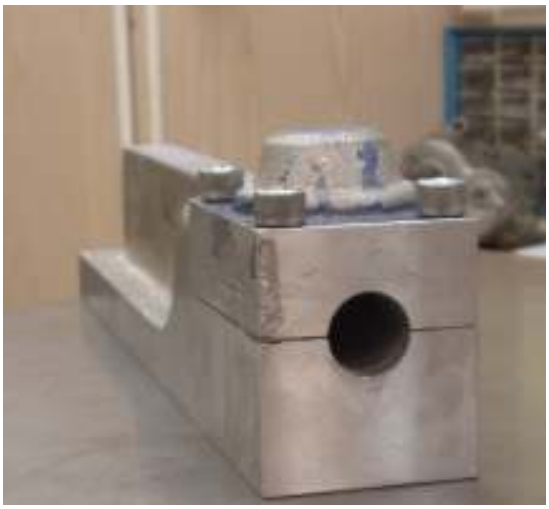
Machining the Ram, Day 4

By R. G. Sparber

01/17/2008



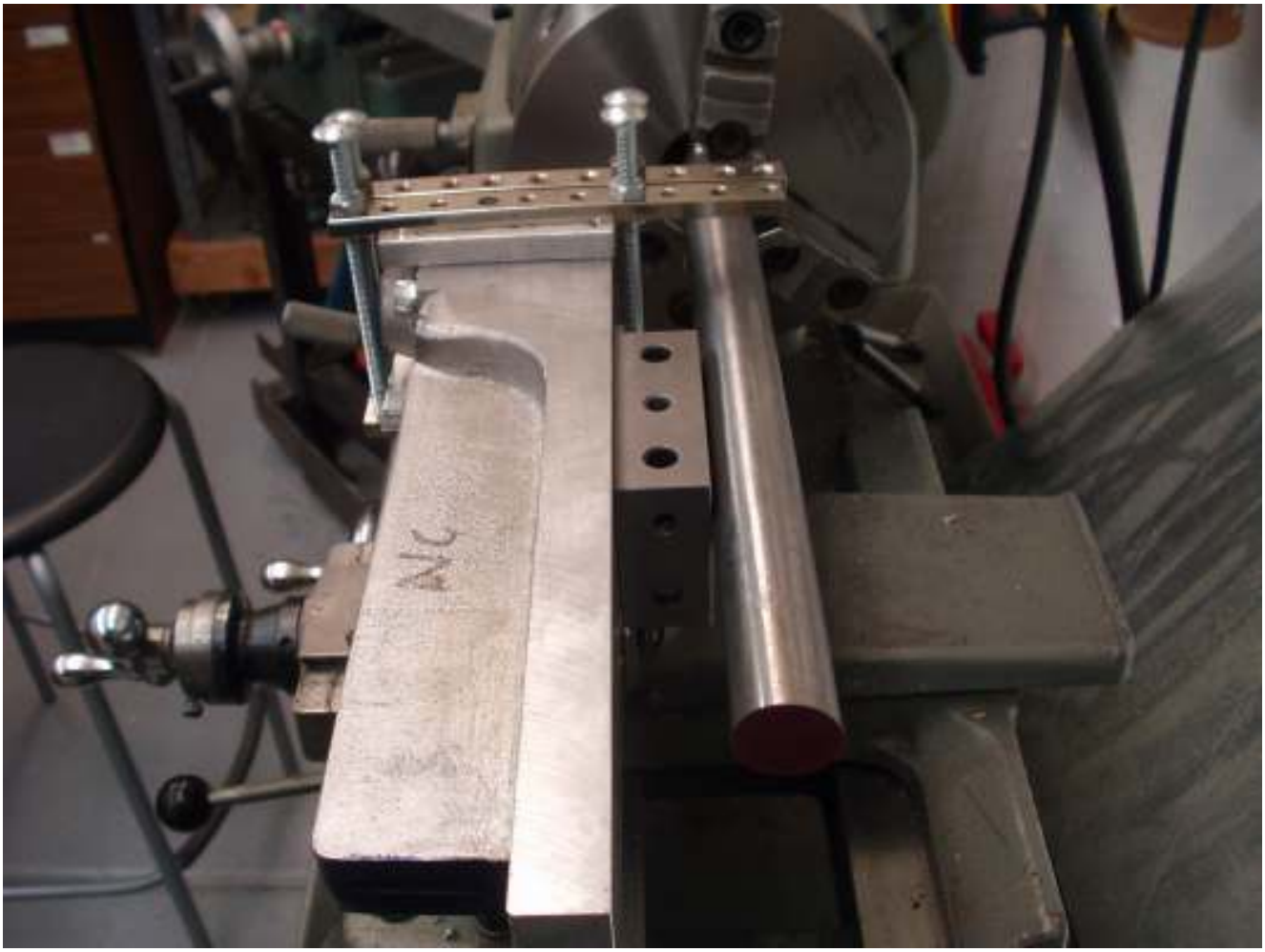
Today was the culmination of a lot of planning and a lot of listening to others. The task at hand was to precisely bore the pivot hole in the end of the casting. This hole must have a centerline that is parallel to the bottom and side of the ram. Additionally, the front end of the casting must be cut perpendicular to this bore.

