the pins in place. Note that the brass bar is curved slightly. Because I milled it in place and match drilled in place, it still fits the top plate.

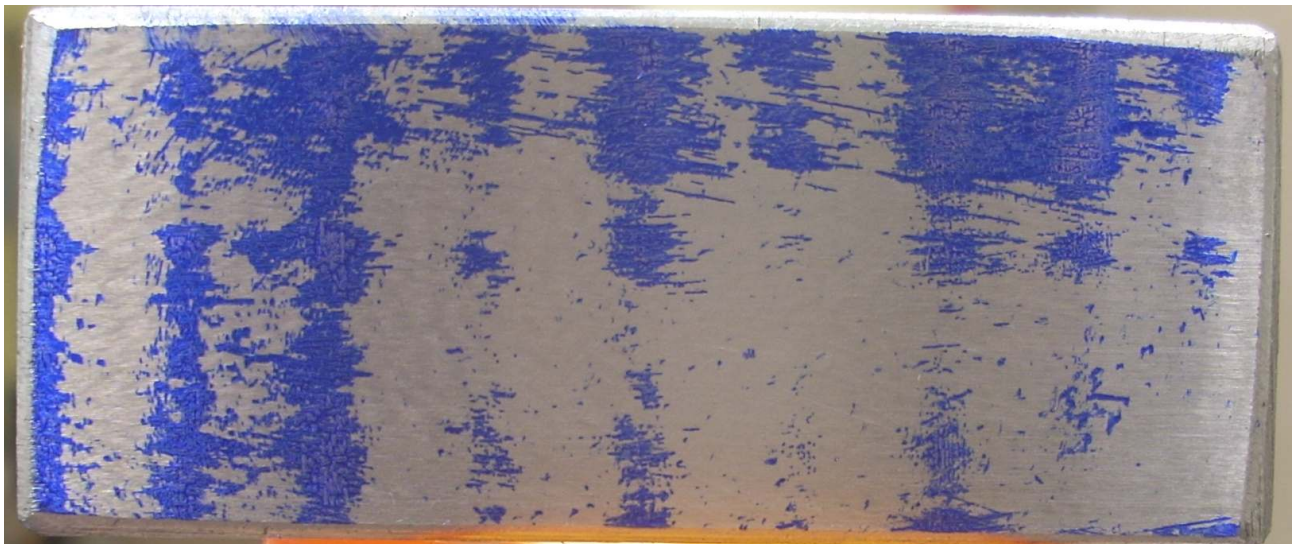


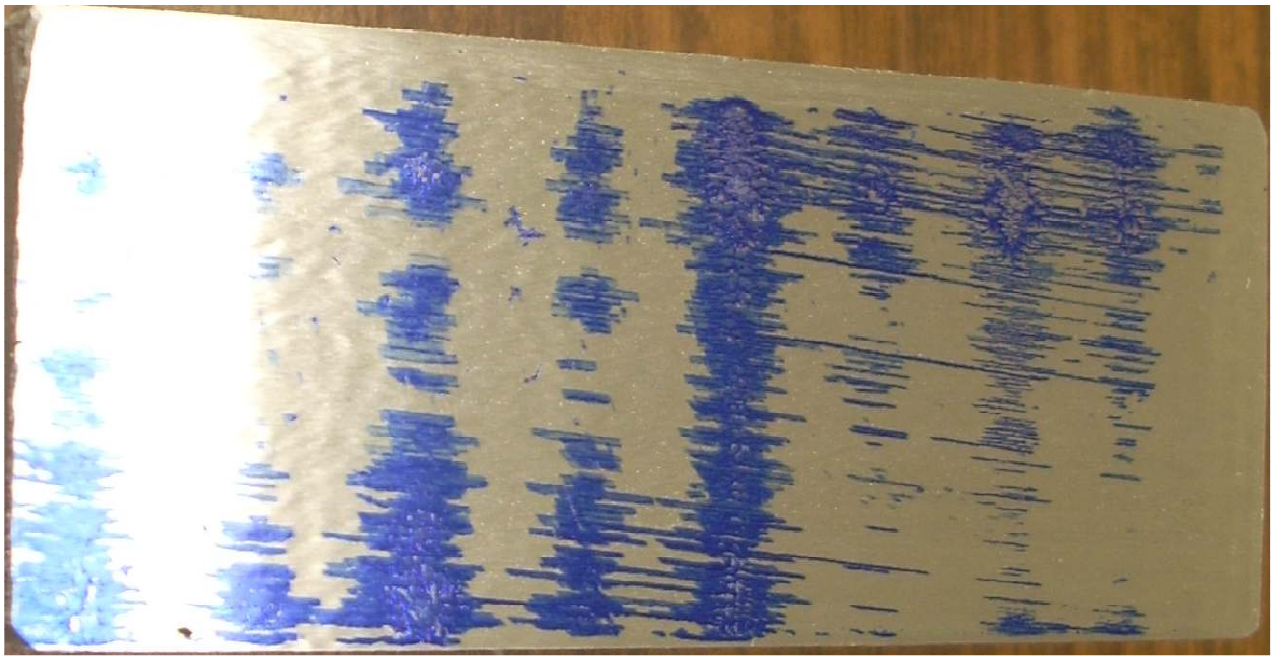
With the top, bottom, and side gibs installed, I then smeared Clover 600 lapping compound on the top of the ram plate. Then I started up the shaper. The lapping compound worked its way around to the three gibs. Periodically I would stop the machine, wipe off the old compound which had flecks of brass in it, and put down fresh. As the ram moved more freely, I tightened the bolts holding down the gib plate.

After the ram ran smooth with the bolts fully tightened, I started the clean up process. First the gib plate on both sides was removed along with its top gib and shim stack. Then I took out the side gib. And finally, the ram was removed. All parts were soaked in degreaser to remove all traces of the lapping compound. I then wiped each part dry. The bottom gibs were cleaned in place since removing them would disturb their alignment.

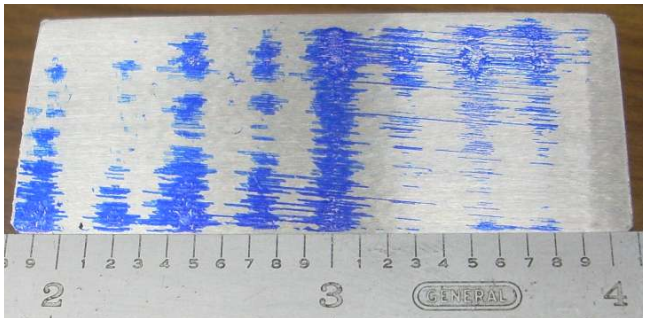
Test Cuts

After reassembly, I coated all gibs with way oil and took my first test cut.





The top surface was cut at a feed rate of 0.002″ per pass and a depth of cut of around 0.002”. I locked the downfeed on the head but did not lock the vertical ways. The bottom surface was also cut at the same feed rate and depth of cut but the vertical ways was locked. I don’t see much difference in ripple.



It is hard to accurately measure the peak to peak ripple but it seems to be around 0.25″ to 0.3″. The depth of ripple as measured with my DTI is around 0.0002”.

So the conclusion is that the UHMW plastic ways were ***not*** the source of the ripple.

I welcome your comments and questions.

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