A Homemade Removable Expanding Anchor Version 1.2

By R. G. Sparber

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Sometimes I want to secure a bolt into a hole but tapping is not an option.

Here is one example. I have thin-walled aluminum tubing with an inside diameter of ½". I want to screw in a 3/8-16 bolt. My homemade anchor solves the problem.

A word of warning: a bolt of this size has strength that far exceeds my anchor. Do not use this scheme where high strength or safety is involved.

I can buy anchors at my local hardware store. However, they tend to not be removable and are almost always the wrong size. Not to worry, I have a lathe and the needed tooling to get the job done.

Here is the finished anchor laid out in pieces. The smaller screw feeds through the larger cylinder and into the smaller cylinder. As it is tightened, the smaller cylinder moves sideways and locks the assembly to the inside of the tube. Then the larger screw threads into the top of the larger cylinder.

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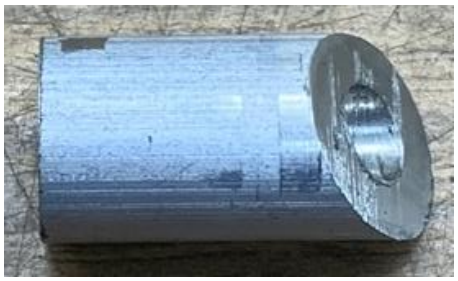
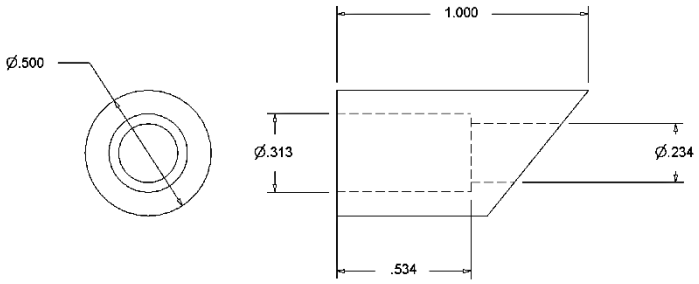
The Main Body



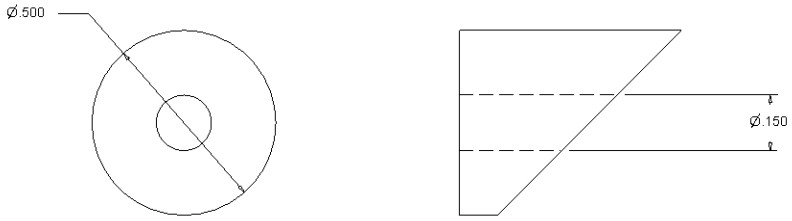


The outside diameter (OD) is a close sliding fit to my bore.

I am using a 10-24 Socket Head Cap Screw (SHCS). The 5/16” (0.313”) hole is a loose fit to its head. The 15/64” (0.234”) hole is a loose fit to the body of this screw. The locking action depends on having this screw shift as it is tightened.

Tap the 0.313” hole 3/8-16 with a plug tap.

The Lock



The lock is made from the same material as the body. After drilling the hole, tap it 10-24.

Fabrication Hints

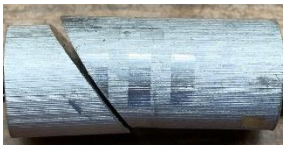
Start with a piece of round stock about 1 ¼” long. Chuck it on your lathe and face the ends. Then spot drill. Drill through with a #25 (0.150”). This is the tap hole for a 10-24 screw.

Then drill down 1” using a 15/64”. And finally, drill down about ½” with a 5/16”. Run a 3/8-16 plug tap.

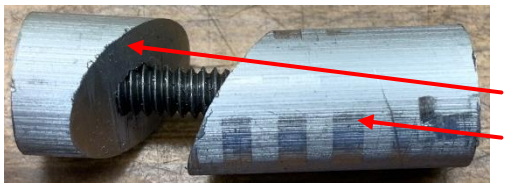
Turn the part end for end and run a 10-24 tap.

Deburr the part.

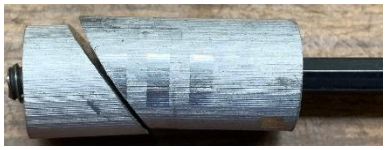
You may have noticed that I did not specify the angle of the cut for the body and for the lock. It is around 45° but the angles should match. This is done by sawing the end of the part off. Just be sure you cut at the threaded end. File the cut faces smooth and you are done.



Assembly



As the SHCS is tightened, the lock is drawn into the body. The angled faces cause them to shift out of alignment. Since they are both a close sliding fit to the bore, this shift causes the lock to dig into the wall of the bore.

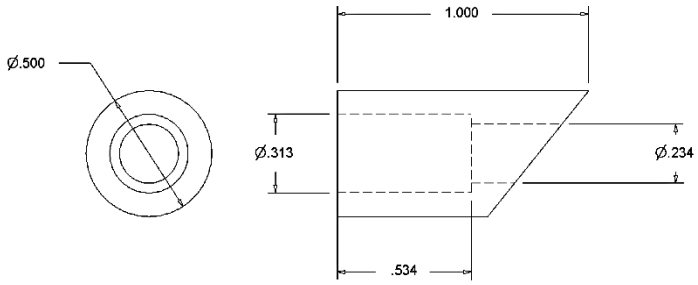


I have found that the lock digs in well enough that I do not need to grab the body as I tighten the SHCS. This lets me set the anchor flush with the end of the tubing.

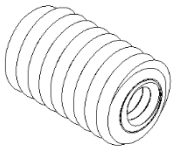
With the anchor locked into the tubing, I screwed in my 3/8-16 bolt.

Note that the anchor is locked in place by the SHCS. The 3/8-16 bolt can be installed and removed without disturbing the anchor. Yet I can remove this bolt, reach in with my hex wrench, and unscrew the SHCS. That causes the anchor to release without being damaged.

This 3/8-16 bolt is larger than I originally wanted. A smaller 10-24 would have been better. Given that the head of the SHCS must fit down the body through the 0.313" hole, it would not have been possible to make the hole small enough to accept a 10-24 tap. Hence, I accepted the 3/8-16.



If I was willing to make this anchor more complicated, I could have added another piece.



One option is to drill and tap a short length of 3/8-16 rod to accept a 10-24 thread. Then I would screw in the rod coated with Loctite Red. This would give me my smaller threaded hole. But there is problem with making it permanent. I cannot feed a hex wrench down the hole to unscrew the SHCS. If I went with a ¼-20 hole in the 3/8-16 rod, my hex wrench could pass but now I'm back to an over-sized screw.

An alternative is to use a hex head bolt instead of threaded rod. This would let me tighten it down during assembly yet later remove it.

So, as usual, design is filled with trade-offs.

Brian Roberts of Wales, UK wrote:

Even though you mention a 45 deg angle of the sloping faces, I have found that a shallower angle of nearer 30 deg gives a smoother, tighter lock. The interference fit created by the sliding parts is the main determinant of the lock's effectiveness.

Acknowledgments

Thanks to John Herrmann for pointing out a confusing paragraph plus noting that removability is a key element of this design. Apologies to Nelson Collar for any confusion I have caused. Thanks to Brian Roberts for his insights.

I welcome your comments and questions.

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