The only machine I have that can handle this task is my lathe.

What makes today's machining so easy is that the casting has a precisely cut bottom and perpendicular sides. They will be used to align the casting before I bore the hole.

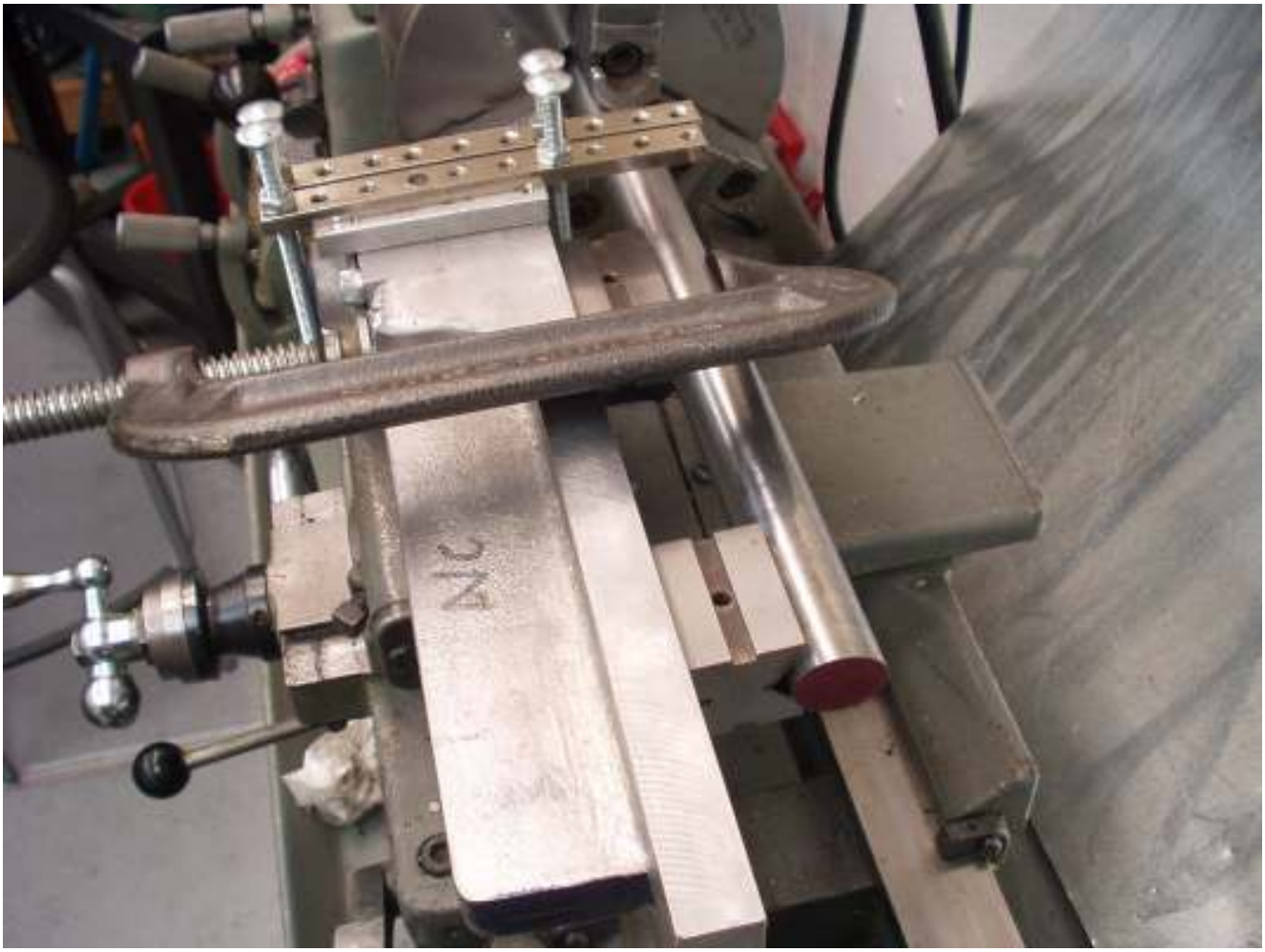
Taking advice from numerous sources including Home Shop Machinist articles and people in the Yahoo group Gingery_machines, I decided to mount the casting on my compound. All of the machining will be in the front 3” so that is what was clamped to the compound. I had found the vertical centerline of the casting and marked it. Shims were then used to raise the casting so the live center was reasonably close to this line. It is not essential that the center of the bore be exactly at the center of the casting.

This picture may be a bit confusing in that the live center seems to be well below the casting's centerline. It is just the position of the camera.

