# Fitting the Vertical Slide on the Cross Slide Casting

***by R. G. Sparber***

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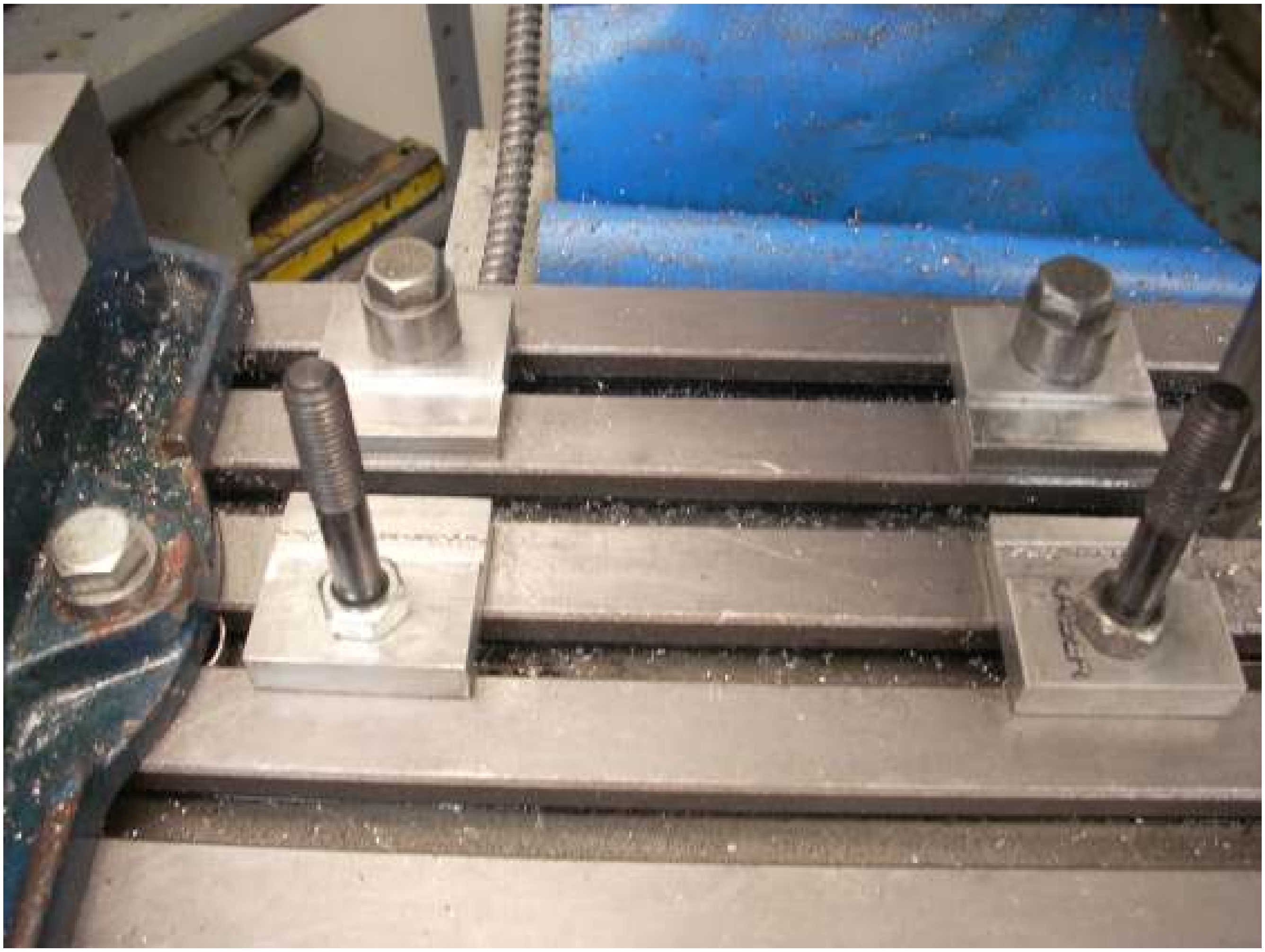
The vertical slide clamps and gibs are essential the same as those on the downfeed head. I get a second chance to do it right!

