Adventures with the EvaNut, version 1.0

By R. G. Sparber

Conclusion

I spent many months trying to perfect the EvaNut and its enclosure for my RF-30 Mill/Drill. After making 10 of these nuts, I have concluded that it cannot handle the forces that exist in this mill and cannot hold a tight fit on the leadscrew. Any large side force deforms the plastic and it does not come back.

I am hoping others can benefit from my work and come up with a way to use this great EvaNut idea. My focus has moved to modifying the existing bronze take up nut. That effort has paid off nicely. So at least for now, I have stopped experimenting with the EvaNut.

Background

To learn more about the EvaNut, just do a search on line. The mother lode of information can be found in the rather long but useful discussion at

http://bbs.homeshopmachinist.net/threads/43645-Making-Acetal-leadscrew-nuts-the-easy-way

My Efforts

I start by turning some 1 ¼ inch diameter acetyl. The outside dimensions are dictated by my enclosure. The inside diameter is 0.04" less than the outside diameter of my 1-10 leadscrew. Then I square up the ends for an overall length of 0.6 inches. The side wall is then cut.

With the 1 inch diameter leadscrew removed from the mill, I snap the acetyl around the threads about 1 inch from the end.

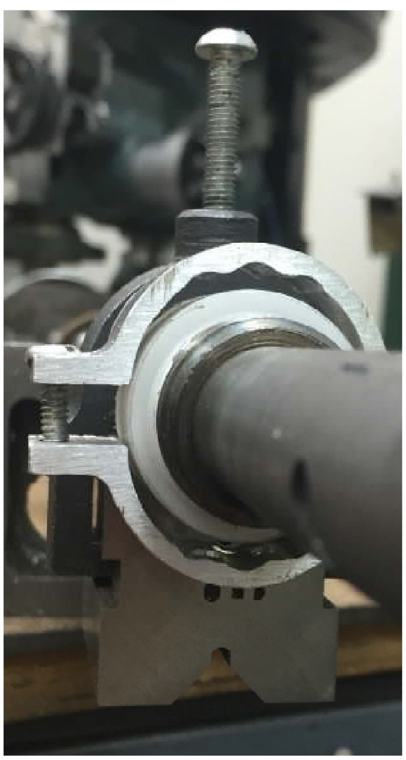
Then I put a ½ inch wide hose clamp around the plastic. Using either a heat gun or carefully using a MAPP torch, the leadscrew is heated to about 400° F. With gentle pressure on the take screw of the hose clamp, it is possible to feel when the plastic is starting to soften. Gently turn the screw until the gap in the plastic closes.

John Herrmann suggested that a piece of Teflon tape between the side of this gap would avoid having to cut them apart later.

Here you see the gap has closed. If you look closely, you will see some of the excess plastic piled up around the thread. As the plastic cools, it tightens on the thread to the point where you can barely turn it. By cutting through the gap, this excessive pressure is released. It is then very easy to turn the plastic on the leadscrew.

Here is the plastic after thread molding. That white stuff on the threads is Teflon tape. I tried to use it to make removal of the part easier plus to give some clearance. It didn't work.

The next step is to fit the carrier. This carrier is CNC cut from 6061 aluminum. The inside face has features that will lock into the plastic when heat is applied. This heat must be applied mostly to the carrier and not to the plastic. In this way the carrier melts ***into*** the plastic.



Similar to the trick with the hose clamp, I use two screws that are gently tightened as the outside of the plastic starts to melt. This is an earlier version of the carrier but you can see how the plastic is slightly larger in diameter than the carrier near the flanges. Heat from a heat gun on the carrier and gentle turning on the screws moves the carrier halves together. You can see a V block behind it. I tried to use it to improve alignment but it didn't help as much as applying uniform heat to the two halves of the carrier.

This picture is not of one of my best moldings but does show how the gap in the plastic is lined up with the gap between halves of the carrier.

When the carrier halves are fully pulled together, the plastic is locked in place.