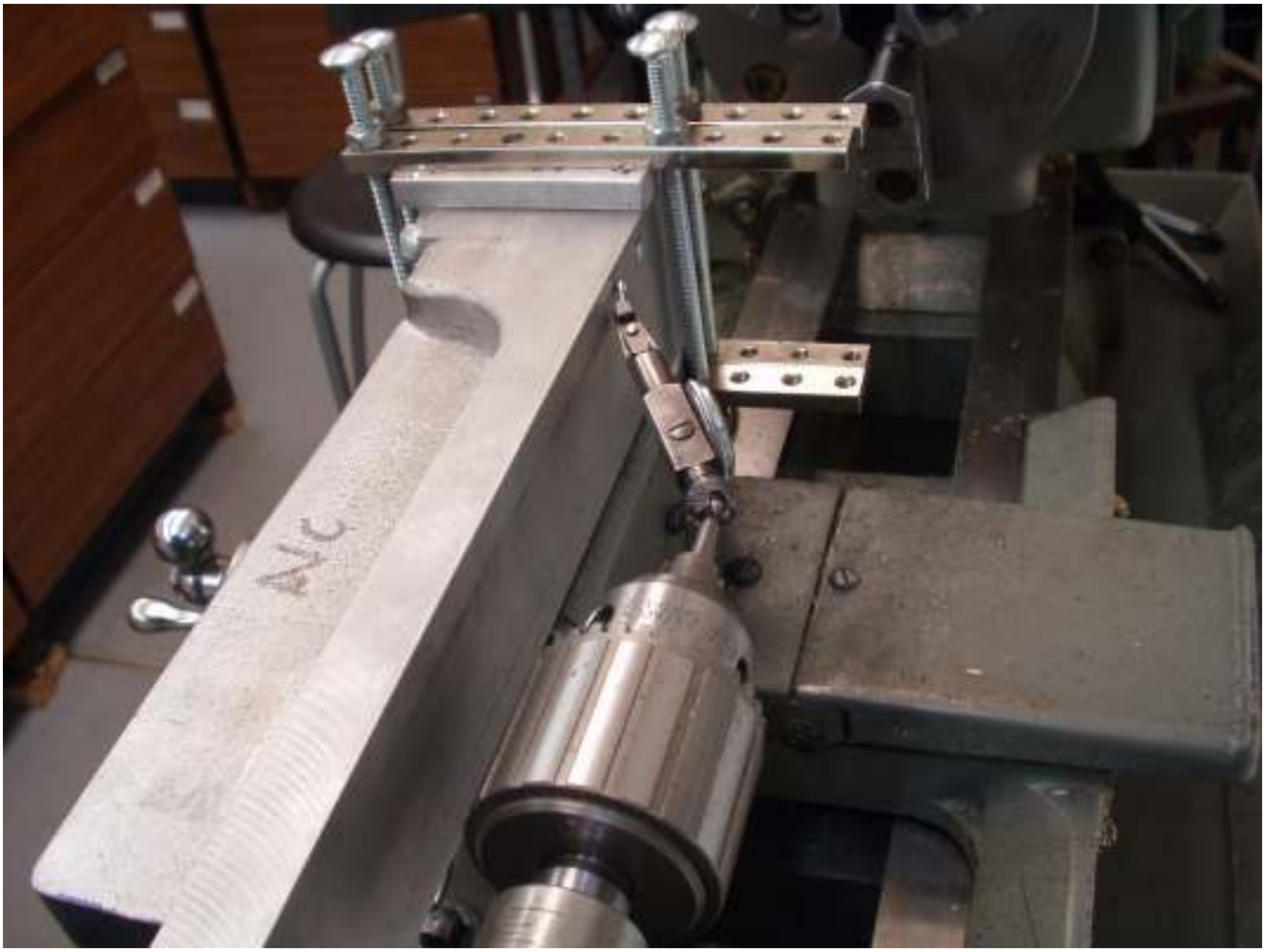


Here is the one semi-original step that I can claim for myself.

How do I accurately and easily pivot the casting on the compound so its bottom (oriented vertically) is parallel to the spindle's centerline? The answer is shown here. I took a length of straight 1” drill rod and put it into my 3 jaw chuck with about 10” of overhang. It was then an easy matter to pivot the compound and feed in the crossfeed until there was a snug fit between casting bottom, and the rod. I am using a 1-2-3 block as my spacer so my reference bar does not hit any of the hold down bolts.