The clamps are holding a piece of scrap ¼" x 3" CRS plate that was left over from the part screwed onto the front of the shaper column. When assembled, the vertical slide will engage this plate.

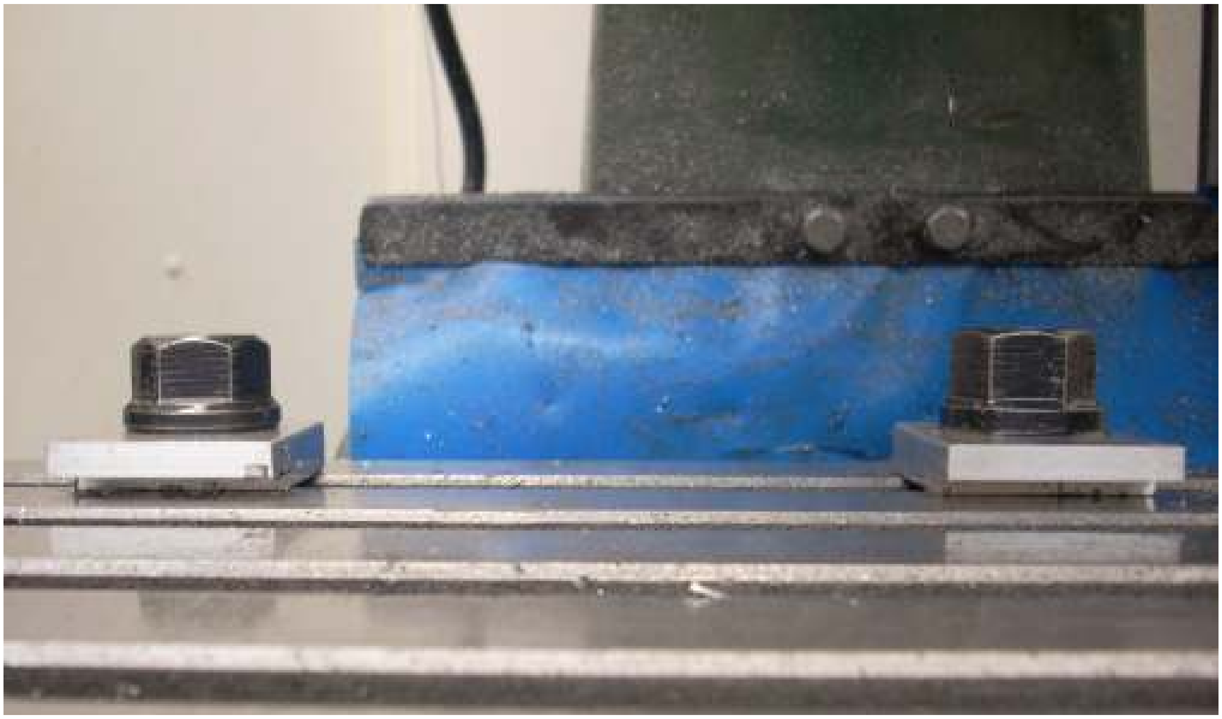
The clamps are made first and set aside. Gingery calls for ¼" thick stock but I could only get 3/8". I had to make many substitutions as I was buying CRS but none have been a problem.



