# Machining the MLA-9 Steady Rest

INTRODUCTION

In October of 2005, I picked up an old Springfield shaper. it needed a lot of work (still does).
The first thing I started on was the lead screw. This is a 1"-4 LH square thread. Its about 24" long and would take the whole length of my SB-9 less tailstock I needed a steady Rest.

For Father's day 2006, my wife and daughter got me a Steady Rest Kit from MLA, https://www.metallatheaccessories.com/ . The kit was reasonable and I figured that I could knock it off in a short time. Yeh! lots of luck. The instructions leave a lot to the constructor. They assume that everyone's machines and tooling is different so why bother with the details. This may be true but since we are dealing with castings a little on where to start would have been nice.

The kit provides 5 castings; the main body, three fingers and a clamping casting.
The general plan was to dive into the main casting and then finish up the fingers and the clamp. Well Since I have only machined a bit of cast iron before I decided to start with the finger first, on the assumption that if I screw one up it would be a cheap replacement. The notes state that the castings are generous. They are quite oversized as we shall see. This is primarily a milling job. I did get to use the lath once or twice.

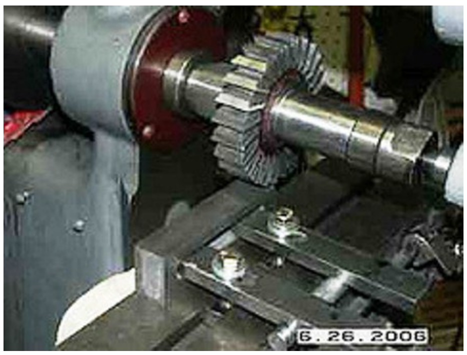
I have a (modified) SB-405 9" with a 36" bed and a Burke #4 horizontal mill so this note is based on what I can do with what I have.

**Start with the fingers**

The finger castings have draft on all sides, so the first thing is to pick a reference side and a way to secure the finger in the mill. I put the fingers into the 3.5" vise I have for my Burke #4 and milled the top narrow side flat. (Figure 1). This side then became the reference for all subsequent operations.


With one clean surface the others are now milled using this as a reference and always working against it. Since everything is tapered the clamping becomes problematic. By using a rod I have a single plane to push against the reference and to mill the sides. (Figure 2) The part was then rotated and the bottom was milled.


At this point, the method of clamping was changed to the setup shown in figure 3 and the third side was machined. You may consider this a rough machining process because I still needed to get the width of the fingers correct.




The plans called for the fingers to be 1 1/8" wide. However, I got tired and stopped at 1 ¼" I told you the castings were generous. The width needed to be roughly centered on the cast slots. So, there was some trial and error. However, if you think the width was generous you should see the thickness. When I measured this after rough machining I decided I would be old and gray if I milled it so I took it out to the band saw and ripped it down. (Figure 3)


Yes that is a wood cutting band saw! I have a 10-14 tpi metal cutting blade in it and I have replaced the single-phase motor 1750 RPM with a 3 Phase 1150 RPM motor and a VFD. Running at about 15 Hz I get a speed that's fine for metal. Turning the VFD up to 90 Hz puts me back at 1750 RPM and that's fine for wood. Yes I have used a metal blade for wood and it works fine. It just slices through metal like butter.

The fingers where then finished to the proper thickness and next we addressed the slot. This was sort of a crapshoot. There is no actual dimension to the slot thickness. So, I made it a few thousands over the thickness of the locking bolts where were tightly specified. This was later to be regretted. It made things too tight and I wound up, later, opening the slot up to about 0.020" over the diameter of the shoulder bolt.


The next thing to be addressed was to finish the ends and to machine the holes for the adjusting screws. I decided that this could be easily done on the lathe. The fingers were chucked up in a 4-jaw chuck and indicated to be on center.


Well, I thought they were on-center, I managed to get two of the fingers 0.100 off center. No problem for facing but I drilled two holes 0.100 off center. I fixed this by making cast iron plugs from some of the scrap I cut off on the band saw and press fitting the plugs in the misplaced holes and re-drilling the holes. If you notice, the pictures have dates on them; this program is now extending over several months and it will be several more months until it's finished.

After facing the ends were center drilled (Figure 5) and then drilled to size. Both ends were faced and drilled. The end not shown was to have two bevels at 30 degrees machined so as to taper down the finger width. This was a back to the milling machine job.

