Installing the Drive Shaft on a Horizontal/Vertical Rotary Table, Version 1.0

By R. G. Sparber

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My goal was to install a cog belt sprocket on the end of my horizontal/vertical rotary table's drive shaft. This required me to remove the shaft, turn the end down on my lathe, and re-install.

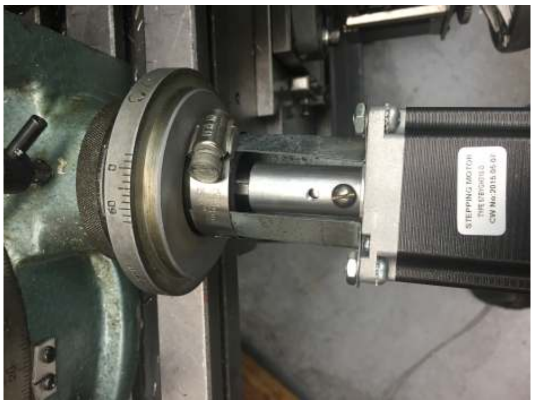
It took a bit of thinking to figure out how to remove the shaft. I sort of remembered where the various set screws went but since I assumed there would be few, didn't bother to document my progress. By the time I realized the complexity, it was too late. Fortunately, I did the reassembly the day after taking it apart so much was still fresh in my mind.

In case you find yourself wanting to remove and/or install the shaft, I offer you this tour of my journey.

My starting point was my stock horizontal/vertical rotary table. When I converted to CNC, this table was reborn as my A axis.

See http://rick.sparber.org/AAD.pdf for details.

The crank came off along with the graduated collar adjacent to it.

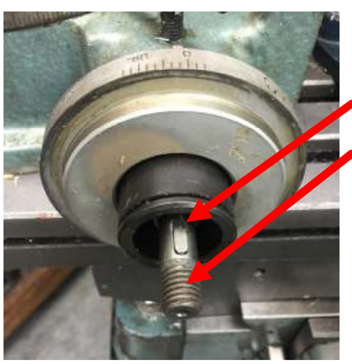


A stepper motor directly connected to the shaft.

This worked well for indexing my A axis. I could set an angle and it reliably went there.

The one problem was speed. When I wanted to turn the A axis quickly, it could not go above 2.3 RPM before the stepper started to miss pulses. That became a problem when I was cutting cylinders. A visit to "Beevo's" machinist's shop brought the answer. He had a converted rotary table that used a cog belt to go between a stepper motor and the drive shaft. Perfect.

Well, maybe perfect. The higher speed would mean less torque. This torque is needed both when cutting and to stop the A axis from turning. My best shot was to modify the rotary table such that I could return to direct drive if it didn't work.



I needed to preserve
the key in the shaft but could afford to remove
the threaded end of the shaft.

With the threaded end turned down, I could slide on my cog belt sprocket.

Here is the driveshaft after I turned down the threaded end. Because the part was originally turned between centers, it was easy to put it back on centers and accurately turn down the end on my lathe.

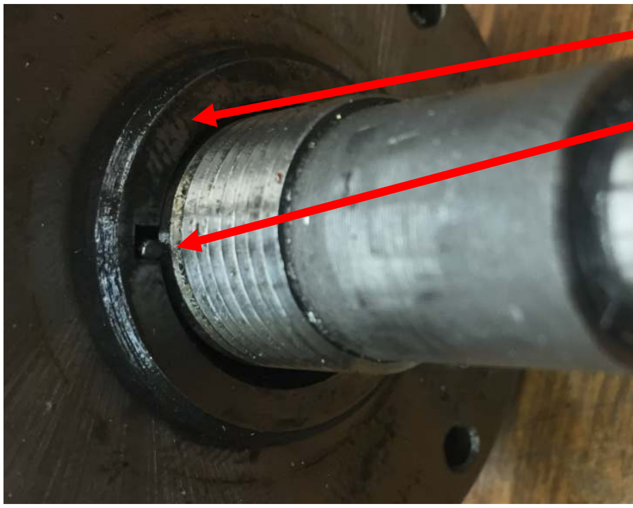
General rule: clean each part before installing it. Failure to do so can trap swarf inside the mechanism and cause jamming or excessive and uneven wear.