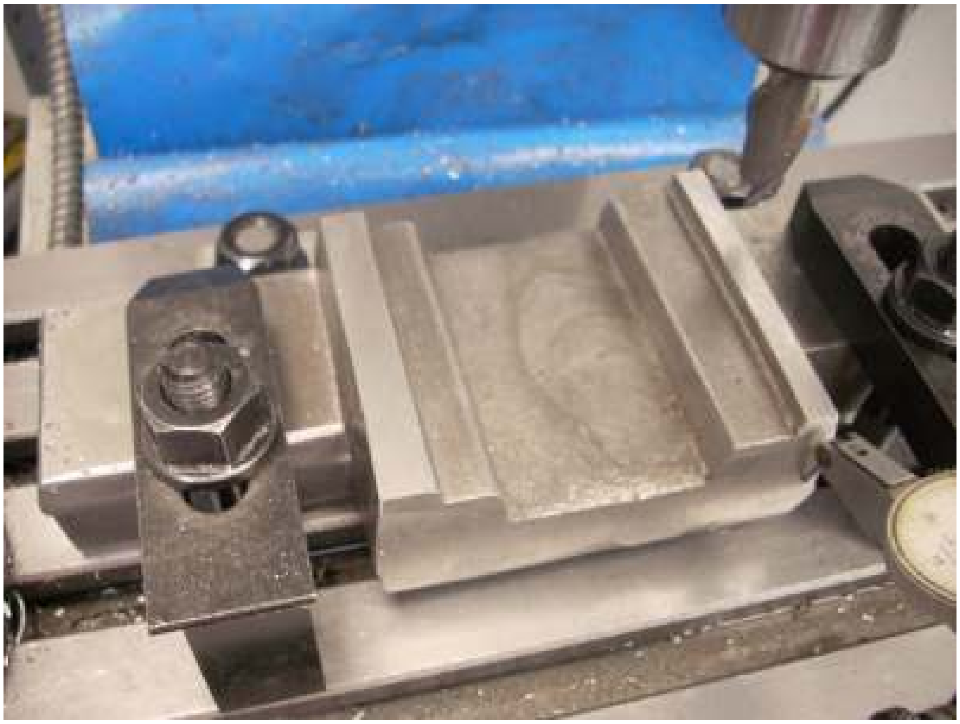
The accuracy of the shaper will depend on having a cross slide that is true. The best way to do this is to machine supports in place, clamp down the casting, and then verify all is bedded right with a DTI.

I am so proud of the above set of pads and clamps. The back pads have been cut to have a true vertical face and horizontal face. The front pads have just a true horizontal face. You can see the ragged edge where the end mill stopped. These front pads are held in place with hold down bolts and small nuts. These bolts will later also hold down clamps.

Only one problem with this set up. It doesn't work. My casting does not have a machined surface where the left back pad must contact it. Oh well, an hour down the drain. Lesson ***re***-learned: trial fit the casting in the unaligned fixture before putting in any work on the fixture.



This time I got it right. I'm using the table as my bottom reference plane. It will contact what I call “primary reference 1” on the casting. After a trial fit of the casting, it was clear that I can turn two of the pads from my last fixture upside down and clamp them on the table. Both contact “primary reference 2”. After tightening the bolts, I took a light cut with my end mill across the vertical faces. The space under this face permits me to fully cut the face and not risk hitting my table. I now have a pair of precise vertical reference stops.



Next came a careful cleaning of all surfaces both on the mill and on the casting. I pressed the casting both against the back supports and the table before tightening the clamps. There is a lot of contact area here so no need to crunch down hard. That will just distort the casting and could crack it.

One spec of swarf can completely throw off the alignment. It is impossible to see that every single spec has been removed so we instead proceed to the next step.

