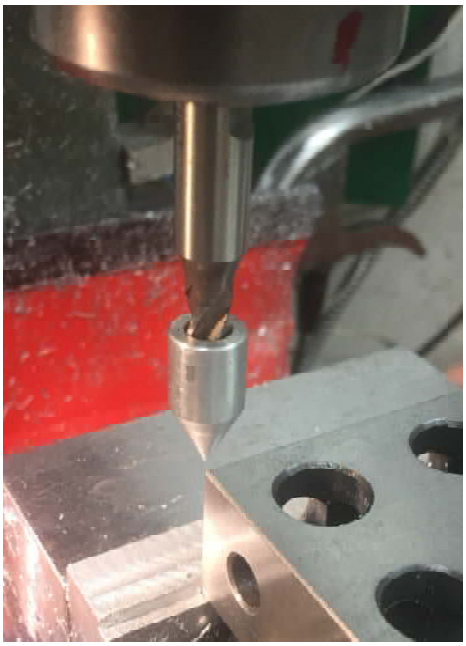
Spuds, version 1.1

By R. G. Sparber

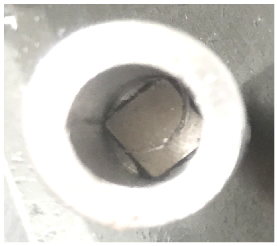
Copyleft protects this document.[1]

No, I have not changed my hobby to cooking. In metal working, a spud is a piece of round stock with a point on the end. You chuck it into the mill spindle and use it to roughly locate a point by eye. Rather useful and easy to make on a lathe.

It can get a bit tedious constantly removing the cutter to temporarily install a spud. Here are two ideas that solved this problem for me.



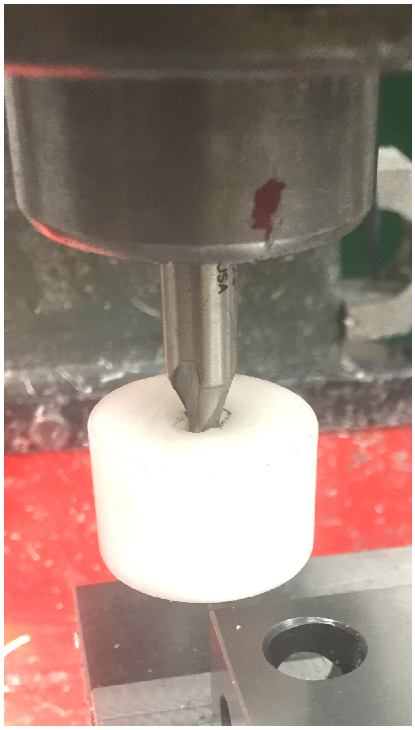
If I am using a 3 or 4 flute ¼" end mill, I can slide on this aluminum sleeve.
The hole was drilled and reamed for a close fit on the end mill.



Then I took a small square magnet, stuck it on the end of a squared off piece of ¼" drill rod, and pressed it to the bottom. This magnet holds the spud in place and provides alignment. If a press fit was not possible, a drop of epoxy would have been used.

I also have two flute ¼" end mills. They present a problem because a cylinder will rock on the flutes.

[1] You are free to distribute this article but not to change it.



My solution for two flute end mills is to mold a puck of Acetyl onto an end mill and then true it up on the lathe. This puck screws onto the end mill when needed.

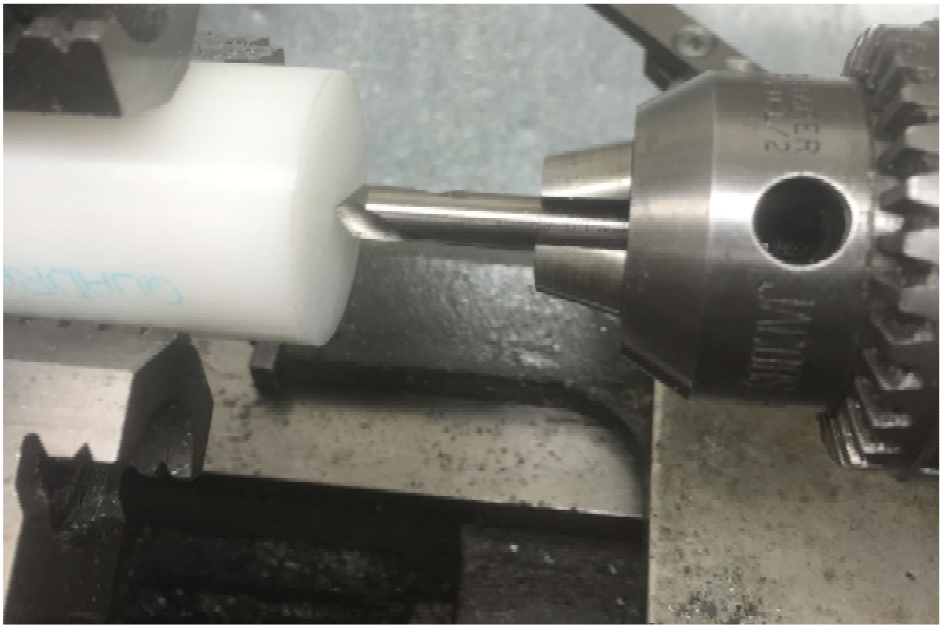
Yes, you would need one aluminum spud for each diameter end mill with more than two flutes plus a plastic puck for each size two flute end mill. For me it isn't so bad since I use mostly ¼" and 3/8" end mills. At most, I could also need to outfit my ½" and 5/8" end mills.