The shaft slid into its carrier. It is a close sliding fit. If the shaft doesn't slide in easily, take it apart and check for swarf.

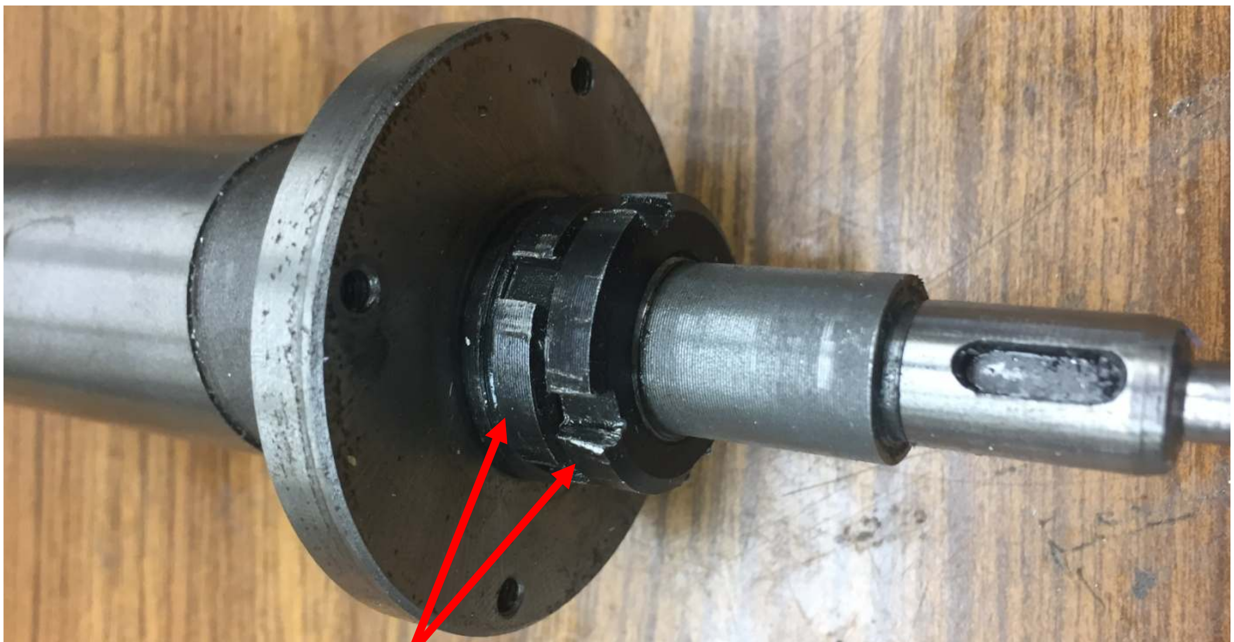
I had pulled a have a tiny piece of wire bent into an "L" shape out of this hole.

Time to put it back in.

I Pushed in the bent wire so the short length was exposed and facing away from the disk.



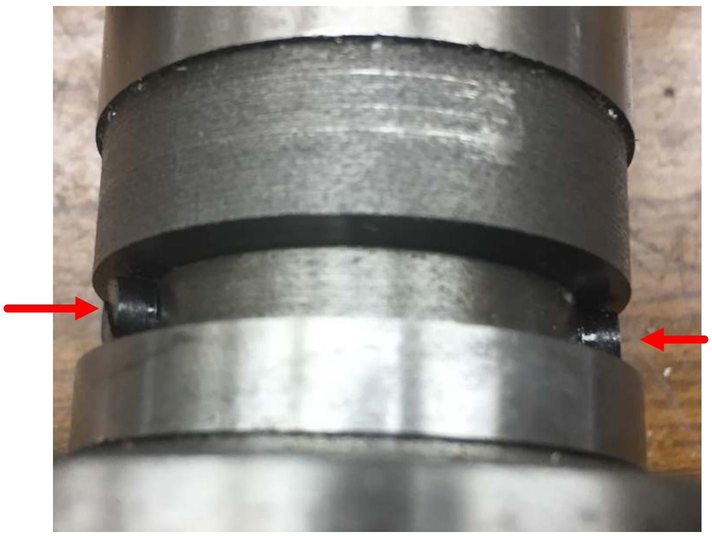
The washer with a slot cut into its inside diameter slid neatly over the bent wire so it locked to the shaft and could not rotate.