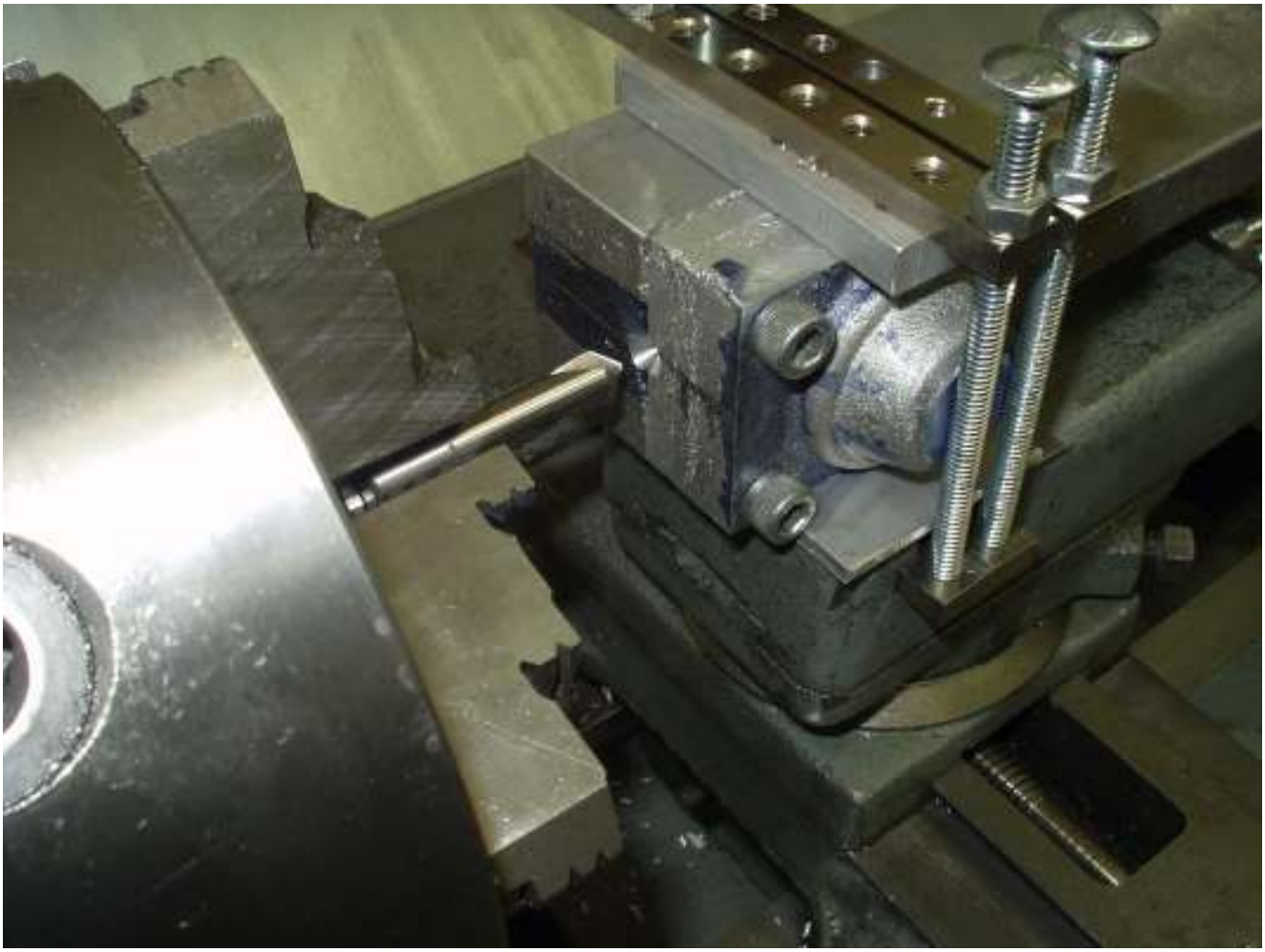
I was not confident that I had the best fit so changed to a set of V blocks. It was then easier to see when the casting was aligned with the bar. The C-clamp is lightly gripping the rod on the first V block and I was then able to better feel how well the second V block fit.



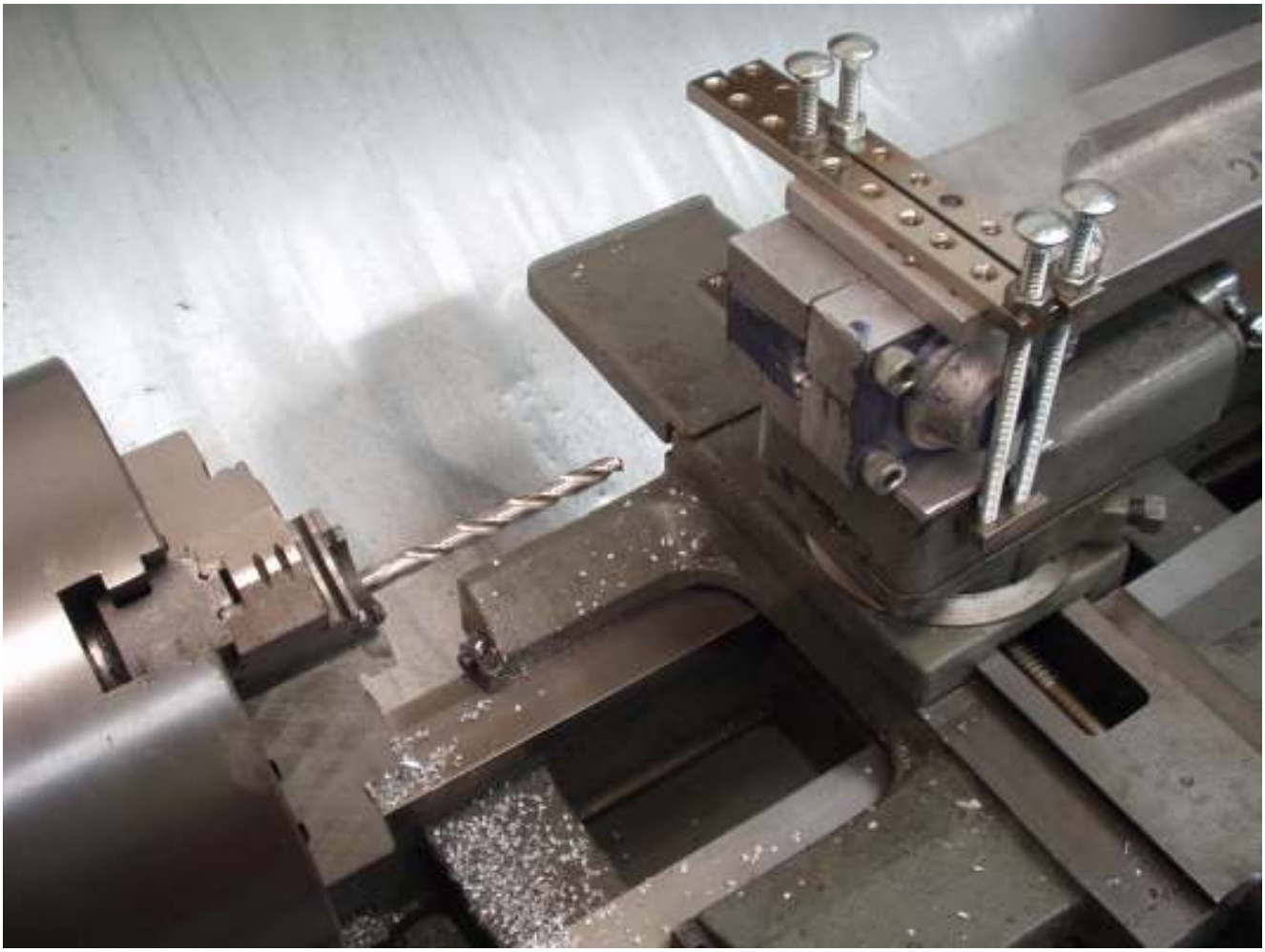
Just as President Regan often said, “trust but verify”. I was confident the casting's base was parallel to the spindle's centerline but still wanted to test it with my DTI. I am actually testing that the casting is parallel to the ways here but that is close enough. I moved the saddle along the ways and noted deflection on the DTI. I mostly saw surface roughness which moved the needle ± .000 5” but no trend to indicate misalignment.