Making An Acetyl Spud

You will need some Acetyl or Delrin of a convenient diameter. I happen to have 1¼" stock so used it. No reason you could not go with a much smaller diameter. I like the larger diameter because it is easier to grab as I screw it onto the end mill.

It would be best if you also had a scrap two flute end mill. It can be dull but must not not be chipped.

First, I measured the minimum diameter of the end mill. It was 0.167". I needed to remove enough plastic so it would not block this central core of metal. An 11/64" drill (0.1719") seemed about right.



With a 2" length of Acetyl mounted in my lathe's 3 jaw chuck, I faced the end and then spot drilled.

Then I drilled in about an inch using my 11/64" drill. Acetyl cuts like butter but tends to contract after the drill is removed.

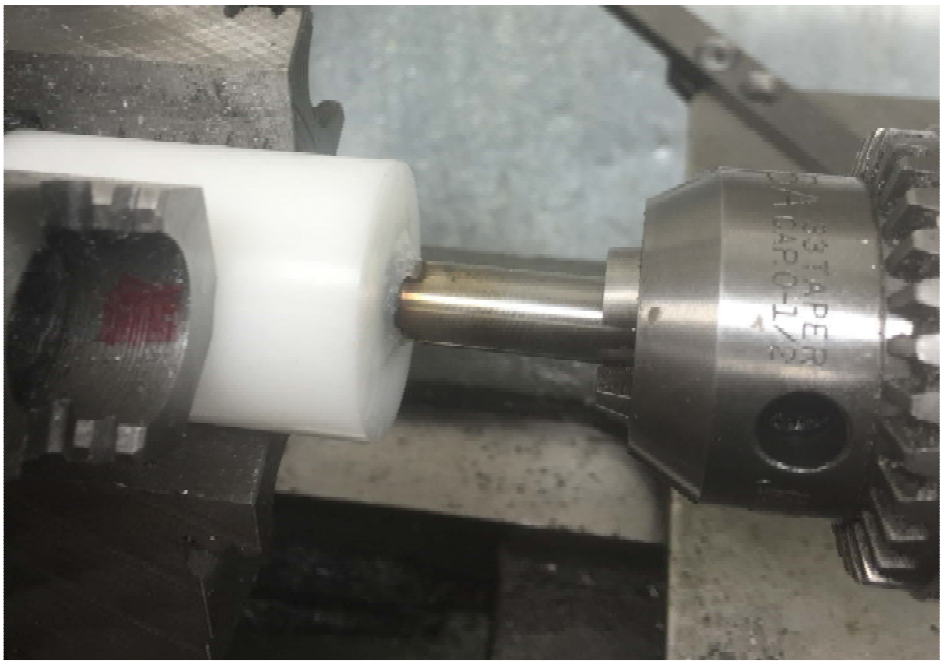
Here is where having a scrap end mill will save you time. You must heat the end mill to above 400° F.

Chuck the end mill in the tail stock drill chuck. The tailstock must be able to freely move on the lathe's ways.

If you have a scrap end mill, no harm in heating with a torch. It took me about 15 seconds to get the entire cutting area to change color.

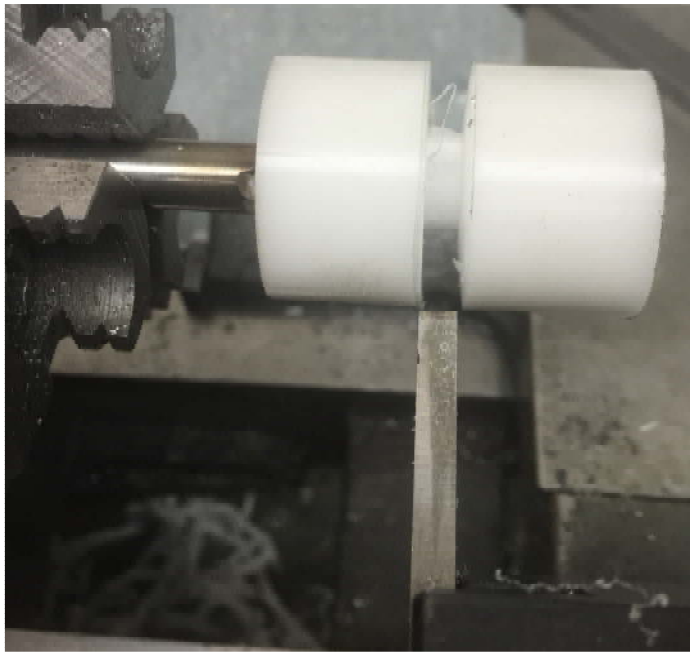
If you are using a good end mill, then I strongly recommend you do not hit it with a torch. A hot air gun should do the job but it will take a lot longer.