Then I screwed on the two nuts finger tight. Final alignment and locking took place later.

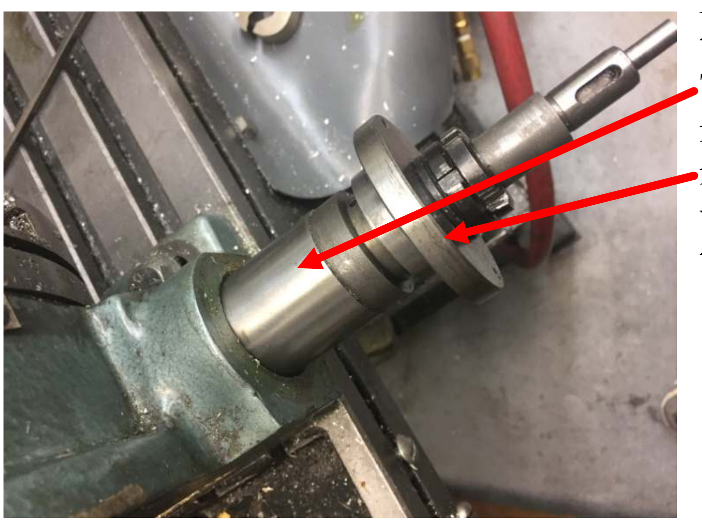
I located two holes in the groove behind the disk. Here is one of them. The other is about 120° off from it.

I located two screws with cylindrical heads. They screwed into the holes in the groove. I called these **radial stops**.



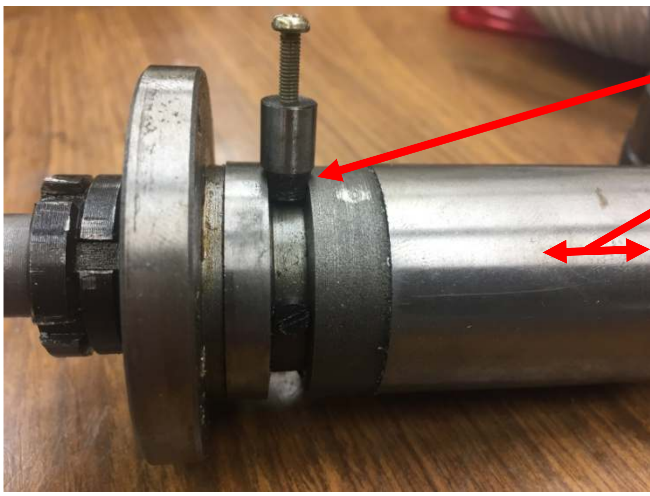
Here the two radial stops are installed and tightened down.

One of these screws provides the stop that sets the distance between gears engaged and disengaged. The other works in conjunction with a long set screw to set the percent of engagement of these gears. Too much engagement causes binding. Too little and backlash becomes a problem.

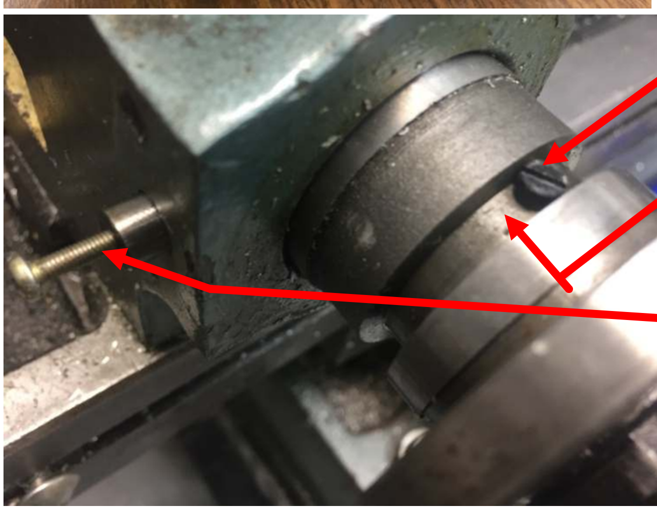


The assemble slides into the rotary table body.
The shaft carrier is eccentric so I needed to
rotate the ring in order to have the worm gear clear the ring gear inside the table.

