

## Grinding Jig for Bench Grinder

I have a bench grinder, but the tool-support is not very good. I looked around and got a few ideas from several places, and decided to make a grinding jig that was adjustable in several directions.

It was possible to drill a 12-mm hole through the base of the grinder for mounting a 12-mm steel rod to act as a pivot point for the jig. A sleeve with a sliding fit and an adjusting screw in one end is used to move the jig closer to the grinding wheel. The jig itself can be clamped in any position on the sleeve.

The upper table of the jig can be rotated 360° and clamped to the lower table. The upper table has T-slots so tool-bits can be clamped to the table.

### Materials

I started with a 27 x 42 x 58-mm piece of HRS for the holder block. I also used a couple of steel rods, one CRS 12 mm in diameter, and one HRS 20 mm in diameter. The upper table was made from a piece of 20-mm aluminium plate.

### Holder block

I should have cast the holder block, but the local foundry closed down a while ago so I made it from a piece of 27mm steel-plate from my scrap box. I used a hacksaw to cut out a suitable rectangular block. After facing the block on all cut sides I drilled a 5-mm pilot hole through, and then opened it up to 18 mm for the sleeve (see picture).

The holder block can be moved length-wise on the sleeve and locked in position.

The upper 6mm hole was drilled 5.9 mm and reamed to 6 mm.

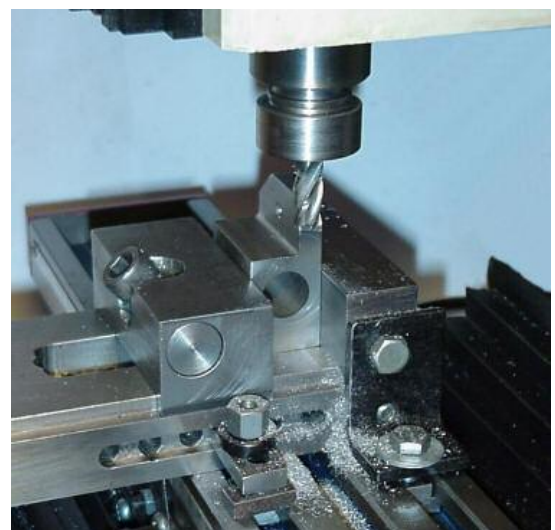
The lower hole was drilled 5 mm, then the it was drilled and reamed to 6 mm for half the length, the rest was tapped M6.

In the upper part of the holder block, a piece was hacksawed away, and then finished in the Mini-Mill (lower right picture).



Together with a mating part from the table, this will make it possible to tilt the table.

I wanted the upper part of the holder block crescent-shaped, so I mounted the block on the rotary table. I adjusted the block so the centre of semi-circle was just above the centre of the rotary table and clamped the block to the table. Then the table was moved so the edge of the cutter was on the periphery of the semi-circle. I cut approximately 1 mm deep for each cut (left picture).



## Sleeve

The sleeve is just a steel rod I turned to a diameter of 18-mm. I drilled an 11.8-mm hole almost all the way through, and reamed it 12 mm for the pivot. The last 6 mm was drilled and tapped M12 x 1. I made a small adjusting screw to fit the tapped hole. This screw is around 15 mm long and is used to feed the jig towards the grinding wheel.

## Tables and holder

The next piece I made was the roughly triangular holder for the lower table. A piece of 10-mm steel plate was cut roughly to shape with a hacksaw, and the three sides milled in the mini-mill. On the side facing the table, a 16-mm wide and 6 mm deep cutout was milled. The cutout was milled to make room for a circular nut that will clamp the rotate-able upper table to the lower table.

In the scrap box I found a nearly round piece of 10-mm steel plate for the lower table. I drilled two 5-mm holes and countersunk them. The lower table and the triangular holder were clamped together with a small clamp so I could drill two 4.2-mm holes in the holder and tap M5. With the two parts bolted together I mounted it in the 4-jaw and turned the table to 60-mm diameter. A 5.9-mm hole was drilled in the centre of the lower table, and then reamed to 6mm.

The upper table was made from a piece of 20-mm aluminium plate, slightly larger than the lower part. A 5.9-mm hole was drilled through the centre, and reamed to 6 mm. The lower part of the upper table was turned to a diameter of 60-mm (matching the lower table); the rest was turned to a diameter of 75mm.