I wish I could tell you that I tested the casting for level as my next step. Instead, I started drilling out the hole and then realized that I forgot to do this test. Fortunately, it showed the casting was within 0.001” for the entire side (facing up) of the casting.

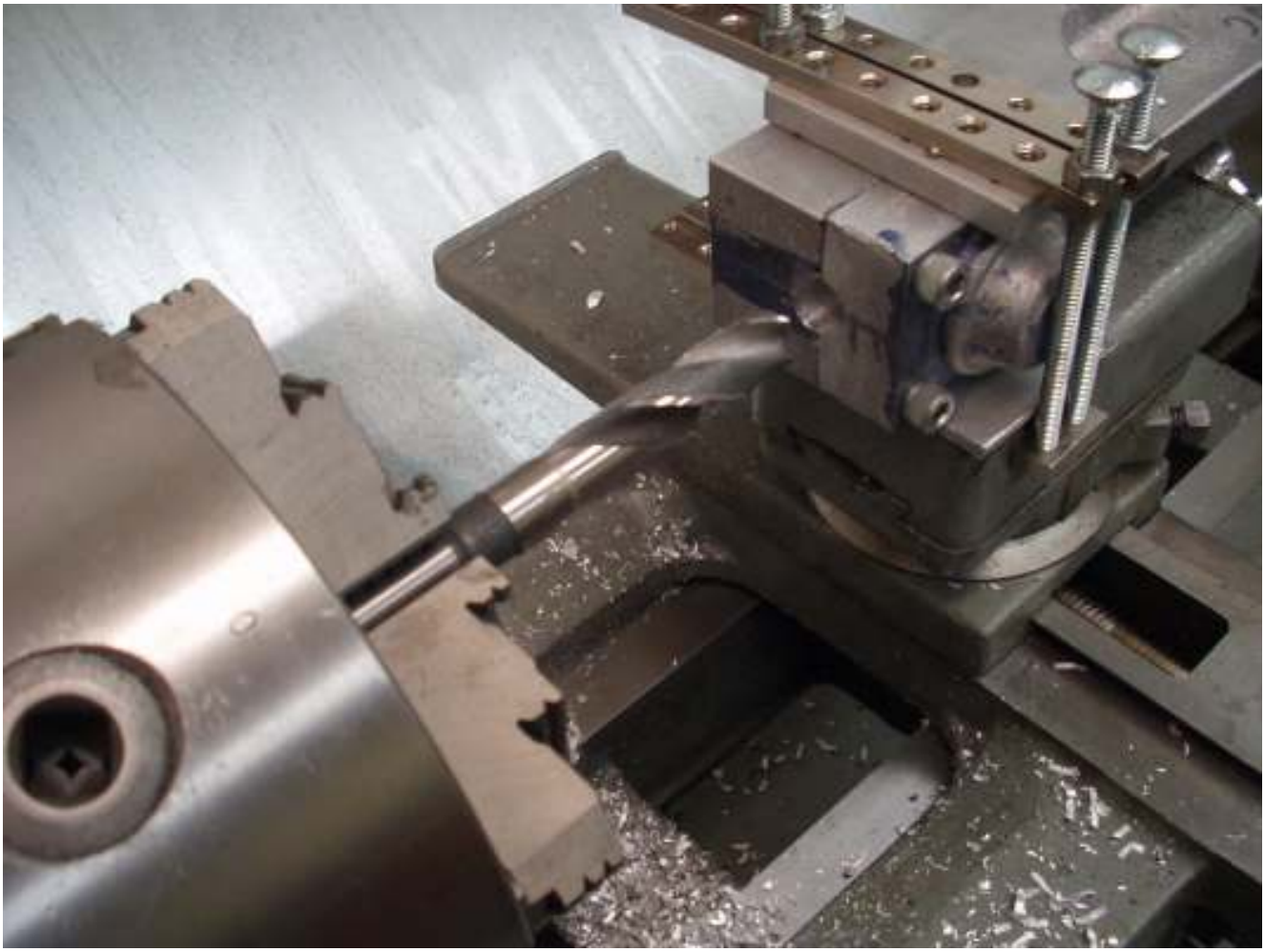
The next step was to position the cross slide so the centerline of the spindle is at the casting centerline. I used a spud in my 3 jaw chuck. This is not a critical position but I do want the bore to be half in the body and half in the cap. I then set the cross feed dial to zero just in case I bumped it.