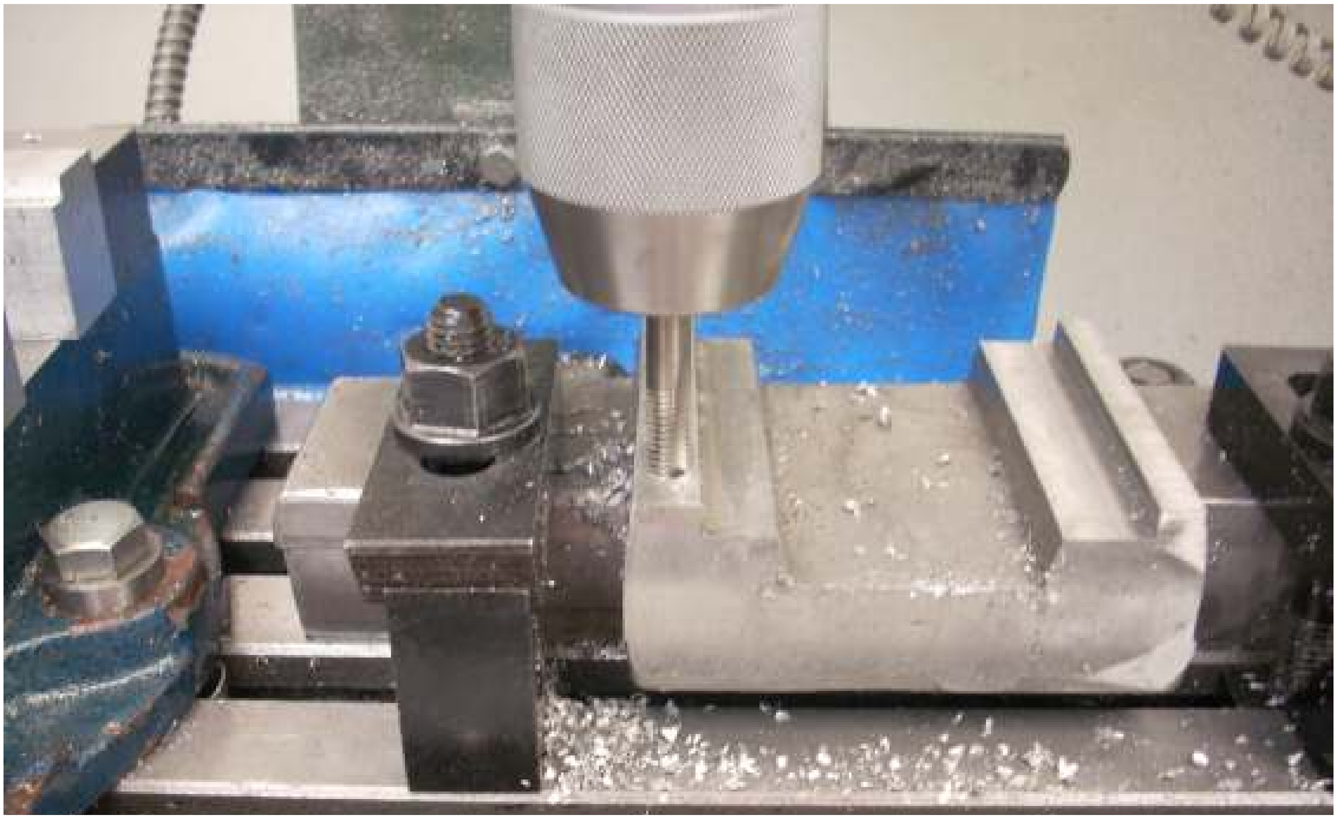
Using my DTI, I verify that my “secondary reference 2” plane is aligned with the X axis of my mill. You can see part of the DTI which has been secured to the spindle. It would have been possible to just move the casting around until the DTI reads zero all the way across the plane but it is more accurate and, for me, less frustrating to use the DTI just for verification. I know from past verification that my secondary reference 2 plane is parallel to my primary reference 2 plane which is contacting the back stops. Since the DTI reads a steady zero, I know that the casting is in full contact with the two stops.

To verify that primary reference 1 is in contact with the table, I want to check from side to side and from front to back on secondary reference 2. The bump I get from falling off of one top surface can cause error in my DTI reading so I prefer to take a known good parallel and place it on both horizontal faces. Then I can run the DTI all the way across without any bumps. It read all zero. I  moved the parallel to the back and read zero all the way across there too.

I then ran the DTI from front to back. I set zero on the front and saw about 0.000 6” on the back. Given that all other readings showed proper bedding, I decided to not disturb the set up. This hopefully is just error in machining. If it is not, then this error will be canceled when the shaper cuts its own table top.

Milling the vertical slide went well. My main concern was that the right clamp support was close to 5/16” wide rather than the ½”specified by Gingery. This was due to excessive taper in the pattern. I had plenty of metal for the support pads so milled down the top faces until I had at least 0.02” of metal around the sides of the holes. More on this later.

