An "Accurate[1]" Drill Location Tool, Version 1.1

By R. G. Sparber


This Drill Location Tool is based on a pointer called a "spud". I'm guessing that the name comes from the spud wrench:

The spud I'm talking about replaces a drill bit and lets you locate its sharp point inside a punched hole. Never seen one for sale in a machine tool catalog. I read about it in the second Guy Lautard Bedside reader.

The tool I am presenting here is both useful and makes a great first projects for people new to using a metal lathe.

My first spud was a length of ¼ inch diameter cold rolled steel with a point cut on the end. It worked fine for drills around ¼ inch but less so for smaller and larger sizes. Then I had to spin the chuck a lot to accommodate both diameters. Furthermore, my spud was rather short so if I was going to follow with a long drill, I had to be sure the table was set to clear the drill before using the spud. These minor annoyances were enough that I did not always use the spud as I set up to drill the hole. This realization always occurred *after* I used the spud so I had to adjust the table and use the spud a second time. Rather annoying.

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[1] By "Accurate" I mean that you can get place the point of the location tool right into the punch mark. The accuracy of the drilled hole will depend on the sharpness of the drill and its radial symmetry. If the drill's point was ground off center, the resulting hole can be oversized and may wander off of the punch mark.

Recently I decided to improve on the spud idea. Now I have three of them with lengths to match my 1/8”, ¼”, and 3/8” drills. Furthermore, I only need to adjust the chuck a maximum of 0.045” as I go from spud to drill.

The spud to the far left is the same length as my 1/8” drill. It has a minimum diameter of 1/8” and a maximum diameter of ¼” (0.125, 0.165, 0.205, 0.250).

The center pair shows my ¼” drill and its spud. Minimum diameter of the spud is ¼” and the maximum is 3/8” (0.250, 0.290, 0.330, 0.375).

On the right is my 3/8” drill. The spud has a minimum diameter of 3/8” and a maximum diameter of ½” (0.375, 0.415, 0.455, 0.500).

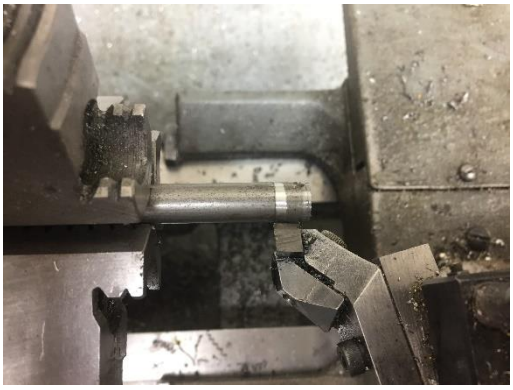
All steps are 3/8” wide. Going narrower increases the chance of the spud not aligning in the chuck jaws. Going wider means the spud will bottom out in the chuck before the full step width of the widest diameter is gripped.

For those readers with some experience with their lathes, this is the end of the article. But if you are just starting out, read on.

I'm going to be making a lot of 3/8" wide steps that do not have to be very precise. I chose a scrap of 3/8" thick stock to use as a gage. Just eye-ball the cutter's position before each step is cut. ***NEVER*** do this with the lathe running.

It is important to start with enough stock sticking out because accuracy depends on not disturbing the part in the chuck until done.

With the lathe running, feed in the cutter until it barely touches the stock. Then zero the in-feed dial.



Next, feed in enough to cut a line to mark the step width.

Feed in 20 thousandths of an inch (“20 thou”),

and cut to the line. The first step is now done.

Repeat these three steps but this time the dial is at 20 + 20 = 40 thou. Our second step is done. The third step is the original outside diameter (OD) of the stock. If you like, take a light cut over this step to true it up.

Without disturbing the part in the chuck, spot drill the end. A spotting  drill has an end like a regular drill but the rest of the body is smooth. It is a good way to cut a cone shaped hole that will later center a drill.

Next, drill the hole that will pass the pointed rod. If you have a reamer of the correct size, drill the hole about 0.01 inches undersized. If you do not have such a cutter, just drill the hole to size.

You must drill down enough to get past the three steps so

$$3 \times \frac{3}{8}\ inches = \frac{9}{8}\ inches = 1\ \frac{1}{8}\ inches.$$

I went in 1 ¼ inches so be sure the point of the drill is beyond the end of the last step. Otherwise, the hole will narrow at the end near the largest diameter.

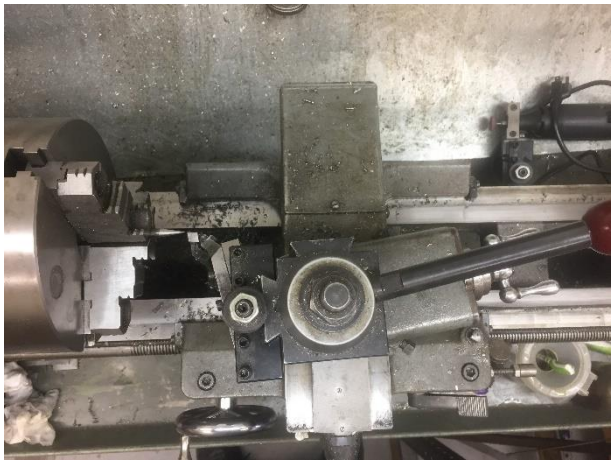
Set the RPM of the lathe for the drill and material being used.

As long as swarf is flowing out the flutes of the drill, you only need to use cutting oil and a slow infeed. But when the hole gets deep enough, the swarf will clog the flutes. When this happens, go in about 1/8" and then retract the drill. Clean out the flutes, apply cutting oil, and repeat.