The center drill went into the 3 jaw chuck first.



I then drilled in 2.9” with a 1/4” drill. This was followed by a 3/8”, 1/2”, and 5/8” drill.

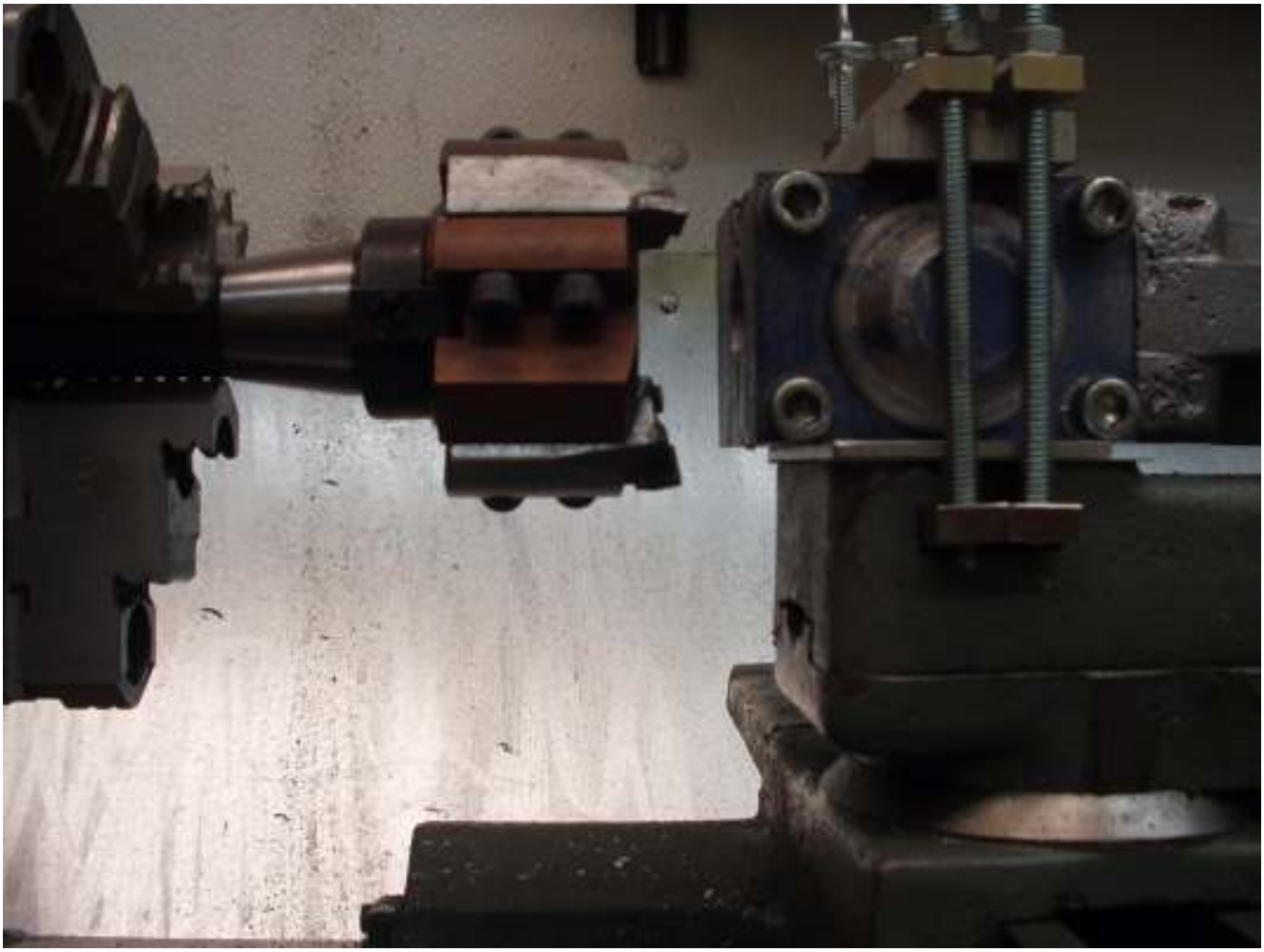


Nothing very exciting here. I just did not want to stress the casting's fixture too much but going from a 1/4” hole right into a 5/8” hole.

