Making a Banjo Fitting

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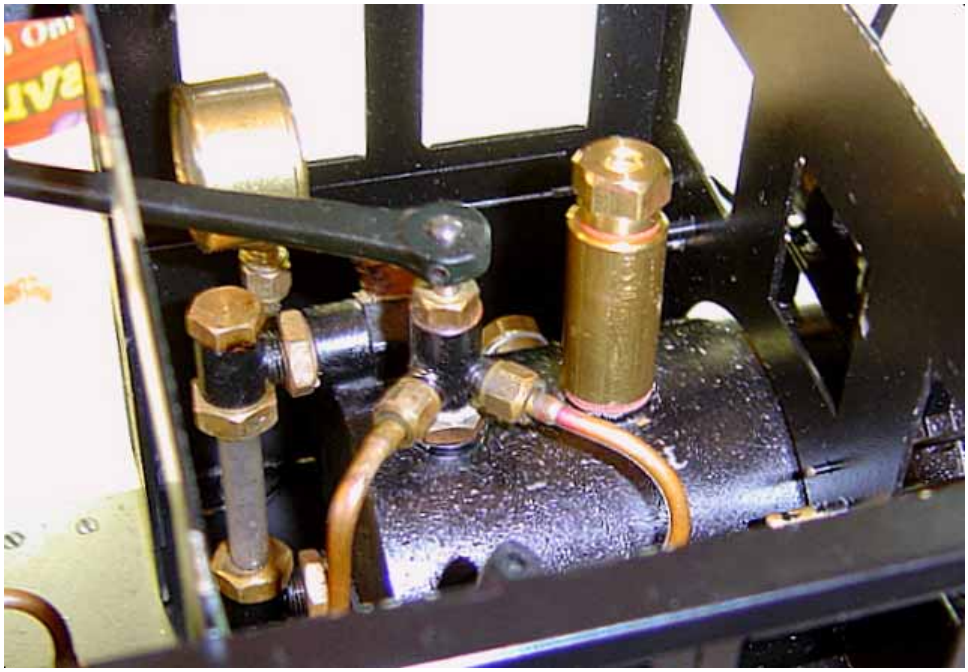
Topic author: cliffordward
Posted on: 11 Jan 2008

I realize this subject may be elementary to experienced live steamers on the forum, but for the sake of those newer to the hobby I thought I would share my recent experiences adding a steam take off to an existing boiler.....Hopefully sharing the info will be of assistance to others....

Here's a dilemma most of us have faced at one time or another....I wanted to add a Weltek Whistle to my Mike Chaney Catatonk Shay. Mike leaves an extra steam port on the boiler in the form of a capped off bushing in front of steam regulator. Unfortunately on my Shay this is already occupied with a Goodall valve fitting.

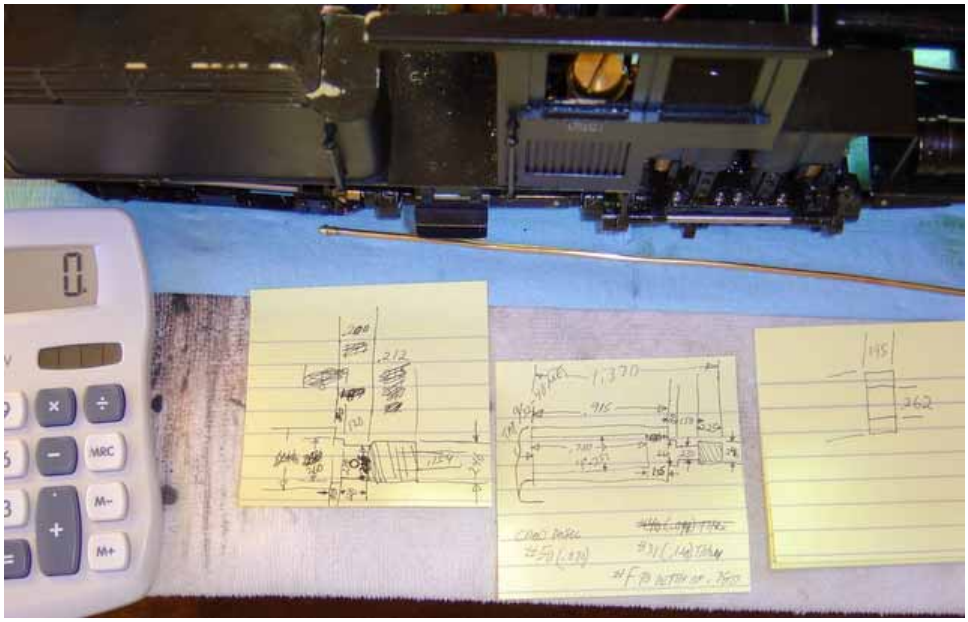
So how do we obtain a steam take off for the whistle?....time to turn to the model engineer's best friend, the banjo fitting. A banjo fitting looks like a very thick donut like washer and has a tube silver soldered to the edge with a hole reaching to the inside of the "donut". Equally important is the banjo bolt which is hollow with a turned down outside section and a hole which provides a route for steam to flow through the bolt, into the banjo "donut" and out through the tube. This explanation is really better served by looking at some photos, so let's get on with how I added a banjo fitting on my Shay. This "tutorial" of sorts is not meant to be a "how to" for every situation, but rather is offered as an example of how a banjo bolt can be adapted to a variety of situations. Making a banjo bolt and donut fitting is extremely easy and can be done on any lathe...let's get on with the show:

Here's a photo of the cab area of my Shay before the whistle installation. Whistle gets mounted on the cab front to the right, with the actuator valve to be mounted on the cab rear to the left. The vertical brass looking piece just in front of the regulator arm is the Goodall valve.....we'll be remaking this into a new version with a banjo bolt added to the lower section:

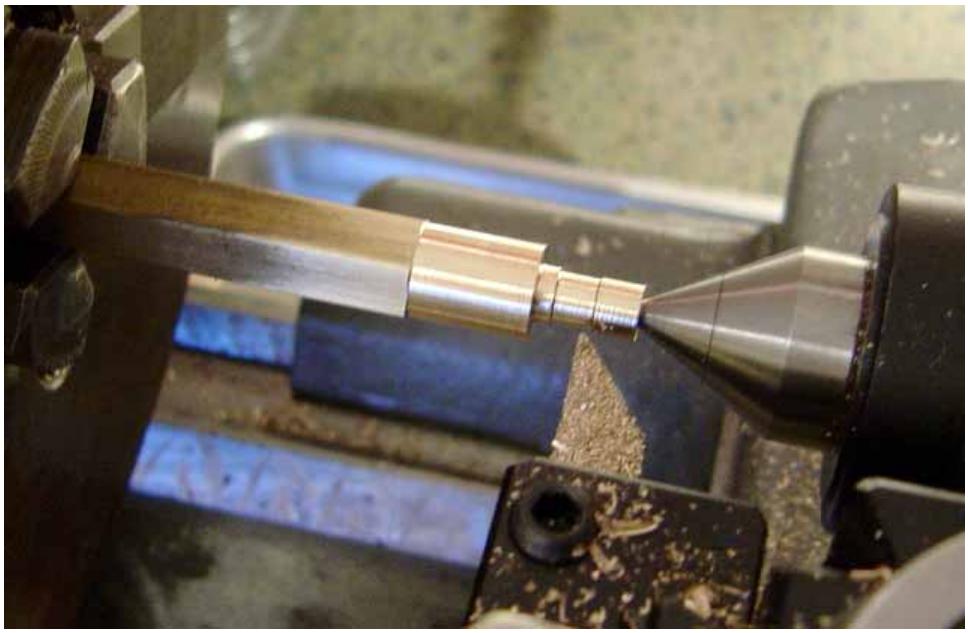


Here's the original Goodall Valve. Great for the boiler refilling function it is made for, but we'll be scrapping the main body and turning up a new piece which incorporates the banjo bolt

This is a typical example of how I do my "drawing work" for a one-off project like this. Scratching out the needed dimensions quickly on these post it notes allows me to sort out the shape of the needed part and check clearances. As you can see I didn't hit the numbers the first time and had to scratch through things a few times. But this sort of figuring goes quickly, and having all the machining dimensions worked out before going to the lathe makes turning work go more quickly:



