Modifying a Mill/Drill

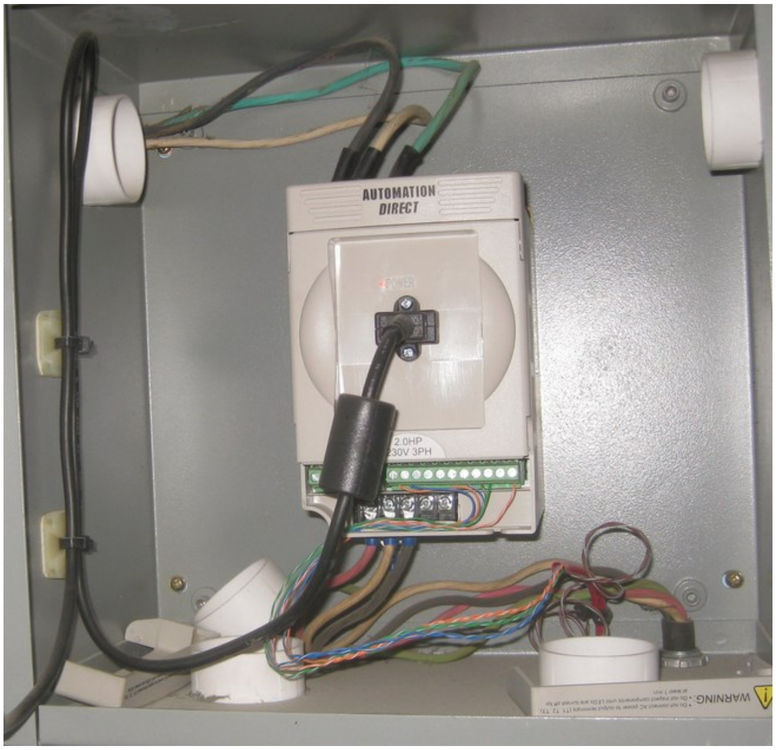
I bought this mill/drill about 4 years ago and knew from the very beginning that some changes were going to have to be made. I am a big fan of VFDs (variable frequency drives) to control speed and rotation and already had a couple installed on a big wood lathe and a 17" Delta drill press. I am now up to 7 installed and two more in the wings) A few months later, Automation Direct approached me and offered to provide all the components, including a new motor if I would do a write up of the conversion for their in house magazine. What a deal!

I decided that at this point, I would increase the motor from 1.5hp to 2.0hp to compensate for power loss at lower motor speeds. I also figured that this was the time to fabricate a new motor mount to replace the cheap sheet metal one that kept bending. Some ¼" plate and a little welding and milling of some slots and holes and that was done. The old motor shaft was 22mm (.0866") and the closest I could come was a NEMA 145T frame. The frame size dictates mounting and shaft size. The shaft on that motor was 7/8" (.875") so I had to bore out the pulley .009" using my metal lathe. A machinist would do this for very little money as it is an easy job which quick set up.

The next part of that project was to mount the VFD and build the remote control for fwd/off/rev and speed control. This was easy enough and I just followed the schematic in the user's manual. It was so simple that I actually called Automation Direct and talked to the tech people to verify that it was as easy as it looked.