The plastic will center in the carrier as long as the heat on the upper and lower halves of the carrier are equal.

A big advantage of this approach is that you do not have to put the leadscrew in the lathe and turn the outside diameter. The big disadvantage of this approach is that the yoke will likely not be perfectly aligned on the leadscrew. However, there is a way to null this misalignment.

In this iteration, I cut the plastic along the carrier lines. It makes attaching to the leadscrew easy but there is no way to adjust the percent engagement of the thread.

Here you see the carrier held in the Y axis enclosure. This enclosure pivots on a single bolt. The trick is to turn the carrier until all angular error in on the same plane as this pivoting.

The X axis nut is not as tall due to the lack of room under the table.

My EvaNut is only ½ inch long. The idea was that this would let me tolerate more misalignment of the leadscrew. But as I proceeded with this adventure, I realized that there was no substitute for a precisely aligned leadscrew. So much of the fancy design work in the X and Y enclosure plus the logic behind the short nut was no longer was valid.

A possible down side of such a short nut is that as the axial force of the leadscrew increases, there is less plastic to deform. This means that the existing plastic deforms more than a longer nut might exhibit.

A possible advantage of the short nut is less drag. I did not make any longer nuts to see if this is true.

You will find my partially perfected molding procedure in the appendix.

Acknowledgments

Thanks to John Herrmann for collaborating with me on this adventure.

Many people on various Yahoo BBS made suggestions that helped this effort along.

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.