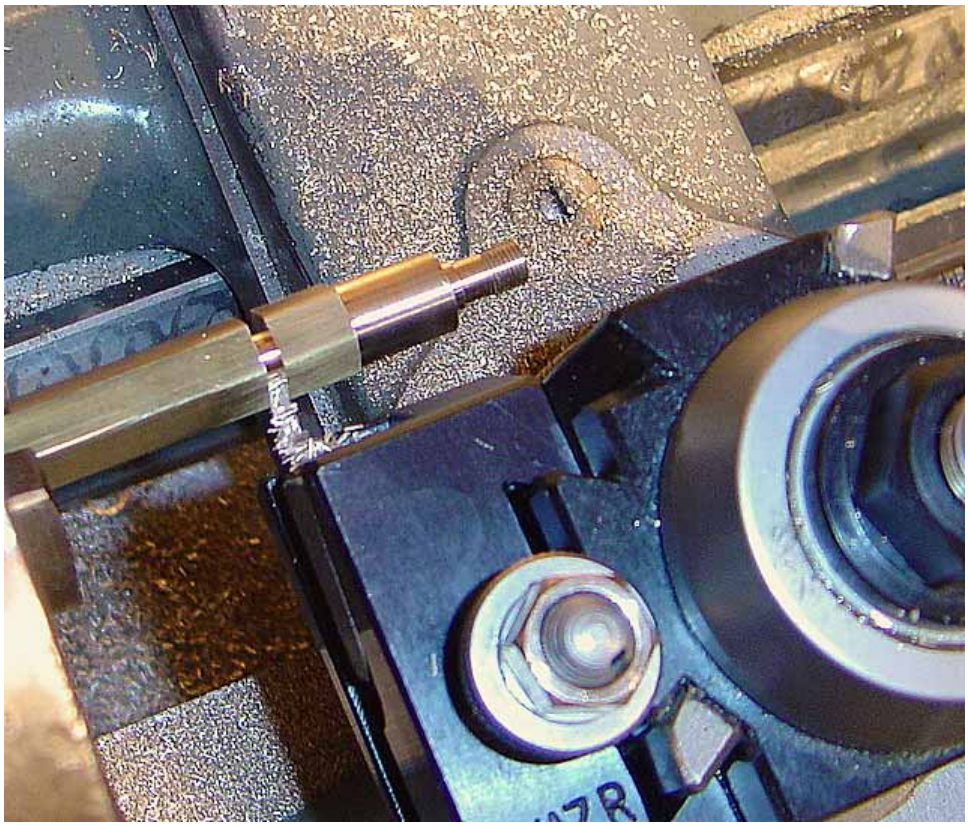
Here's the new Banjo Bolt after first turning operations. I started with a piece of hex so I could have a built in means of tightening the bolt on the boiler. Easily seen in this photo (just in front of the cutting tool) is the turned down section which will provide the passageway for steam to travel from the inner bore of the bolt out through the banjo fitting:



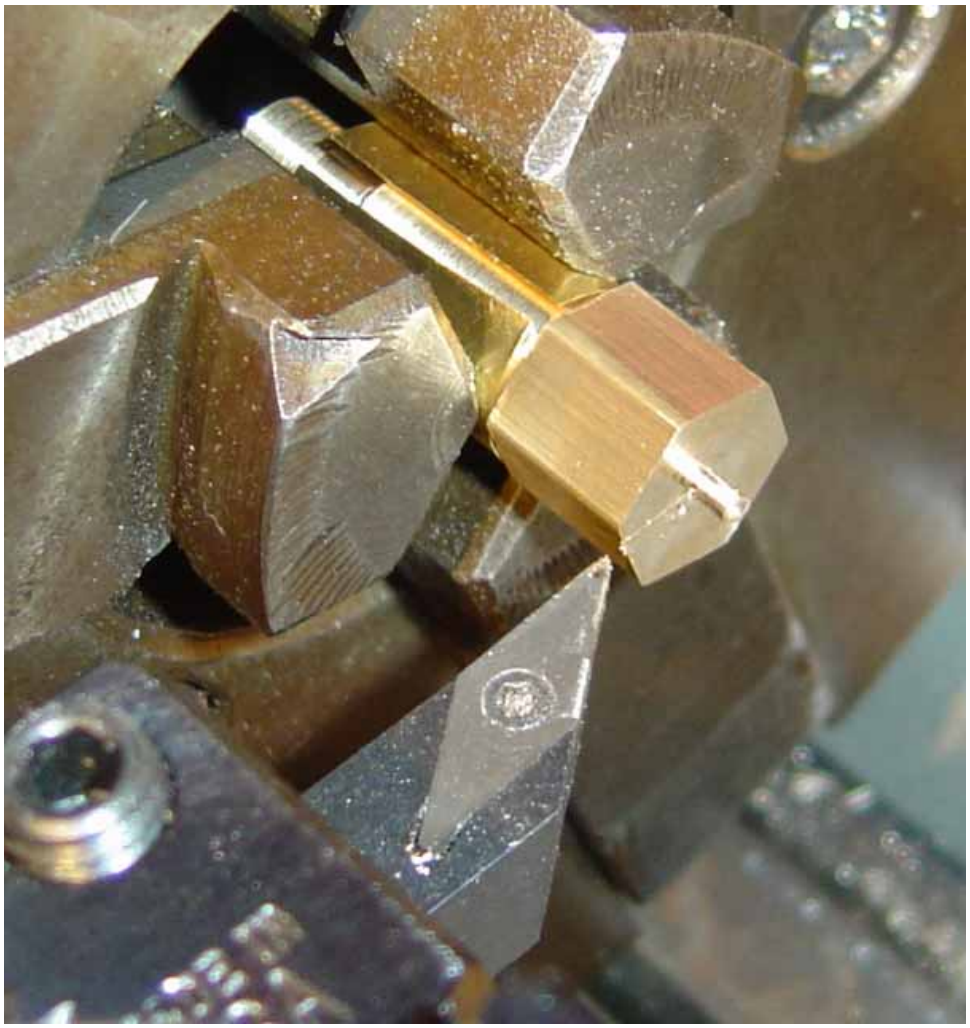
Now we come to drilling the hole through the Banjo bolt. Normally this hole would only extend up to the turned down area with the upper portionof the bolt remaining solid. In this application, however, I wanted to keep the Goodall valve function so the bore extends clear though the bolt and we will later add treads to the top for the Goodall valve to screw into:

Next comes cutting threads on the lower end of the banjo bolt. In this photo I am using a tailstock die holder....it makes quick work of cutting the threads...I recommend adding this tool to your arsenal of lathe tooling. Note that up to now we have performed all operations without removing the stock from the 3 jaw chuck. Doing everything in one set up keeps everything lined up properly and makes the project go quickly. If you look closely you can see that the turned down area on the banjo bolt starts just above the threads. This will be more clear when we look at the finished product:

Finally the banjo bolt is parted off and now begins to look more like it's finished form:



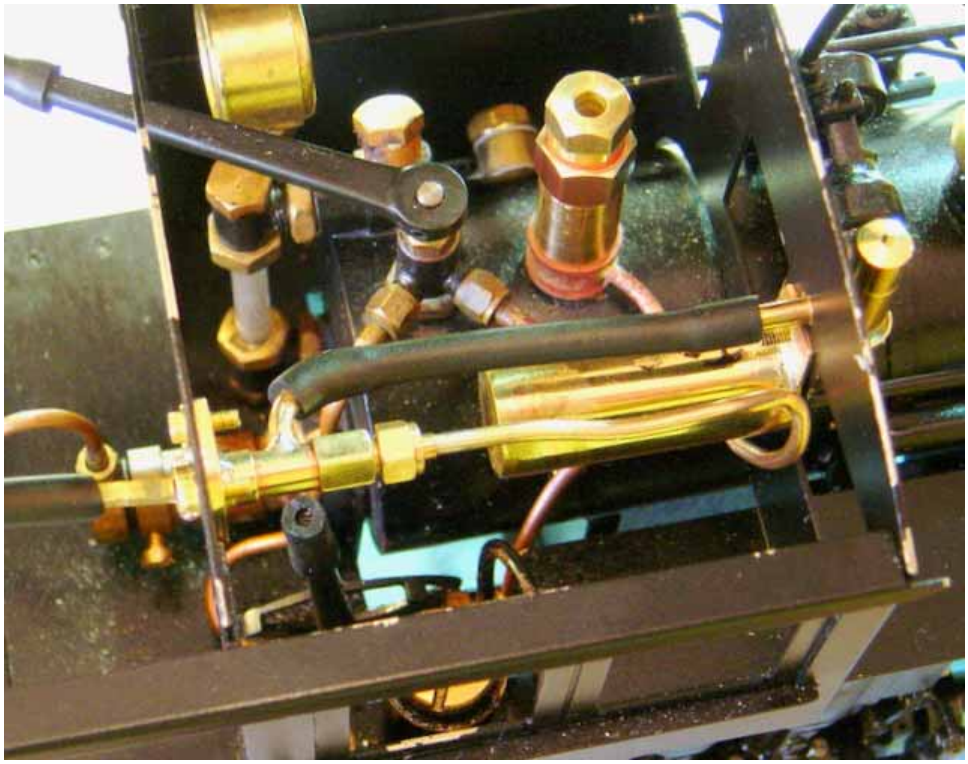
Now that the banjo bolt has been cut off, it is turned around in the lathe chuck, and in this photo is being faced off in preparation for boring and internal threading. This is the top of the banjo bolt where the Goodall valve will screw into. Note also that small pieces of shim stock are being used on the jaws of the lathe chuck to protect the finished outer surface of the banjo bolt:

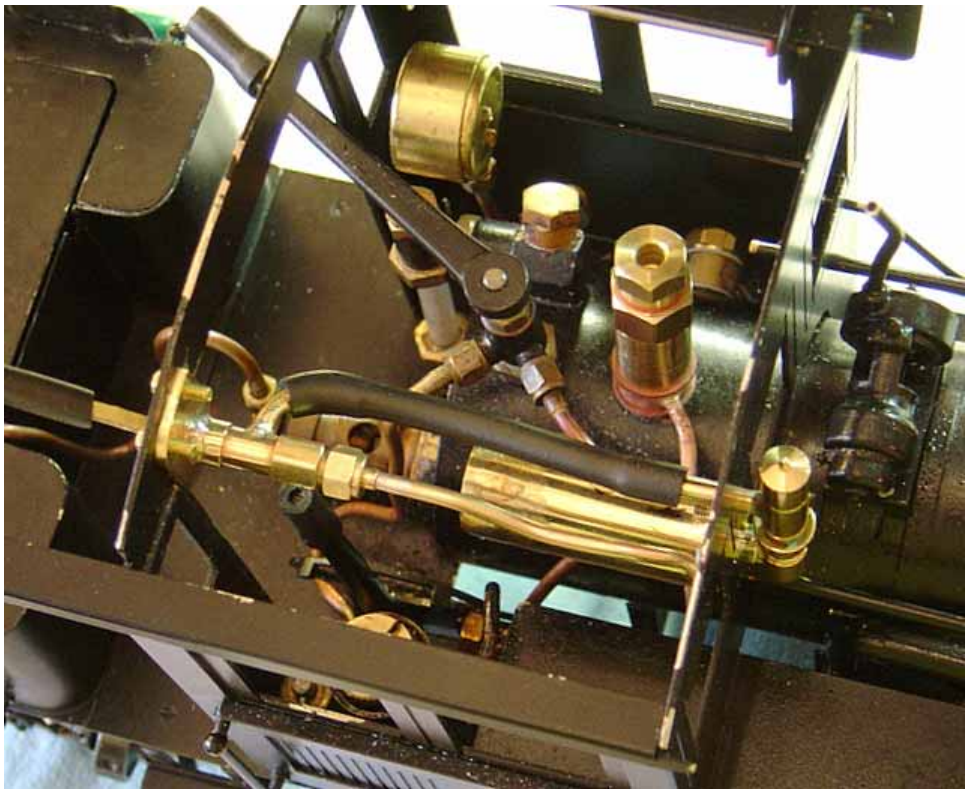


Here's the finished banjo bolt showing the Goodall valve and also the banjo fitting with steam tube. The banjo fitting "donut" is a simple straight turned piece with a bore just large enough to slide over the shoulder on the banjo bolt. This shoulder is seen just above the cross drilled hole in the turned down area of the banjo bolt. In use the bolt tighens down on the banjo fitting donut and with the red fiber washers shown creates a steam tight seal.