Once I cut enough metal to get this width, I fed the end mill down 0.240” and cut the support pads. This gives me 0.01” for shims under the clamps for final adjustment.



I used my DRO to find the center of the left pad. With my clearance drill mounted in my drill chuck, I used one of the clamps as a guide to set my Y location. I want the clamp to be close to true but most important is that all 3 screws cleanly fit through the clamp and into the casting. After center drilling, I drilled the tap hole to a depth of 1.5”. I then used a spiral tap to go in 1”. This leaves me 0.5” to hold the swarf since spiral taps push the swarf ahead.

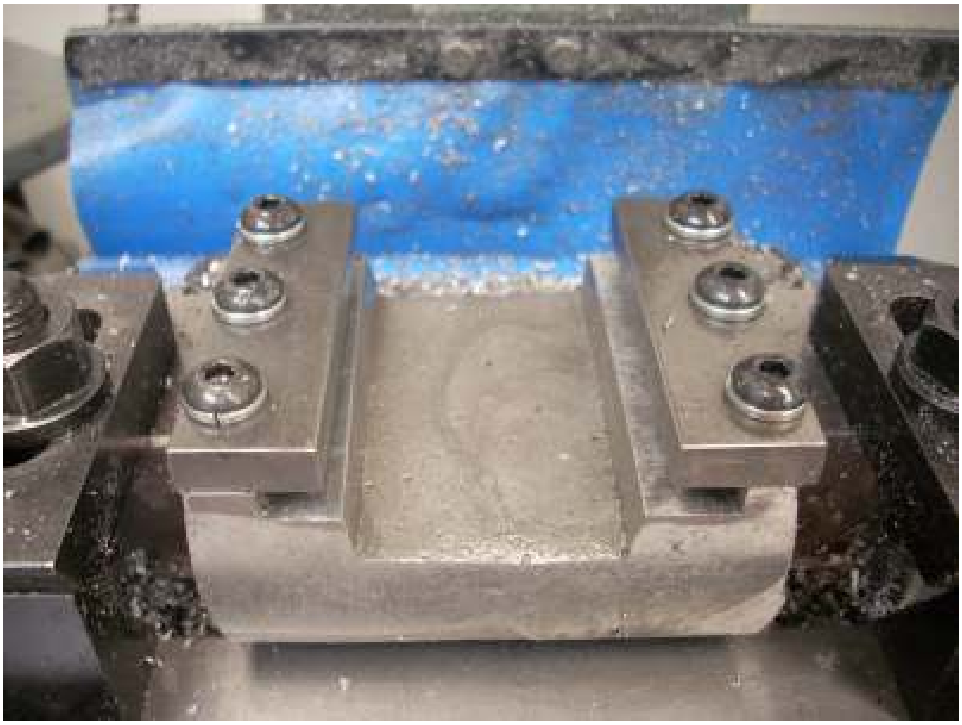
The technique for using the spiral tap continues to work well. With plenty of WD-40 in the hole and on the tap, I run the mill up to full speed, bring the tap close to the surface, cut power, and plunge the tap into the hole. You can see that I went in about ½” which is fine. If I bottomed the tap in the hole it could snap off and make me very unhappy.

With the tap half way in, I released it from the drill chuck and finished the job with an open ended wrench. It would be better to use a tap wrench but the T style I have is too tall. The ones that clamp from the sides are nice but I don't own one. One of these days I'll probably snap off a tap and then go out and buy one or make it.

With the first screw in place and just snug, I use the clamp to locate the next hole using my clearance drill. I do not change the X axis position but rather swing the clamp and move the Y axis until I can lower the drill down the hole without it touching. Then the clamp is swung aside and I drill and tap the hole.

The cycle repeats as I locate, drill, and tap my third hole. This approach takes longer than just dialing in hole locations and drilling but I've had too many experiences where a screw does not fit. I'll take the conservative approach here, thank you.