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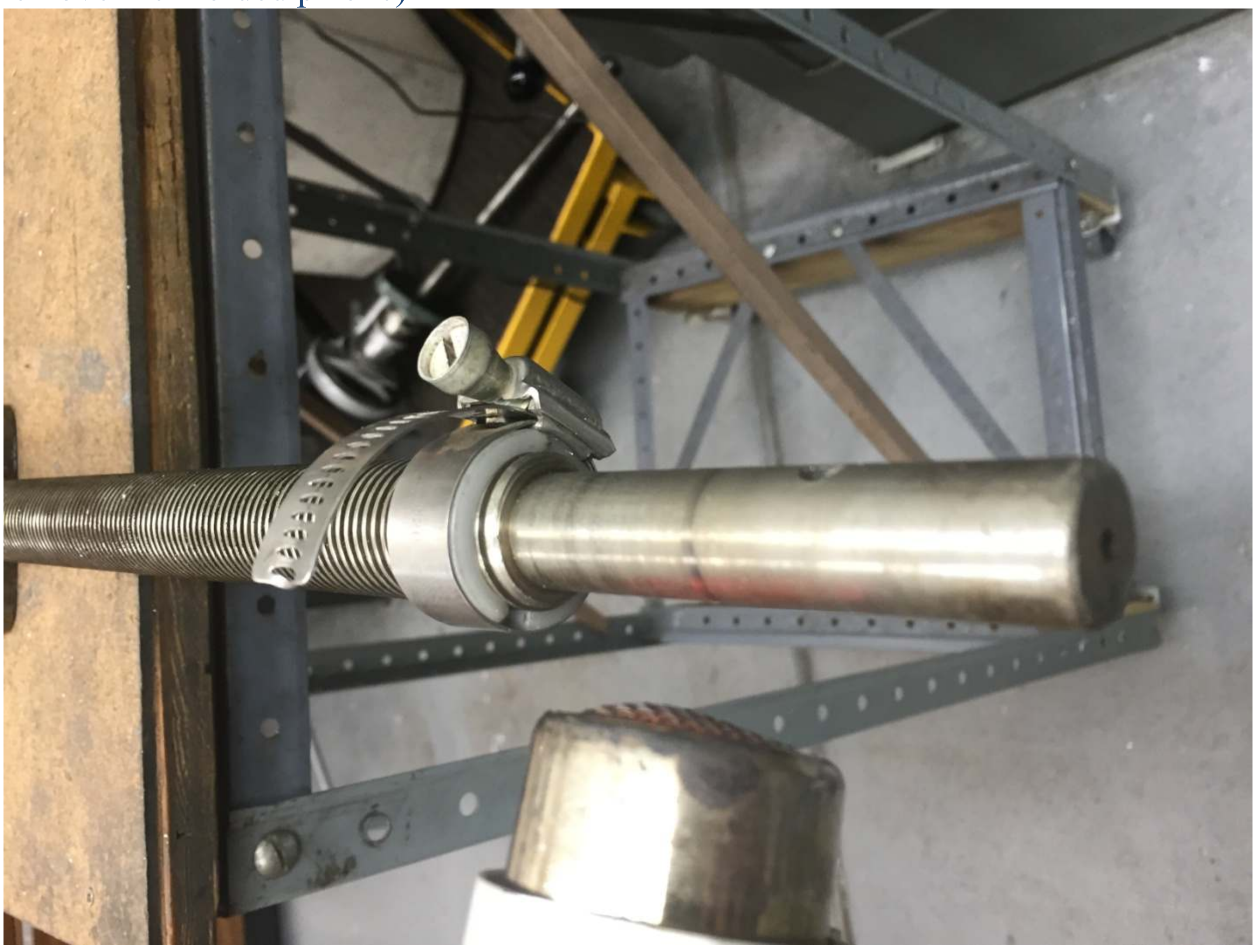
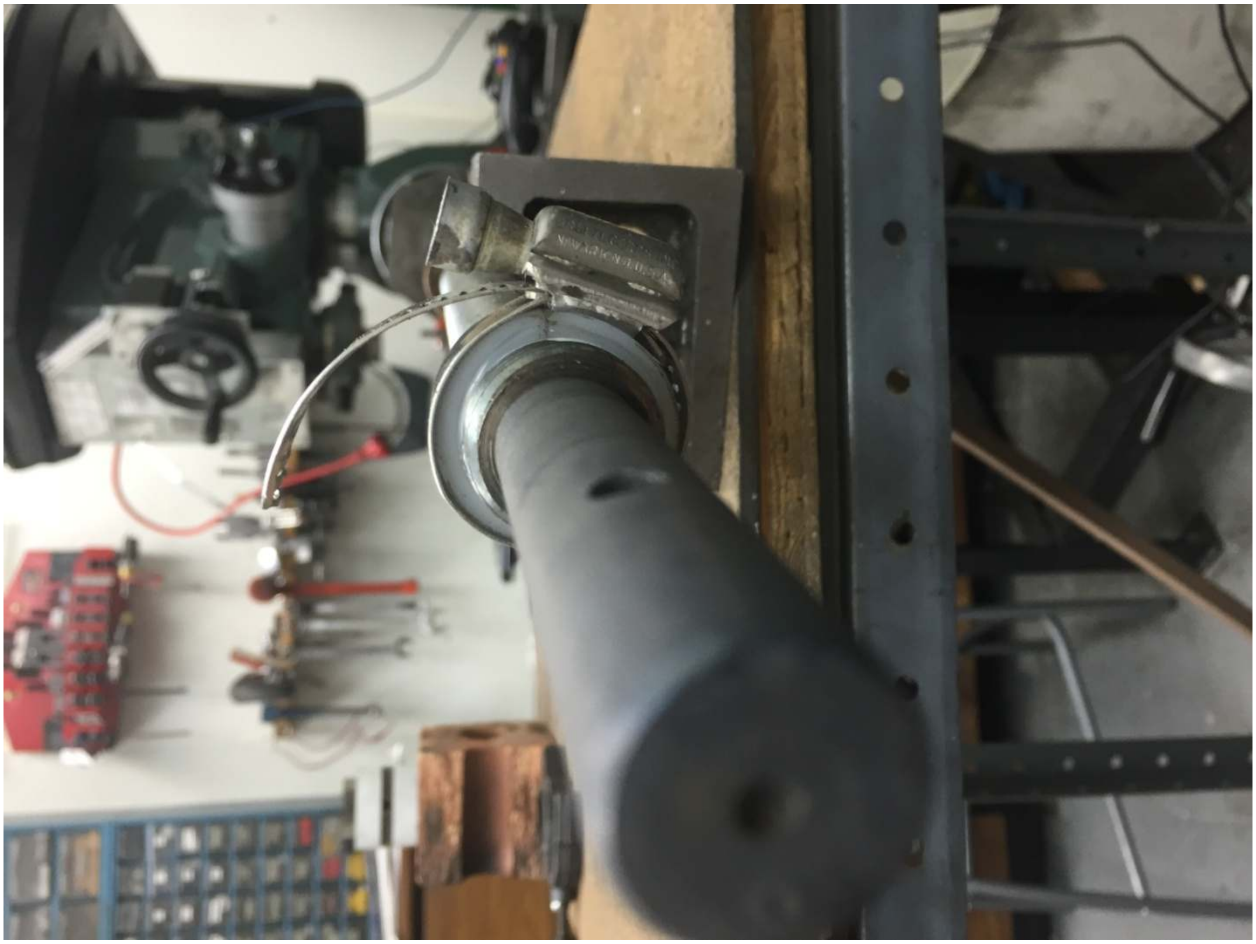
Appendix