A lot of time was spent thinking about what tooling I had (and that was not a lot), how to use it and how to both hold and fixture the parts. If you noted how the fingers were held onto the mill before you will have noticed two shop made bars with slots and screw holes. These proved invaluable. They were pressed into service here. One was set at a 30-degree angle using a protractor; the other locks the finger in place. There was a tendency for the large end mill, which was not particularly sharp to push the finger back. The Shop made bars had vee's machined into them and they were pressed into service along with an Allen hex key to prevent this.

The beveling process turned out fine except that on the last finger there was a hard spot in the casting and I got a shower of sparks and messed up the end mill good.

Well, we finally got all three of the fingers finished, (I had to open up the slots later). The three peas in their pods are shown in the next picture, sitting on the feed for the Springfield


I don't know if it comes through in the photo but I continue to be amazed with the finish the Horizontal cutter gives. It is close to a ground finish.

**The Clamp and the Stud**

The next thing was the clamping block. Actually, this was done some time before. This was a lathe Job and is shown in Figure 8. this casting was problematic. There is a raised boss, which is supposed to center the block on the bottom of the ways. This boss was cast off-center. So, by the time I was able to get the remaining boss centered it no longer did its job of centering. Here again I made a modification to the plans. They called for a 3/8 tapped hole. If I had done that I would have needed another wrench to tighten the Steady Rest. I wanted to use the same wrench I use on my tailstock, which has a 7/16 bolt with an oversize nut. I happen to have a spare one so I went to 7/16 on the threaded hole.


The next item to be made was the attaching screws. These were turned on the lathe out of Hex steel. The MLA plans showed them being turned out of round stock However they need to be tightened down to lock the fingers in place. With round stock there is no way to apply counter torque and the tightening torque is all taken on the adjusting screws. These screws are fabricated from 1/4-20 all-thread. I thought about milling the shafts of the screws square to take the torque but decided to use a piece of hex stock, which I already had.

Unfortunately, I cannot find the photos I took during the turning. However, I did have a spare screw and it is shown in the next Figure along with the completed assembly.


I also made a change to the drive screw. The MLA plans called for the threads on the drive screw to run through a drilled hole in the cast iron fingers. There was to be a turned knob pinned to the shaft and the shaft was to be affixed with an off-center pin riding in a grove on the threaded portion of the shaft. I did not like either the idea of threads for a bearing shaft or pinning in a groove, which just removed the threads. I turned three bushings. These had ¼-20 threads on the ID. There is a 5/16 portion, which becomes the rotating shaft in the fingers. There is a ½ " boss next ending in a 3/8 thread to take an off-the-shelf knob. The bushings are silver soldered on to the all-thread and the locating groove is then continuous and if done right does not intercept the threaded portion of the shaft.

That finished up, it is important that the drilled and tapped holes in the clamping studs be exactly on center. With the modifications I made to the screw and the fingers I was able to use the finger itself as a jig to drill and tap the hole. This is shown in Figure 10.

A bushing was turned and inserted into the now 5/16-diameter hole in the end of the finger. This acted as a drill guide for drilling the studs, which were firmly clamped in place by adding a spacer between the finger and the nut on the stud. The fingers were once again put into the 4 Jaw chuck on the 9" lathe and indicated true.

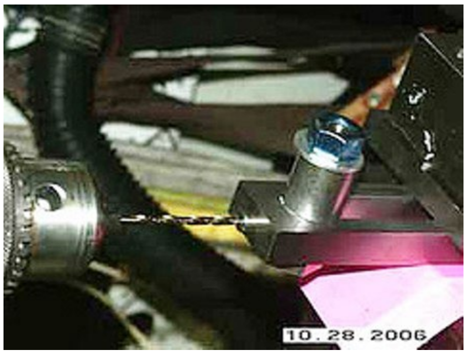

The blue color of the nut signifies that it is a grade 8 nut. The drill and bushing were then removed and with the stud and finger still in the lathe the hole was tapped through.
the first part of the project. I took some time before I started the main casting. I was apprehensive about this part and thought about how to go about it.