The remote control and 3 axis DRO mounted

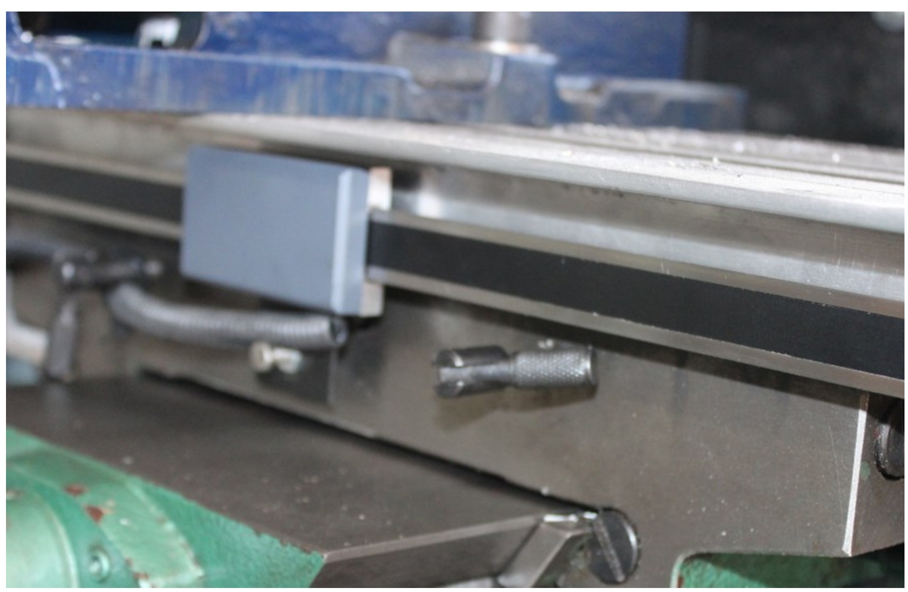
The new motor and motor mount



The VFD inside a metal protective box

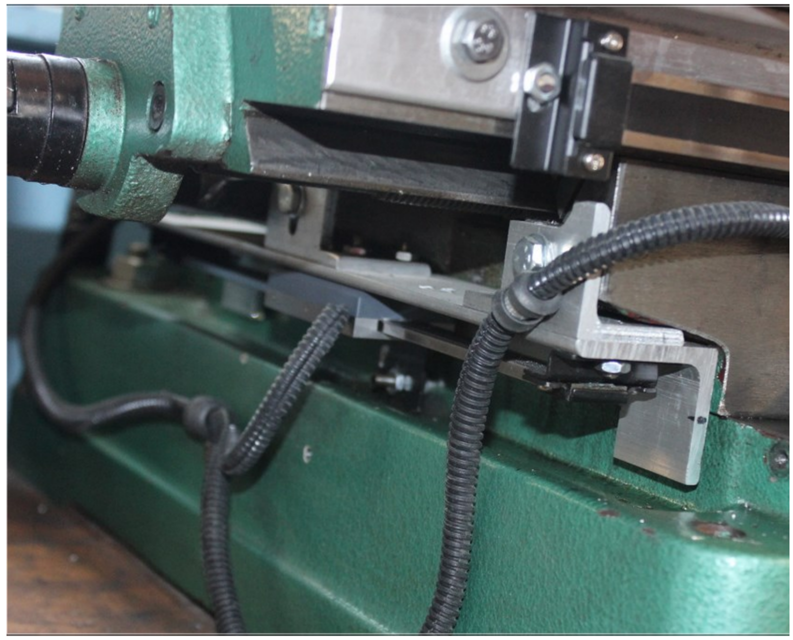
The display and key pad mounted on the outside of the box

The next big project was to Add the 3 axis DRO. I had picked up a 3 piece set of the *Igaging* DROs and all I had to do was figure out how to mount the scales. “X” & “Y” were pretty straightforward after viewing a couple of YouTube videos but the “Z” was another thing altogether. I bought some 2” aluminum angle and a piece of 2” flat aluminum to build mounts and protection for the scales.



The “X” axis scale was attached to a piece of angle and the angle was attached to the the bed of the mill using the “stop” bolt nuts. I rounded off the ends of the angle to make it more user friendly to me. The sensor was attacted to the bed base using the holes that formerly held the stop bracket.

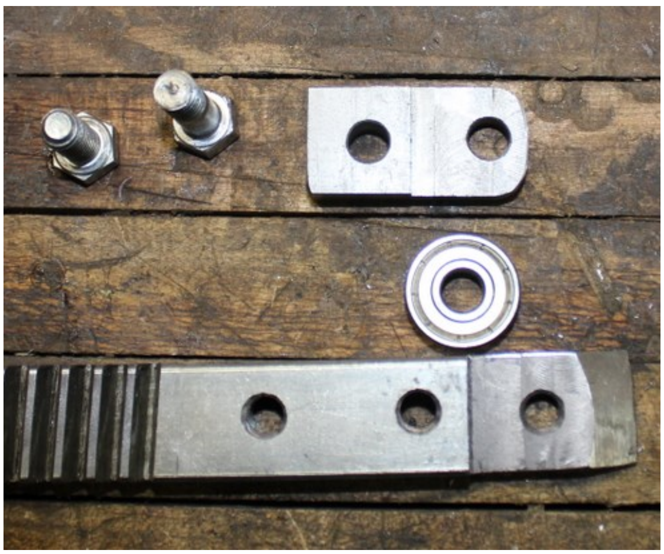
The “Y” axis was attached in similar fashion but required a couple more pieces aof aluminum shaped to hold the main angle. The flat top on the angle keeps the debris off the scales and sensors. I cut away part of the angle to provide running room for the sensor. In this photo you can see the added brackets that hold the scale in place. Some drilling and tapping was required, but this is not a valuable antique, just a working machine.