Keep a fire extinguisher on hand plus a small spray bottle of water.

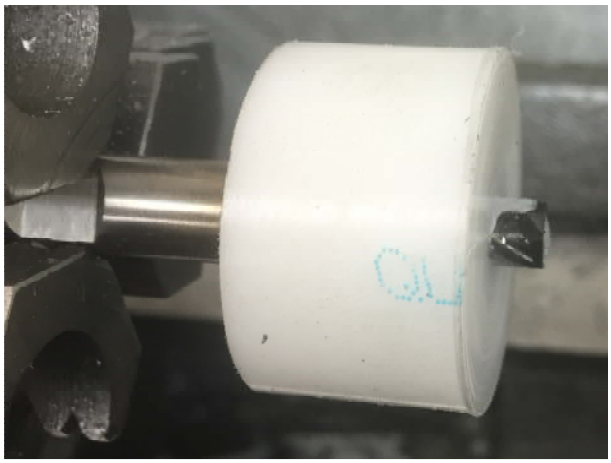


Here is your 10 seconds of excitement. While you push the tailstock towards the headstock, turn the 3 jaw chuck counterclockwise by hand. As long as the end mill is hot enough, it will easily screw itself into the plastic. There will likely be a little smoke and maybe a brief flame during the process. If necessary, use the spray bottle of water.

Do not disturb the set up until the end mill is cool to the touch. A few clouds of mist from the water bottle speeds things up. I would only do this if the end mill is scrap. You do not want to damage the hardness of a good end mill.

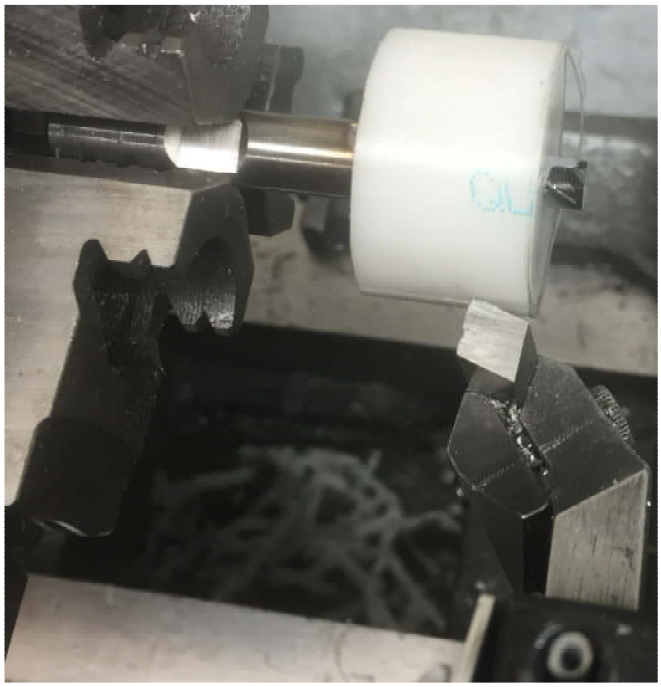


The plastic should be tight on the end mill. Remove the end mill from the tailstock chuck and mount it in the 3 jaw chuck. Part off ***beyond*** the end of the end mill.



Gee, I thought I had measured right!

Fortunately I did not feed the parting tool in all the way. It was easy to break the plastic off.



Then I turned the OD using light cuts. I chose a diameter of 1.200" giving me an offset of 0.600".

The resulting puck has molding flash on one end and a drilling burr on the other. I just cleaned this up on my belt sander.

You can see the complex shaped hole formed by the hot end mill melting the acetyl. Since the plastic shrunk a little as it cooled, this is a nice, sliding fit.

Here I am preparing to touch down for my Y axis. It is easy to sight between the puck and the reference surface and watch the gap go to zero. Since the plastic deforms, overshooting touchdown by a few thou is harmless.

After touching down, I know I am 0.600" from zero.

Testing

This is far from a metrology grade test but should be representative.

After setting zero with the puck, I used a piece of 3/8" diameter drill rod in a collet to find the actual zero point. I used my milli ohm meter[2] to detect touchdown. This approach is accurate to better than 0.1 tenths.

Before touchdown, I was measuring the resistance from the vise, through the table, base, column, head, quill, spindle, collet, and drill rod. At touchdown I am measuring between vise and drill rod. The change in resistance is very easy to see.

In this sample-of-one test, I was off 3.5 thou on the X axis and 2.1 thou on the Y axis. Not bad for eye balling it with a plastic puck.

[2] See http://rick.sparber.org/electronics/ramp.pdf

Acknowledgments

Thanks to John Herrmann for kicking this idea around with me. This work was inspired by the EvaNut.

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