EveNut and Yoke Procedure

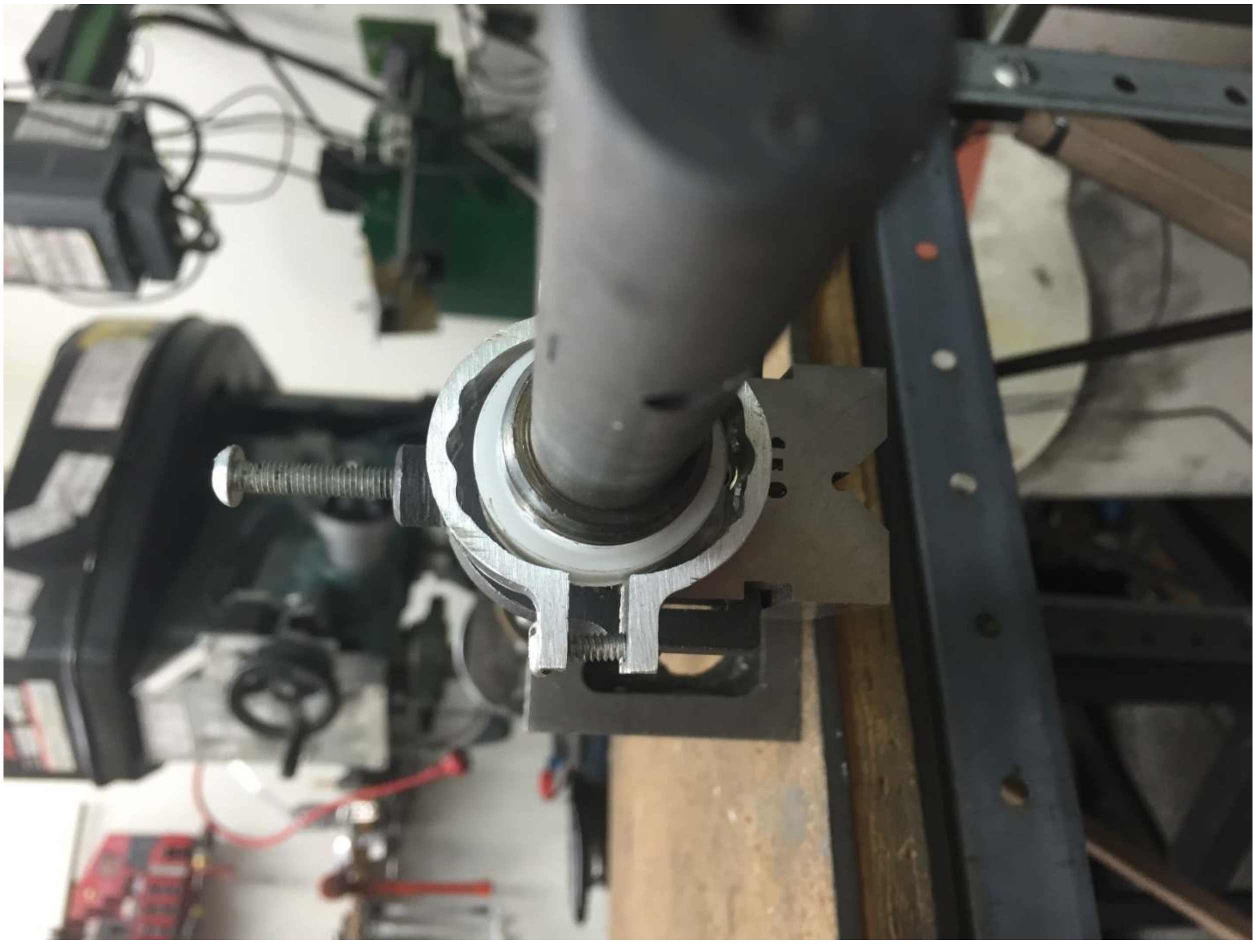
1. take 1.25" diameter acetyl and turn OD and ID for 0.5"; part off
2. cut through the wall on one side (this gives me alignment during molding; if I cut all the way through, it is harder to juggle the parts)
3. wrap 2 layers of Teflon tape around the leadscrew for about 1" near the end of the leadscrew. The tape helps give me some clearance (since the plastic shrinks as it cools, this only partially helps with clearance but does also make it easier to remove the molded plastic)