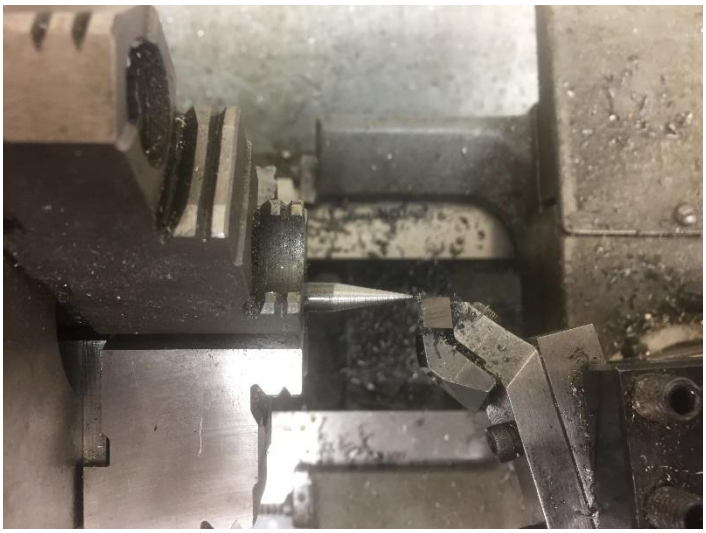
Note that I cut the steps first and then drilled the hole. This was done so the round stock would be as stiff as possible for the step cutting. There is a lot of side force. End drilling the rod applies a force along its major axis. There is no net side force.

Since the steps were cut and the hole drilled without disturbing the part, they are as concentric as the lathe will allow.

Saw off the part again using the 3/8 inch block to set that last step. Leave a little more width so the end can be trued up on the lathe. ***NEVER*** make these adjustments with the saw running.



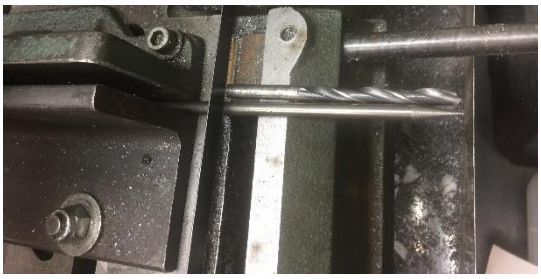
Next we will cut the pointer. The compound is set at about 80°.



Start by checking that the cutter is right on the center of rotation so the point will be as sharp as possible.

For the ¼ inch and 3/8 inch diameter rods, you can takes passes of 20 thou without any problem. Use the infeed to advance into the stock and the compound feed to move up and down the cone.

The 1/8 inch rod takes a bit more care. Only have it stick out about ½ inch to minimize bending due to the cutting force. Take as light a cut as possible.



Next, take each rod over to your saw and cut them to the same length as your drill bit of the same diameter. Using a file or sander, smooth the cut end.

If you reamed the holes, the rods should be a snug sliding fit into the stepped collars. If drilled, they may slide a bit more freely. This will decrease accuracy a little but should be fine.

Deburr and degrease all parts.

With a reamed hole, Loctite Red can be used to secure the parts. I prefer the gel rather than the liquid in this case.

If the hole is looser, epoxy will do the trick. Let the epoxy set up with the tool vertical so the rod tends to be centered in the hole. Laying on its side will offset the rod in the hole.

Be sure to have 3/8 inch of rod sticking out the top of the collar. Hmm, looks like the middle spud was wrong in this picture.

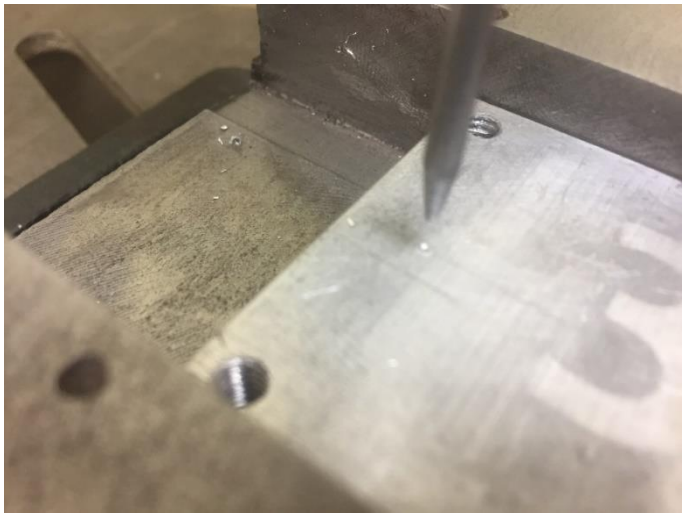
Note that the largest diameter of each collar is towards the point.

Time to try out our new tools!

Grabbing the largest diameter, the end of the rod has bottomed out in the chuck. Yet there is enough contact between spud and chuck jaws so it is aligned.

Holding by the smallest diameter, the spud still proves to be solid.

Since the change in diameter along each spud is 40 thou, it doesn't take much spinning of the chuck to go from the spud to the desired drill bit.



Here you see a faint scribed line with a punch centered on it. My spud is being positioned so the point enters the dimple.

Feeding down, I do my final adjustment and the point of the spud is now in the dimple.

Be sure the part does not move as you replace the spud with the required drill bit. For larger drills, clamp the vise to the table.

Then drill the hole nicely lined up with the punch mark. This picture shows how difficult it can be to even see the punch mark with the drill over it.

Acknowledgements

Thanks to Guy Lautard for his amazing Bedside Reader series. “The Machinist’s Second Bedside Reader”, page 104 introduced me to the spud.

Thanks to Dave Kellogg for finding a typo.

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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