The idea behind the banjo bolt is that when installed there is an air gap all around the banjo bolt where steam flows from the bolt bore out to the banjo fitting. The hole and attached tube of the banjo fitting donut carries the steam out to whatever accessory is being added. In this case the tube is the steam supply line for the whistle:

And here's two views of the new banjo bolt and fitting in use with the whistle installed and functioning. Using the custom made banjo bolt and fitting retains use of the Goodall valve, and makes for a neat and tidy installation:





For those interested in studying this installation up close, I'll have the Shay at Cabin Fever next week and will keep it out on the table so it will be easy to look at.

Hopefully this tutorial has provided some food for thought and given some ideas for your next live steam project.

Replies:

Reply author: rbednarik
Replied on: 11 Jan 2008

Cliff,
Superb! I actually have a few of these to make after Cabin Fever. Tailstock die holders sure do speed up the threading process. Unfortunately, the Unimat jewelers lathes didn't come with said option...unless someone makes a 1/2" shank die holder, I'm stuck with doing it by hand....which I don't mind, but it would be quicker on the parts I have to make multiples of.

Maybe I can snag one at Cabin Fever this next week, maybe.....

Reply author: Chuck K
Replied on: 12 Jan 2008

Cliff, what size and make of lathe are you using? It looks pretty stout. Thanks.

Reply author: Dwight Ennis
Replied on: 12 Jan 2008

Thanks for the tutorial Cliff! Perfect for us budding machinists.

Can anyone recommend a Tailstock die holder for a Sherline lathe?

Reply author: Gary Armitstead
Replied on: 12 Jan 2008

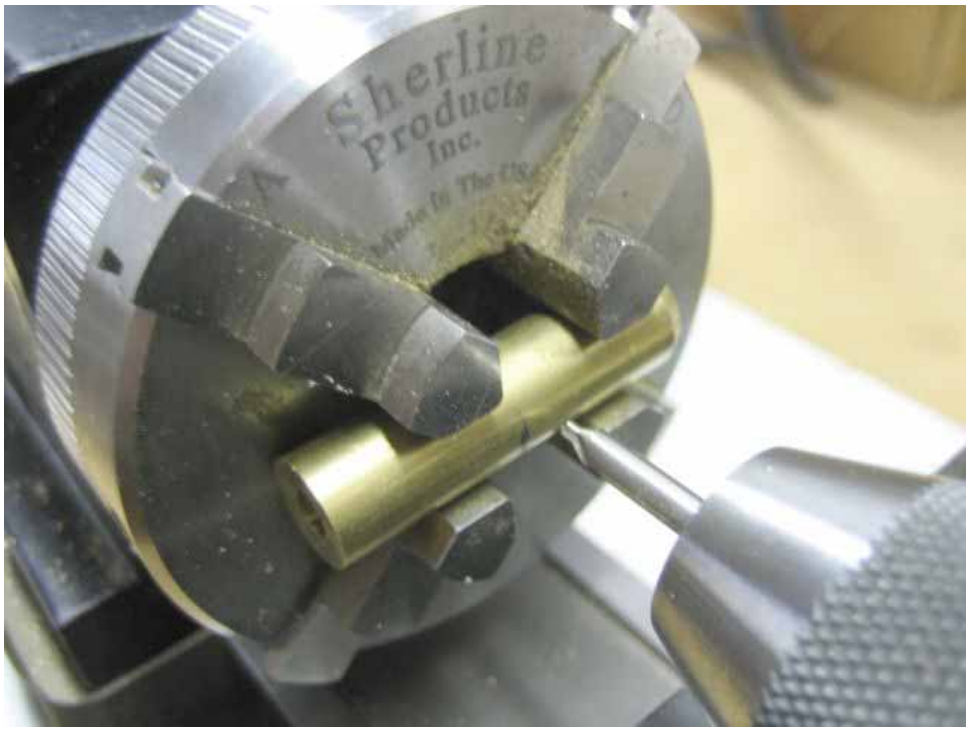
Dwight
I ran across this Sherline tailstock die holder this morning. Don't know if it is what you are looking for.