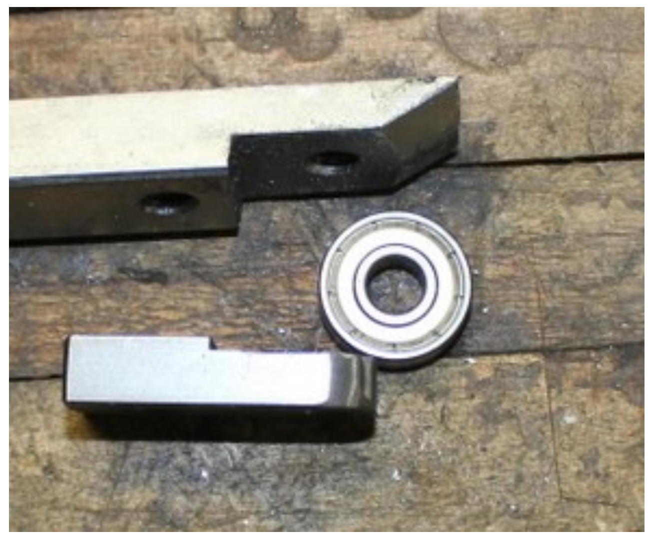
Next came the “Z” axis. There was no clear path for this and in the end I removed the depth stop rod assemble and made a new one that carried the sensor and attached the scale to the milling head. On the “X” & “Y” axis the sensor is fixed and the scales move past it. On the “Z” axis the sensor moves and the scale is fixed. The scales I had all had to be shortened and they are HARD stainless steel. I cut then using a cut off wheel in a Dremel tool. It work fine!

In the right photo, you can see the guard/cover that I made using a piece of angle and a piece of flat. The readouts are designed to be ganged up by connecting them one to another using a thumb screw. That worked OK, but the plastic rod that they mounted on was way too wimpy and not ~~ridged~~ enough so I eventually built a new mount out of some of the alumi-num that is much better. The new mount supports the readouts both top and bottom and is very solid! A big improve-ment.

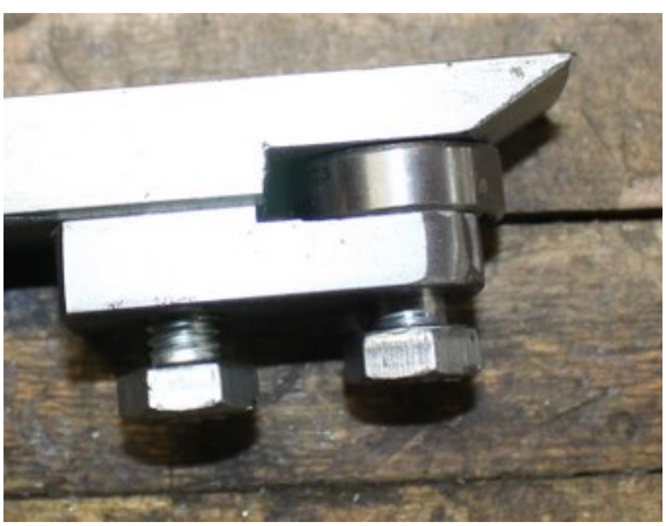
Another issue that had bother me from the beginning was the “geared stake” that was part of the head raising mechanism. If you wanted to turn the head, and I frequently do, the stake jerked around and was not smooth. I have some big Delta and Walker Turner drill presses and they use a ball thrust bearing in this position. I thought about this for a while and then came up with this idea, simple and cheap and it works. The bearing is a number 608 and mine came off a band saw blade guide. It does not have to be rated for any speed as it is only rolling a little from time to time. The stake is milled to allow the bearing to ride on the top of the collar at the base of the column. The added piece is held on with two 5/16” bolts. This works so well and is so cheap, I do not understand why they don’t make them this way? The bearing is fitted to just lift the stake out of the slot enough to allow the movement without dragging. Keeping the point of the stake in the slot keeps it from sliding off the collar.