I knew that the narrow pad would be trouble even with 0.02” of metal between hole and outer face. After drilling the tap hole, I went back and used a clearance drill for the first ¼” in hopes of not having the tap blow the sides of the hole out. It did help but still bulged the side out. On the next hole I used a drill one letter smaller than the clearance hole and that helped. A few passes with a file removed the bulged areas.

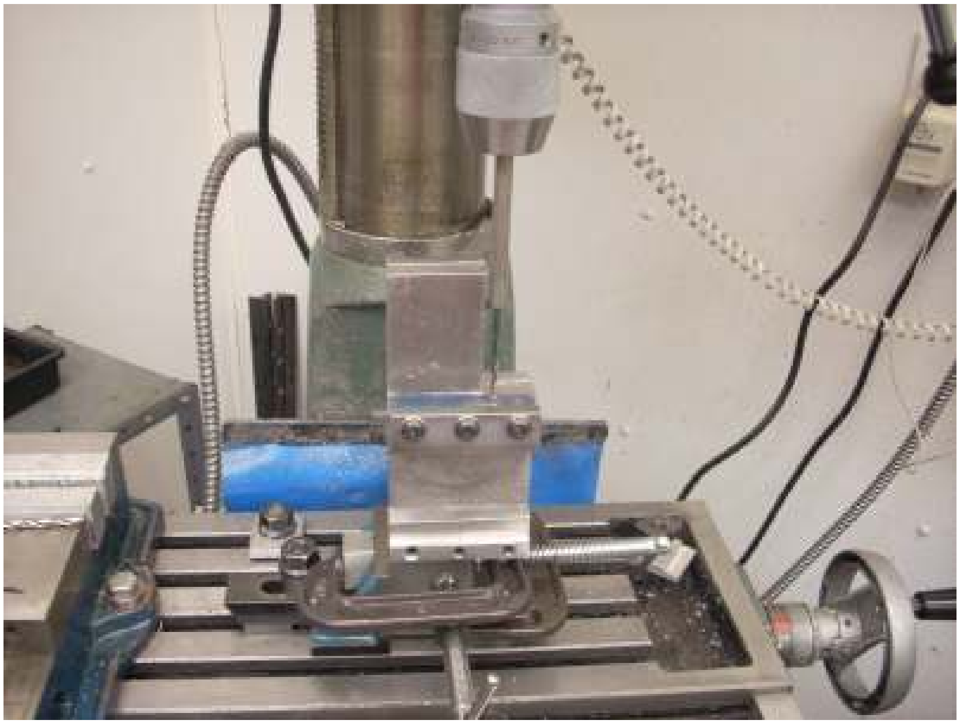


Both clamps are now in place and all looks good. Only now will I remove the casting from the table.

Each clamp was marked with a center punch so I can put them back in the same place after dismantling. One clamp has a single dimple on the edge that matches a dimple on the casting. The other clamp has two dimples.

The next step is to install the gib screws. Gingery suggests buying a jobber length drill. Well, first of all, I don't want to get in my car and go find one. My local Ace most likely would only have the shorter number drilled. Secondly, I don't want to spend the money on a drill that I may never need again.

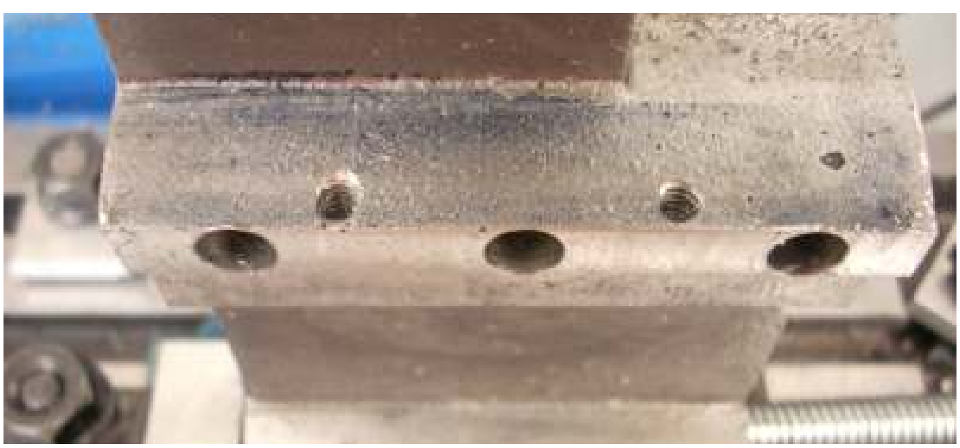
The solution was quick and easy. I took a piece of 3/8” CRS, put it on my lathe, faced the end, and used the tap drill I had to drill a 1” deep hole. Moving to my mill I then cross drilled and tapped ½” from the end for a set screw. Instant jobber length number drill.