I located this part and called it an **axial stop**. At least in my case, there was a hole in the other end that was tapped. I found an odd screw that fit the hole.



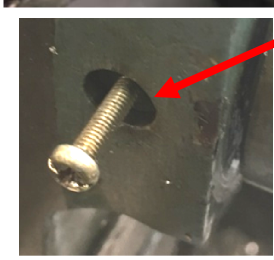
The flat part engages with the groove and is tapered so when snug, the shaft carrier does not slide in and out.



With one radial stop facing up and the other to the right,

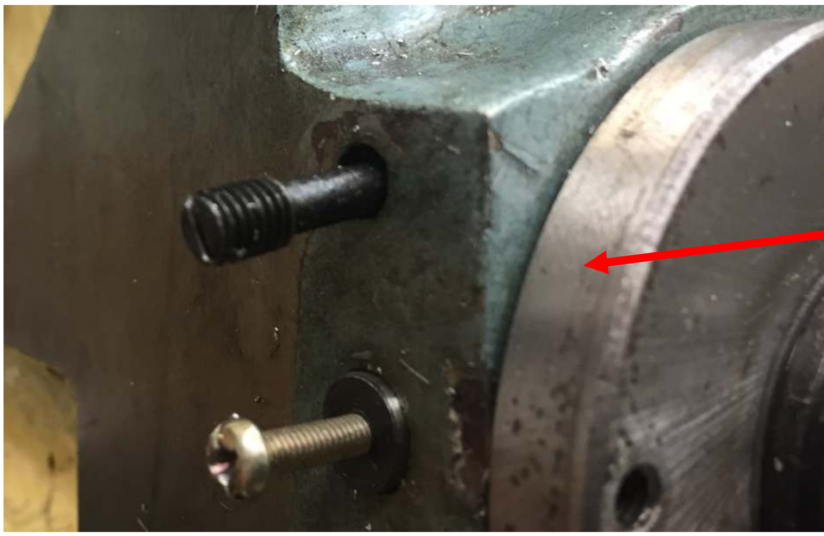
I slid the carrier into the rotary table body.

The flat end of the axial stop with attached screw fits in the large hole in the side. That screw made it easy to keep the flats vertical so they would engage the groove.



When correctly positioned, the end sat below the surface of the casting.

I found this odd shaped set screw.
The smooth end contacts the side of a radial stop in order to set the percentage of gear engagement. I called it a **gear stop**.

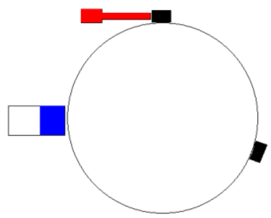


I slid the gear stop into the hole just above the radial stop.

I turned the disk until I felt the gears engage. Then I screwed in the gear stop until it bottomed out. Next, I backed it out while rotating the shaft. At some point I felt the gears start to bind. I then turned it in just so the gears engage with no backlash.

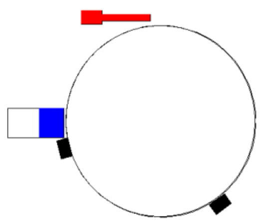
I located one of the longer set screw. It screwed in behind the gear stop and locked it in place. The gear stop can have no pressure on the end of it so without this locking set screw, it could turn and be out of position.

I knew I had installed the correct set screw because, when tight, the face was just below the surface of the casting.



This diagram shows how the radial stops (black), gear stop (red) and the axial stop (blue and white), interact.

With the carrier (circle) turned as far as it can go counterclockwise, the top radial stop contacts the gear stop. By screwing in and out the gear stop, the amount of rotation of the carrier can be adjusted. This sets the percentage of engagement of the worm gear on the shaft with respect to the ring gear on the table.