**The Main body Part 1**

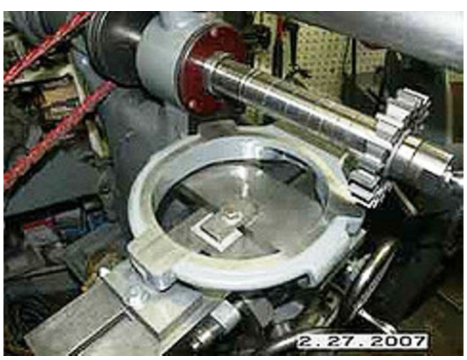
As in all castings you need a reference surface off which to measure everything. The MLA instructions point to using a cast boss on the front of the rest. The issue was how to machine this. In the as cast state the boss/casting was both too wide and too long to fit on my Burke #4. The instructions also suggested that it would be cleaner if you first painted the casting and then machined it. I put on about 4 coats of primer, sanding between coats until the surface was smooth and then doing one final coat. The paint is Benjamin More M22 Urethane enamel.

The back of the casting has three bosses, where the locking studs penetrate. I started by facing off these bosses. I just cleaned up the bossed.
I had a piece of 5/8 thick ground stock. I cut off two pieces one of which spanned the bottom two bosses and one which acted as a pad on the top boss. Now since three points determine a plane the reference ring should then be parallel to the faced off bosses. Before starting the reference surface, I milled flats on the side bosses where the screws that clamp the two halves together would go. While in the same set up I drilled for tapping the two holes, the screw bodies and the counter bore for the Allen head screws that will eventually hold the two (yet to be cut) halves in alignment.

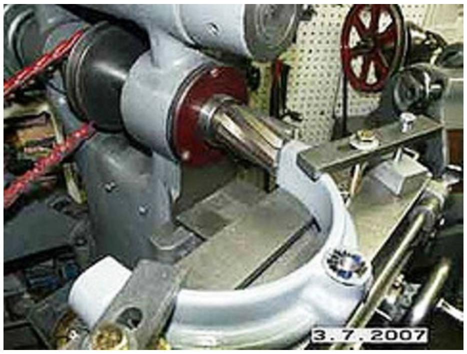
These ground pieces allowed me to move the body on the table since I could not cover the full face due to the limited (9") travel of my mill




The width of the casting limited my Z-axis (in and out) movement to about 1 ¾ " also the total length including the bosses was about ½" to long for the X travel of my Mill. However, with the horizontal configuration I can move the cutter along the arbor. I have several arbors. The one in Figure 11 is the longest. It also has a LH threaded nut thus the cutter must run in a clockwise direction. Here you see the reference surface finished machined. Note that the ground plates are clamped to the tee-slot of the mill. There are counter bored 3/8 Allen head cap screws underneath. The machining was done in many passed. Initially, up to the point where the top boss, left most in the picture) the cutter was move along the arbor in increments of 1 ½". After each move the surface was reestablished. The cutting was skipped around the middle boss and continued after to the outer edge. The assembly was then moved along the table and the middle boss was machined. I believe that I was able to keep the reference surface flat to within 0.0005 in this process.




I then cut the casting into two halves using the horizontal band saw shown earlier. I tried to cut as close to the middle as possible. The cut ends were then faced off using my last big endmill. They were also trimmed to the point where the break was exactly in the middle and the opening was round within 0.005. This is shown in the next figure. Note that we are now clamping to the reference surface so the ends should be at a right angle to this surface. You can also see how I found the middle of the back of the boss to drill and tap the holes for attaching to the ground plates.




While I was in this setup, the boss for securing the steady rest to the lathe was faced and drilled. Since I wanted to use the same wrench for the steady rest as for the tailstock the hole was opened to 15/32. I did have to come back later and tale about 1/8 off the web just below the hole so the wrench would have enough clearance. (Figure 13).


**The Main Body Part 2**

The other end was faced in a similar manner and then the slot for the top finger was cut making sure that it was at right angles to the surfaced off ends of the casting.

The two halves were then bolted together and using a protractor they were set at 120 degrees to the top. A slot was cut to within 0.010 of the proper depth and the width was trimmed until the two scales, referenced to the edge of the slot just touched at their edges. The slot was then finished to the proper width and depth. Note that we are now back holding the assembly by using the ground plates. (Figure 14). Once the slot was opened to the proper width it was possible to test the fingers. These slots are just wide enough to get a tight sliding fit so if I was off in my measurement it would have been a very bad day. However, as you can see I was able to get a pretty good fit. The reason for the marking dye is to scribe lines, which gave me pretty good windage of where I was.


The assembly was then rotated 120 degrees with the large mounting boss still to the outside and the third slot was cut using the same procedure.