http://www.sherline.com/1206pg.htm

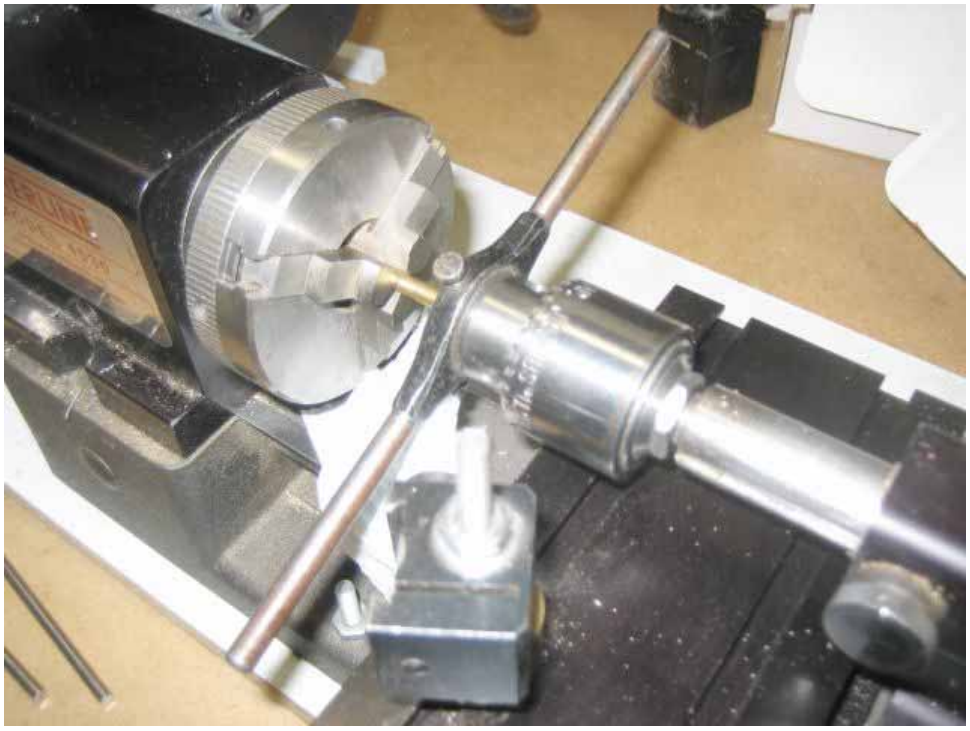
Reply author: HMeinhold
Replied on: 12 Jan 2008

Cliff,
thanks for the tutorial. Here my (additional?) 2 cents

I found, that the much neglected self centering 4 jaw chuck is ideal for cross-drilling (round/square/hex):



For thread cutting in the lathe I use the drill chuck to steady the die. I learned this trick many years ago during an internship.



Reply author: modlmkr
Replied on: 12 Jan 2008

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Find an old taper shank drill. MT2 are easy to find, often thrown out or real cheap. Cut the drill part off, and if necessary turn the remaining part of the shank to a handy size- I used 1/2". Then turn a simple

cylinder with a 1/2" hole through it, and a larger hole in the end to hold the die. I made mine about 1 1/2" dia, maybe 3" long. I cut one end to fit a 1" die, the other to fit some other size I had. The taper shank goes into the tailstock, the cylinder hold the die and simply slides on the 1/2" shank. I didn't even knurl it, I figure if the load is so great I cant hold it something is wrong and better to let is slip than break something.

Reply author: rbednarik
Replied on: 12 Jan 2008

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Never thought of doing it that way...I'm putting that on the to-do list for after the show. Many thanks for the idea! See you at CF.