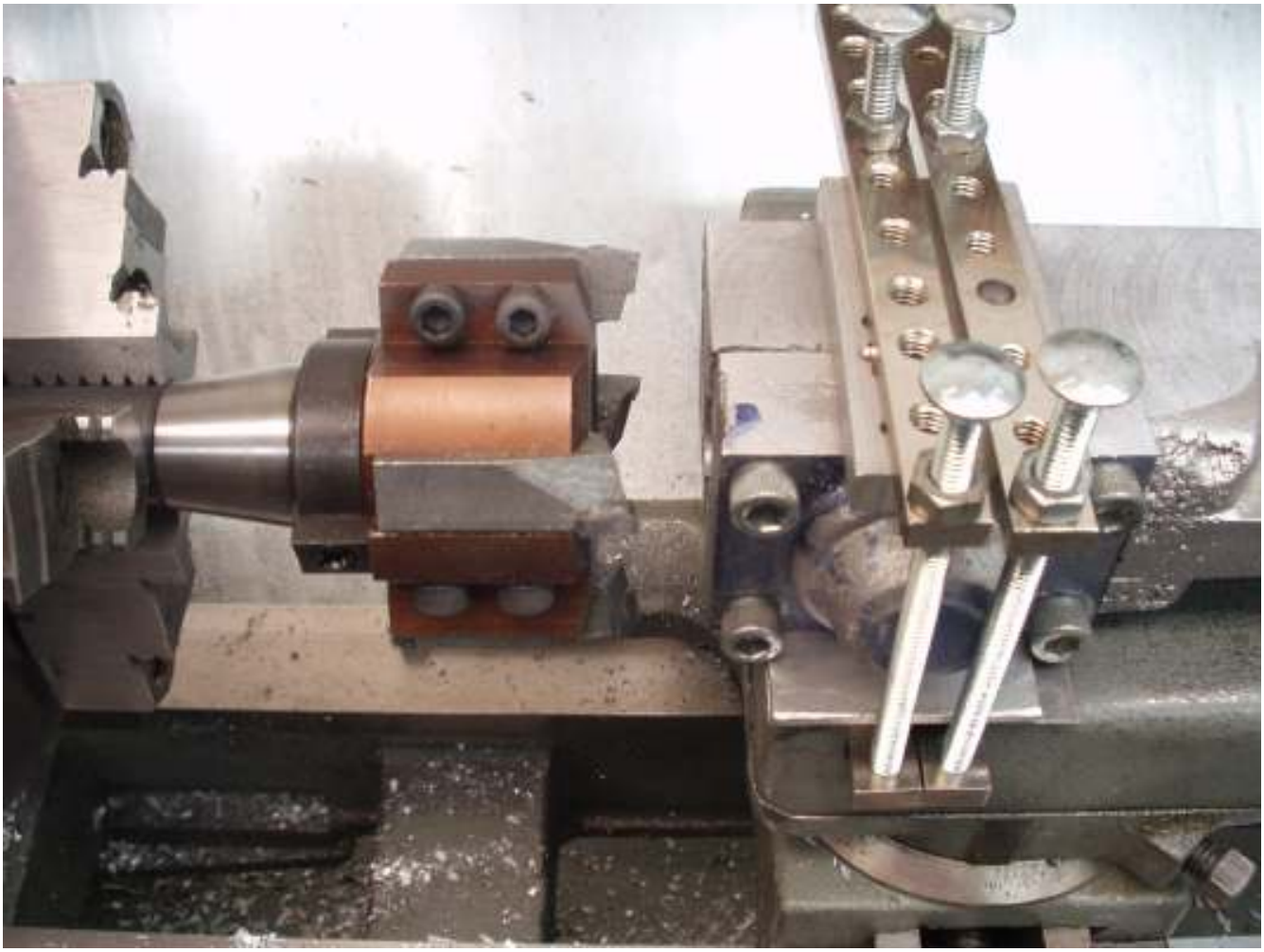
The hole is now large enough to take my boring bar. This boring head normally runs in my mill/drill but works fine here. The thing to remember is that the head gets advanced to increase the hole's diameter, not the cross feed.

This cutter has a carbide brazed insert. I ran at about 1100 RPM at first and had a lot of chatter so dropped to 800 RPM. That stopped most of the chatter.

It did not take long to open the hole out to 0.750” diameter but the surface finish was poor. Rather than spoil the precise diameter, I decided to sand the bore a little when done.



Next, I mounted my shell mill on the 3 jaw chuck and changed to 2072 RPM. Note that the boring and this facing operation were done without disturbing the orientation of the casting. This gives me the best chance of having the bore's centerline perpendicular to the front face.



The facing operation was quick and easy.