Looking at the next Figure you can see that this approach was quite successful. Sure, it would have been nice to have a full-size Bridgeport and a large rotary table, but that was not the reason for this exercise. One of the challenges for the HSM is to “do” with what is at hand and to “do” an acceptable, although time-consuming job. The little Burke 4 was really tasked to do this job. It’s a capable mill and being horizontal its very versatile, however it needs a bit more travel and having only one tee slot is a limitation I keep running into.

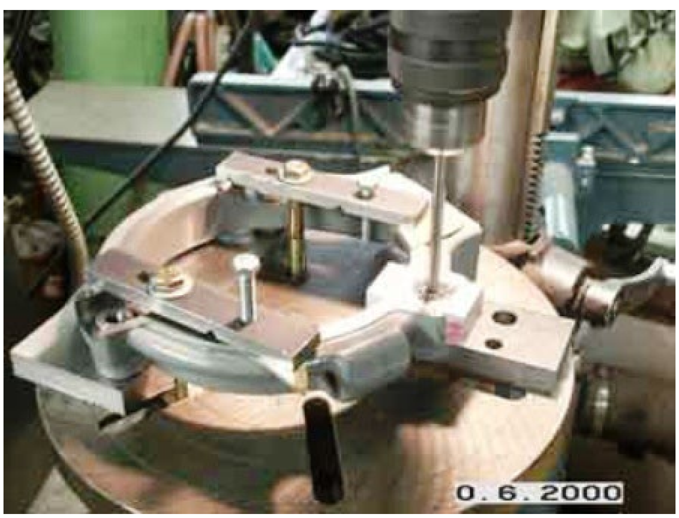

Next the excess of the mounting foot was cut off. The casting is sized for use on either a 10” or 9” lathe. You are given a dimension and cautioned the “Your mileage may very”, measure your own lathe. Yeah! That’s not a trivial measurement. I tried and come up with a number about 0.015 under the “target” dimension. I cut it to my measurement, Should have left it alone.

The base was then milled flat. This was done by referencing to the tip sliding finger which was a very tight fit towards the end. Using this the finger was set at right angles to the table and the bottom milled to the measured dimension.


Next a vee-groove needed to be cut for the prismatic way. Paula showed how to do it on a vertical mill. The horizontal mill let me clamp the large casting in a safer manner. While I do have a 90-degree cutter for the over arm/arbor mode of the mill I was unable to figure out a method of securing the base half of the steady rest. I chose instead to tilt the base at 45 degrees and use an end mill while moving the knee up this is shown in above.

**Finishing it up**

The final step is to machine the holes for the clamping studs. These are 9/16 diameters. They need to line up well with the three tapped holes I have been using to secure the Steady rest to the ground fixturing plates. I tried several approaches but each one looked like it would be problematic. Finally, I made a fixture shown in the figure I have several 5/16 hardened drill bushings I bought on eBay for a job for my daughter. I made a fixture out of ¾ aluminum, which is a tight fit into the slots and a press fit over the ends. Since this is a casting the press fit over the ends works for only one slot at a time. I started with the narrowest one and filed the corners of the Al fixture to fit the next, progressively larger slot.




The hole was opened in 1/32 increments up to 1/2 “, then in 1/64 increments after that. The instructions state that the final hole should be reamed to 9/16. I bought a 9/16 chucking reamer just for the task. It cost $9. When I went to use it I found that it was 0.010” undersize. I talked to vendor and they basically stated “S--- happens”. Send it back and we will credit your card. But it would cost $5 to send it back. So, I ate it and vowed not to buy cheap reamers again. I did use in the opening process as this left only 0.010 for the last drill to remove.

Well, that finished the fabrication, and in the last photo you can see the finished steady rest holding the lead screw from my Springfield shaper.

This was the reason I bought the rest in the first place; however I later got a SB Heavy 10. Since the bore through the headstock is big enough to take the lead screw my needs have changed. For a while I was going to make the rest fit the heavy 10, however upon my retirement last December the crew gave me a gift of some money. Rather than blow it on dinner I decided to get something tangible that I would remember them by and bought a SB knock off heavy 10 steady rest form Jeff Beck at tools4cheep.net.

No to be sure the MLA kit has some feature that Jeff's does not have. Primarily it has a huge opening, which is just the ticket for building steam boilers. However, knowing what I know now, unless you are looking for a good project or you need the opening width, I would buy the knockoff.

This was truly a learning experience and stretched my capability. I do now feel a lot more capable and I guess it was worth the effort.

Jim B.