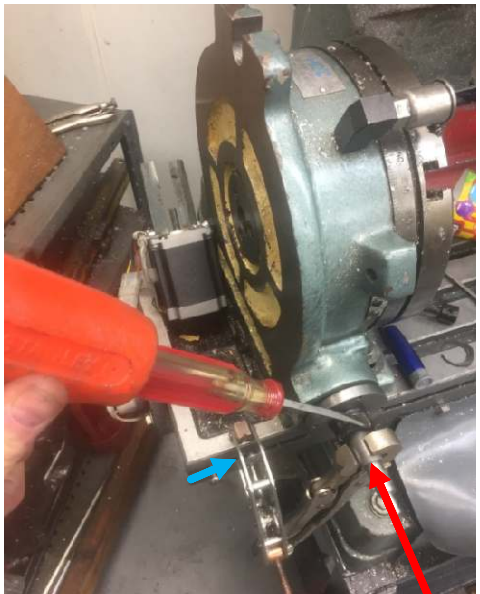
By turning the carrier clockwise, the radial stop that was at the 4 o'clock position now contacts the underside of the axial stop (blue and white). The shaft and table now spin freely.

I found these two set screws. The longer set screw was used to lock on the graduated collar but I will use it to better lock the smaller set screw.

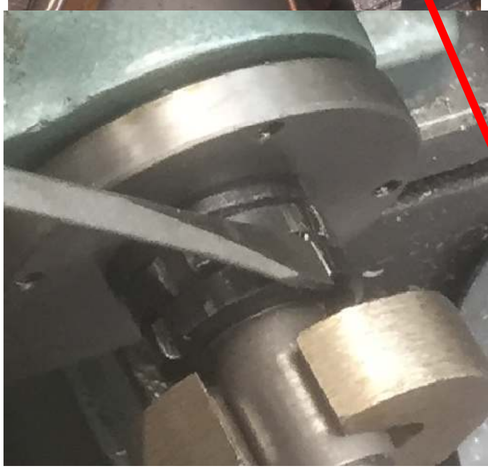
The rounded end set screw threaded into the bottom hole first. It took a lot of turning before it contacts the axial stop.

With the axial stop's flats snuggly engaged with the groove, I tightened down the rounded end set screw. Then I screwed in the longer set screw to lock the subassembly.

I could then unscrew the bolt from the axial stop.



This next step was to remove most of the axial movement of the shaft. I first tighten the two nuts together so they locked using a pair of Channel Locks. The trick was to have a gap between the disk and the inner nut. Then there was room to grab this nut.



Once the nuts were locked together, I clamped the shaft in a non-critical area. In my case, it was in front of the nuts because the turned down section must be preserved. Note the Kant Twist clamp that acts as a stop for the Channel Locks (blue arrow).

Then, using a screwdriver and a dead blow hammer, I slowly turned the pair of nuts towards the washer. After each tap, I tested the rotation of the shaft to be sure it still freely turned. When I went too far, a tap in the opposite direction brought me back to free turning. When adjusted correctly, there was no axial play in the shaft while it turns freely.

I located the thumb lock next.

It screwed into the side of the casting and locked the shaft carrier so it would not rotate.

I located the collar and the four screws that hold it in place.

Next, I aligned the holes in the disk with the holes in the collar.

This was the once place where the ***dis***assembly was a bit tricky. I figured out that I needed to use a gear puller on the collar after removing the screws.

There were two pieces left over. The calibrated ring is a press fit over the collar. After removing the set screw, I used the gear puller to slide it off.

The key will also not be needed.

Both parts will be put in a safe place. I will at least need the key if I need to return to direct drive.

With the rotary table reassembled, I was able to attach my small sprocket and start to design how the belt and large sprocket will be attached.

Acknowledgement
Thanks to Beevo for pointing out his cog belt driven rotary table.

I welcome your comments and questions.

If you wish to be contacted each time I publish an article, email me with just "Article Alias" in the subject line.

Rick Sparber
Rgsparber.ha@gmail.com
Rick.Sparber.org