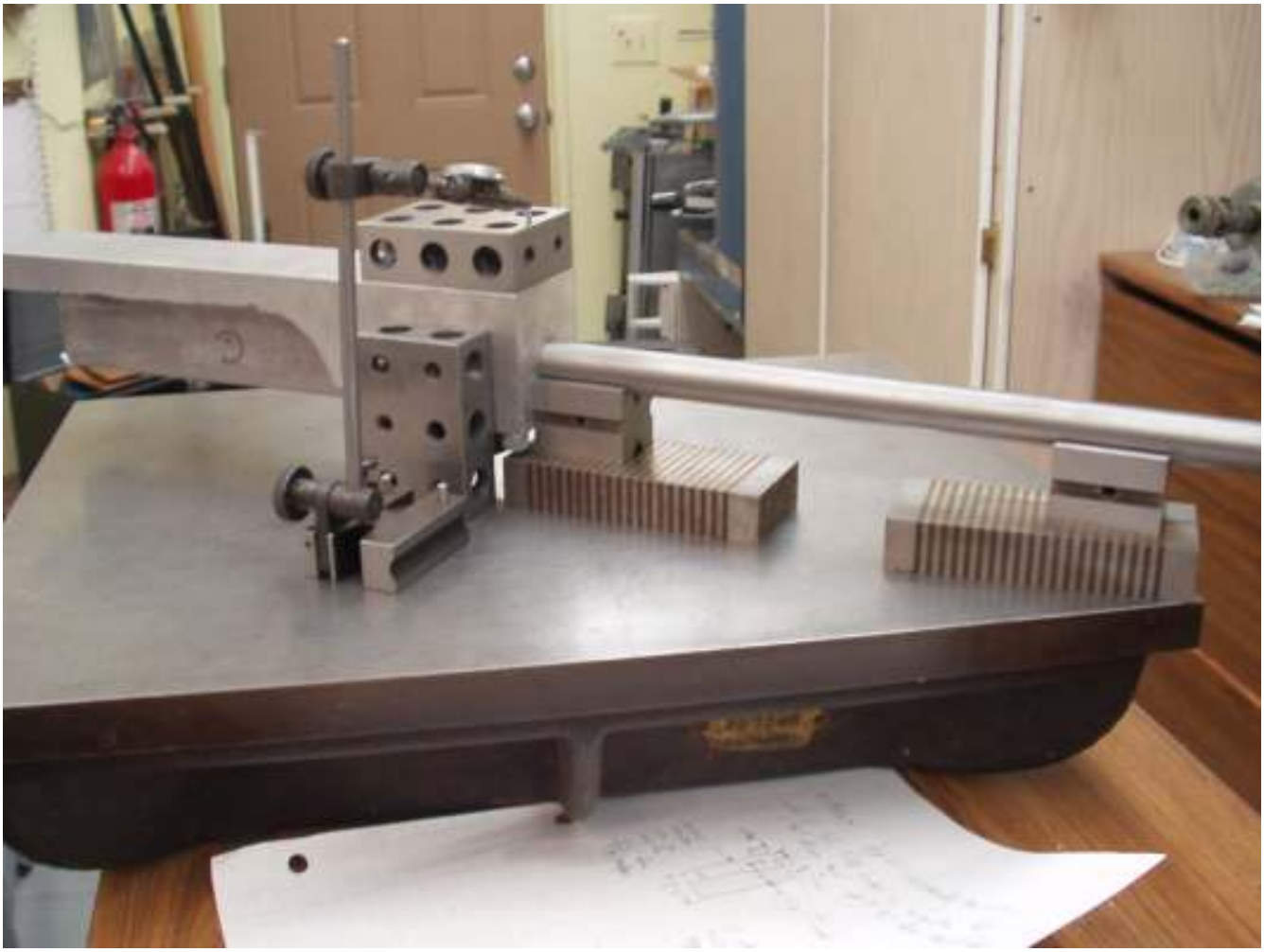
It looks like there is a problem with the surface of the casting here but it is just funny lighting.

You can see some of the poor bore finish in this picture.

Here is the full, ugly truth. There was a fair amount of chatter and gouging. Although not pretty, it is not all that serious.

I wrapped some 220 grit emery cloth around a 1/2” rod and took off the high points. I would rather have this rough surface than risk reboring the hole and going oversize.

You can see the 20 thou shim on the body half of this bore. This shim was intensionally chosen to be aluminum rather than stainless which might have disrupted the machining.



The next step is potentially painful: evaluating how the bore came out. I took a length of 3/4” drill rod and clamped it into the bore. The rod is on my V blocks such that the rod is supporting the casting. A 1-2-3 block flanks the casting to insure that the bottom face (oriented to be on top), is parallel to the surface plate. A second 1-2-3 block has been placed on the reference surface so the DTI does not see any roughness. As I swept the DTI longitudinally along the block, I saw no deflection of the needle. I then swept the DTI transversely (perpendicular to the rod) to verify the surface was indeed parallel to the surface plate.

The casting was then rotated 90° to verify that the bore is parallel to the side of the ram. I again moved both transversely and longitudinally. Needle deflect was less than ± .000 5”.

I would say that getting this much accuracy is 50% planning and careful work. The other 50% is dumb luck.

The next and final step on this part is to attach the steel plate that will support the ram.

Rick Sparber

rgsparber@AOL.com