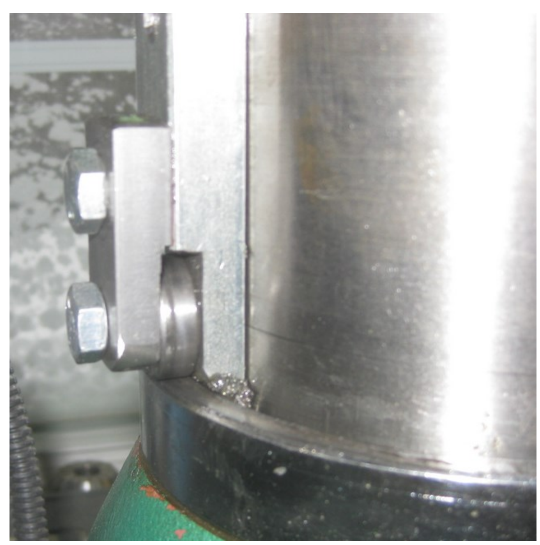
The pieces ready to install



Side view

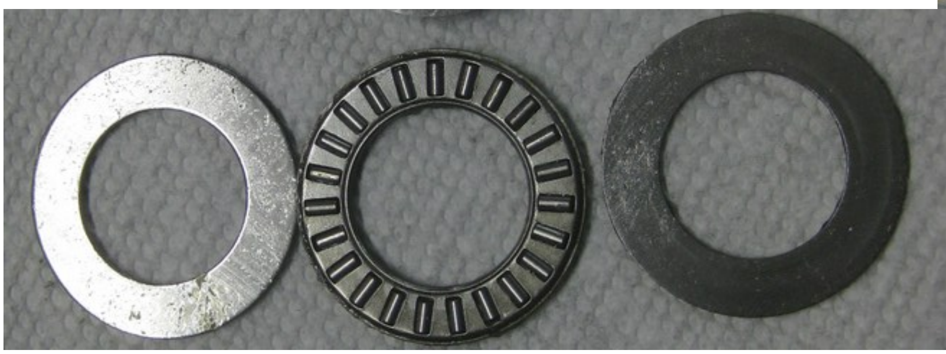


Assembled

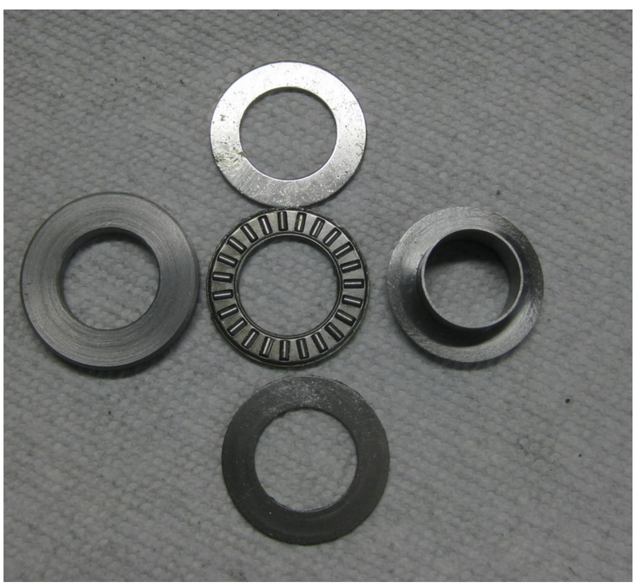


In place

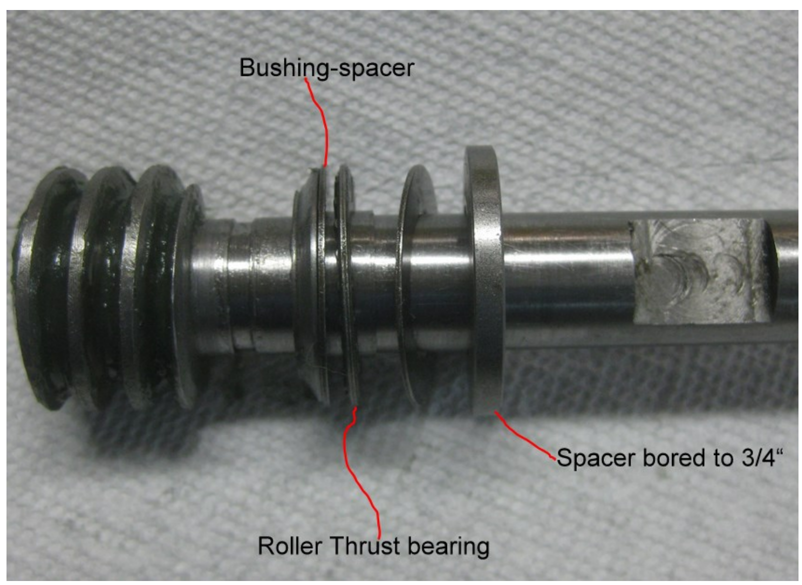
And the last thing that I have work on was the worm shaft for the head raising worm and pinion mechanism. It felt rather coarse and worked hard and when I investigated, this is what I found that they were using for a thrust washer - a snap ring in a groove on the shaft! It had worn the housing where it had been rotating against it. The shaft is 18mm (0709”) and roller thrust bearings normally come in Imperial sizes like 3/4”. I I ordered up a bearing set, two hardened washers and a caged roller bearing. To make the set work



on the 18mm shaft, I turned a shouldered bushing and a flat spacer. The space was to correct the alignment of the worm and the pinion gear. It was badly misaligned and the worm was running on the very end where it had been turned down to provide clearance. This put it back on the solid part of the worm.