4. Pry the plastic part open and slide it over the taped area being sure there is thread on both sides
5. put a 5/8" wide hose clamp snuggly around the plastic



6. heat the end of the leadscrew (I can use an air heat gun but it takes about 20 minutes. Using a MAPP torch and keeping it moving plus away from the threads takes only 2 minutes. I'm not real happy using this much heat but 20 minutes is crazy)
7. when plastic touching threads starts to get shiny, gently tighten the hose clamp. It takes no force at all when the plastic is ready to flow. I turn the hose clamp screw until the cut ends of the plastic just touch. This is a closure of about 0.05".
8. let cool; I can use a water mist to speed this up; don't know what this does to the leadscrew but it seems to be OK (not real happy with this but don't like waiting an hour either)



9. place the two yoke pieces around the plastic using ½” long 6-32 screws
10. using a hot air gun, I heat the yoke and the nearby plastic. (picture shows V blocks but that didn't work because excess plastic pushed against it and not the yoke)

11. after about 3 minutes I can tighten the screws through the yoke with almost zero force and see the yoke sink into the plastic. When the two yoke halves touch, I stop and wait for it to cool. Plastic flows into the ID's peaks and valleys plus into the locking holes. This part works well as long as I have enough plastic. A fine mist of water speeds this up and I don't think it causes any problems.

12. I back the two screws through the yoke off a little to relieve pressure on the threads. Then I unscrew the yoke from the lead screw. It can be difficult to turn but I have learned to use gloves and avoid anything that can mar the surface or bend the yoke. The tape does help here.
13. with the yoke and embedded plastic off of the leadscrew, I verify the halves of the yoke are aligned and tighten the screws. Then I use the belt sander to remove the excess plastic with minimal removal of yoke metal
14. if I can screw the EvaNut back on, that is good. But it is easy to cross thread so I found it better to first use a hacksaw blade and cut the plastic along the yoke parting line. Then I can drop the two halves straight onto the leadscrew and tighten with shorter screws.
15. I flank the yoke with V blocks that are lightly tightened onto the lead screw. Hot air is again applied to the yoke halves until it can twist. Then I use a big C clamp to squeeze the V blocks together to get my final alignment.
16. let cool and then do a second clean up on the belt sander.