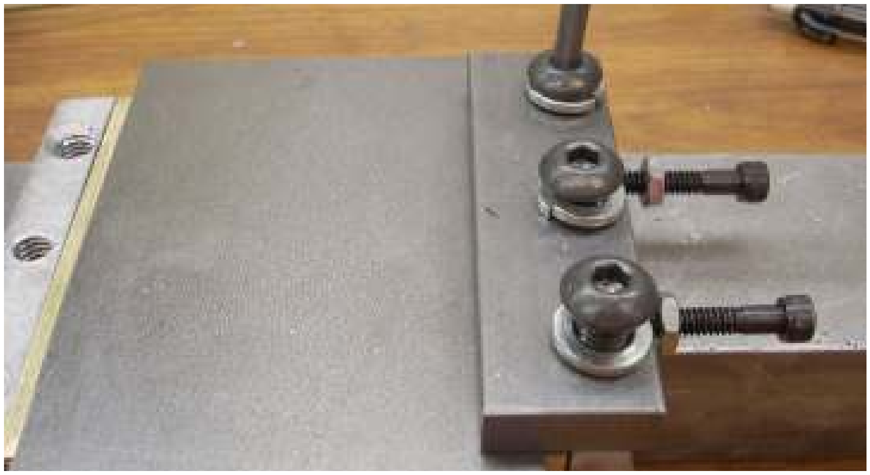
The casting is set up on knees against my primary reference planes 1 and 2.

A lesson learned from my last gib screw installation was to have the clamps tightly bolted down first. This provides backing for  the thin metal between gib hole and the top face of the support pad.

I then tried to drill my gib holes but ran into a minor problem. Since I had not milled this face flat, the drill bent as it skidded down the sloped surface. It would have been easy to side mill this face before removing the casting. Oh well, *hopefully* lesson learned. Not a big deal to fix. I chucked up the largest drill I had that would not hit the clamp and used it as a center drill. Worked OK. So did the tap drill extension.



And look, no break out!



I had room for a brass gib on both the left and right edges. The left gib is held in place with Locktite®. The right gib has two shallow holes drilled in it to accept the gib screws.

Alternately, I could have used a ¼" square piece of brass and only had a gib on the right side. Didn't think of that one until after I cut the brass.

I do have an interference problem between the lock nuts and the clamp. One solution is to make small cylinders so the nuts are clear of the clamp. Another solution is to mill away some of the clamp. For now I will go with my third solution and do nothing. The top half of the nut locks against the edge of the clamp and that might be good enough.

An exploded view is always fun to see. You can barely make out the ends of the gib screws on the right. The ends were pointed on my lathe. I still have some fine tuning to do with shims but that will wait until I fit the assembly to the shaper.

I use an industrial paper punch to make the holes in the shims. Note that the left gib has not been Locktite'd in place yet.

The next step is to mount the cross slide ways. I'll start a new article for that since this one is big enough.

I do want to mention two typos in Gingery's book. On page 102 he says to use ¼”-20 gib screws. He meant to say 10-24. Then on page 103 he calls for a slide way made from a ¼” x 3” x 1” slab of CRS. He meant ¼” x 3” x 10”. Good old “Uncle Dave” must have had a bad day. The book has so few errors, when I see one it really jumps out at me.

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