Reply author: Chris Scott
Replied on: 12 Jan 2008

Last summer I was looking for a particular type of tailstock die holder and came across a nyumber of sources:

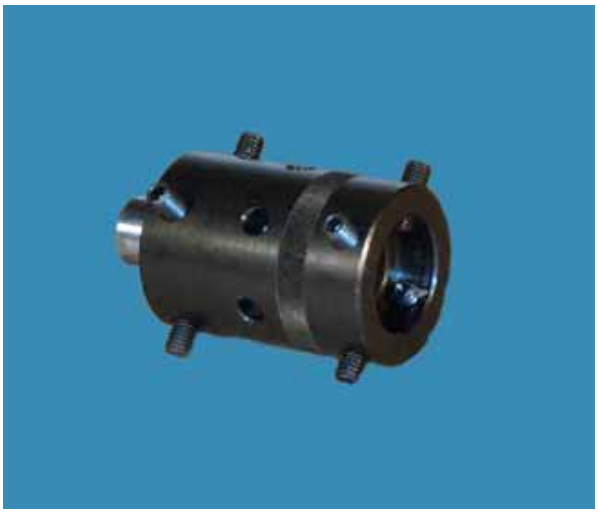
Micro Mark:
http://www.ares-server.com/Ares/Ares.asp?MerchantID=RET01229&Action=Catalog&Type=Product&ID=82774

Best but custom made:
Model Engineer's Workshop:
http://homepage.ntlworld.com/v.ford/tsdh.htm

Axminster Power Tool Centre Ltd:
http://www.axminster.co.uk/product-Axminster-Axminster-Tailstock-Die-Holder-453621.htm

Little Machine Shop:
http://www.littlemachineshop.com/products/product_view.php?ProductID=2572&category

Peatol Machine Tools:
http://homepage.ntlworld.com/tony.jeffree/accessories.html
(scroll down page)



Reply author: rbednarik
Replied on: 12 Jan 2008

Well,
Of course my mind would slip on that. All very good sites, but since I have been away from the lathe for the week, I had forgotten that the tailstock can only accept 1/4" shank fittings. I have the M12 tap/die to thread a shank nut or insert, so looks like I'll be machining some parts this winter.

Reply author: livesteam5629
Replied on: 13 Jan 2008

The Sherline tailstock is a Morris Taper zero MT0. Sherline has an adaptor for Jacobs chucks etc.

Reply author: clifforddward
Replied on: 13 Jan 2008

Lots of great additonal comments here....just goes to show there must be at least a dozen techniques for every machining job.

Ryan, since your lathe accepts 1/4" shank tooling in the tailstock it may be easiest to buy the die holder you like, then adapt the shank. The tool you obtain is unlikely to have a hardened shank, and it is a quick job to turn it down to the size you need....I can help you out with this if you don't have access to a bigger lathe. Biggest thing for you to think about is how long overall the body of the dieholder is....the bed on a unimat is pretty short, so overall length of any diestock holder you obtain is a consideration. You will want to obtain a die holder as short as possible to avoid using up precious bed length. Since the Sherline lathe is also fairly short maybe their offering would be a good place to start. After overall length main thing to think about is having the ability for the dieholder to slide along a shaft...that way everything stays lined up as the threads are cut.

Here's another photo of my diestock holder showing the separate pieces. Mine holds both 13/16" and 1" dies...nice as it covers most of the dies I use:

This one would be too long for the Unimat, but others have already posted some photos of diestock holders that would be sized OK for your needs.

Let's talk at Cabin Fever...I am certain you will be able to locate a die holder to fit your lathe, maybe even without modification.

Reply author: clifforddward
Replied on: 13 Jan 2008

Hi Chuck:
I have a 9" South Bend lathe in my tiny home shop which occupies a spare room in our home. Even though I am shoehorned into a tight space the advantage is that the tools are readily availble for use and I get more projects completed that way. Of course it helps having the most understanding wife on the planet as she allows me to do machine work in the house....then again she says if my shop was located elsewhere she would never see me!

Here's the lathe in my workshop:

I started out with a Chinese 7x14 Mini-Lathe....after a year or so of figuring out how to machine parts on it, I knew what I wanted in a lathe and could shop intelligently. I bought this lathe from the estate of a model engineer hobbiest....since it had never seen production work it was in like new condition. Cost more than a "rebuild project" but I have never regretted the purchase as holding fine tolerances are just a matter of a steady hand...the lathe is up to most any task I need.

Even though I used a larger lathe, as I mentioned earlier on this banjo fitting project can be done on any sized lathe...I made them before on my 7x14 mini-lathe and I am certain Ryan will be able to to the same on his Unimat.