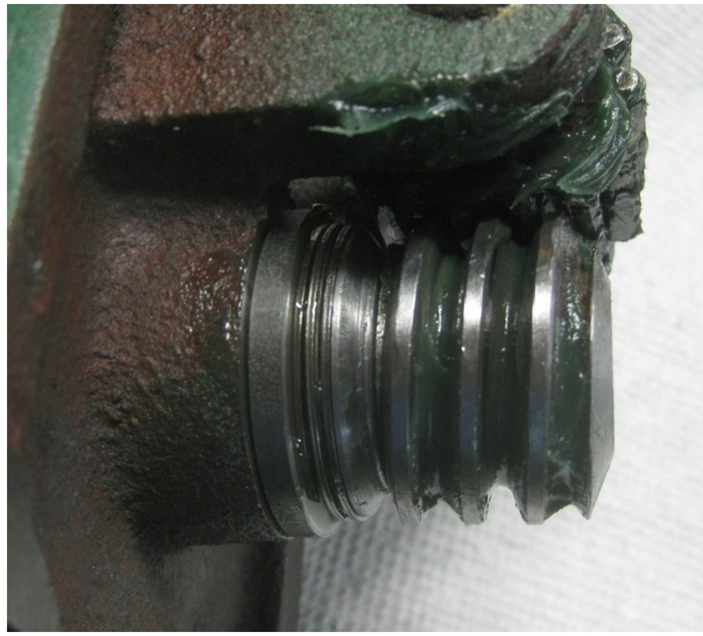


The complete
bearing/bushing/spacer set



Installed on the shaft

And in this photo you can see the way that the two gears mesh with the roller thrust bearing in place. I did use a custom boring bar to mill the damaged area of the housing flat to properly seat the new thrust bearing.



All in all, it would have been easier to buy a good used Bridgeport and in this area they are readily available, but I was concerned that my shop floor would not hold the concentrated load. This set up weighs about 800 or 900 pounds with the stand and steel stored under it. A Bridgeport would have bee close to 3 times that weight.

I hope this is a help to someone and I can say that these modifications have really made the machine much more usable for me.