The table was mounted in the Mini-Mill and an oval recess was milled to receive a M6 bolt. The oval recess will prevent the hexagonal head of the M6 bolt to rotate when the nut is tightened.

The nut is 15 mm in diameter and knurled on the outside. In addition I drilled some 3-mm holes around the periphery, so the nut can be tightened with a small Tommy bar.

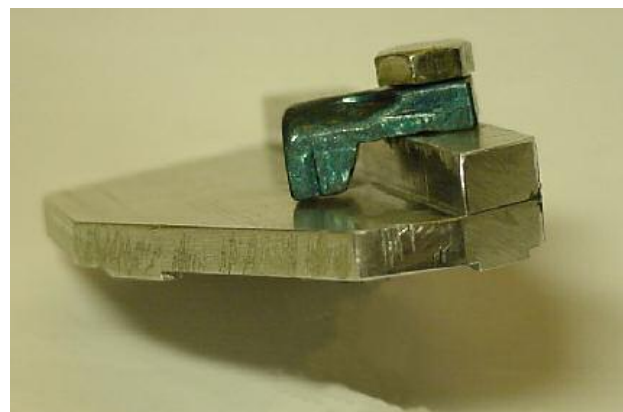
The two T-slots were marked on the upper face, equally spaced on each side of the centreline. The slots was first milled with a 6 mm slot drill (two flute) to a depth of a little over 10 mm. The cross-slide was moved a few tenths of a millimetre and a cut made to widen the slots to 6.5 mm.

To mill the T-slots I used a small cutter from my Dremel toolbox. The cutter is small so the slots had to be milled in several cuts lowering the mill-head the width of the cutter each time. To make the width of the bottom wide enough I had to move the cross-slide a bit and take several cuts again.

The picture shows the finished T-slots.

The upper table was held in the 3-jaw and 36 marks milled (i.e. 10 degrees) equally spaced around the bottom part.

To hold small tool-bits a made a small fixture (right picture) that is clamped to the upper table. The tool-bit is wedged between the blue clamp and the fixture. The bottom side has guides that will fit the T-slots.



## Drill Grinding Jig

The grinding jig has mostly been used to grind HSS tool-bits, especially bits used for threading. On [gadgetbuilder.com/](http://gadgetbuilder.com/) I found a description of drill sharpeners and collets used to hold drills for grinding. To hold the collets he used a rectangular pin vice; this makes it easy to align both sides of a drill. Since I mostly use larger drills I scaled up the collets. Ron Chernich ( [modelengineneers.org/meng/quorn/drilljig.html](http://modelengineneers.org/meng/quorn/drilljig.html)) used a collet diameter of 5/8 in. in his jig for the Quorn enabling grinding of drills up to 1/2 in. I decided to use 16-mm silver steel (drill rod) for my collets, and a 20-mm square pin vice. I modelled my collets after the information I found at Ron Chernich's site.

## Materials

I started with a piece of 20-mm thick steel plate for the pin vice and used 16-mm diameter silver steel for the collets.

## Pin vise

I started with a rusty piece of steel a little over 20-mm thick from my scrap box. I used a hacksaw to cut the piece to a width of a little over 21-mm and a length of 60 mm.

I filed one side as flat as possible and placed this side against the fixed jaw in the vise. I used a piece of steel rod both under the work piece and between the work piece and the movable jaw. This way the work piece is supported on three sides and the flat side pressed against the fixed jaw. This way the top and right side should be square after facing the top.

Next the work piece was turned 90 ° so the newly machined surface was facing the fixed jaw.

Then the new top face was milled flat (right picture).

The work piece was turned 90° again and the third side milled to 20-mm thickness.

Turning the work piece another 90 ° brought the last side to the top. The end protruded slightly from the vise so it could be faced.

After the milling operation the work piece was mounted in the 4-jaw. I used a DTI to centre the work-piece. I used a piece of wood under one jaw and measured with the DTI. Then turned the work and mandrel 90° for each measurement until the DTI varied less than 0.01 mm (right picture). The top slide was adjusted 15 ° from the centre line. First, I drilled an 11mm hole through. Then I used a small boring bar to bore the hole almost through to a sliding fit for the 16 mm silver steel. For the last part I used the top-slide to create the taper in the front. Then the rear was threaded with a 1-mm pitch.

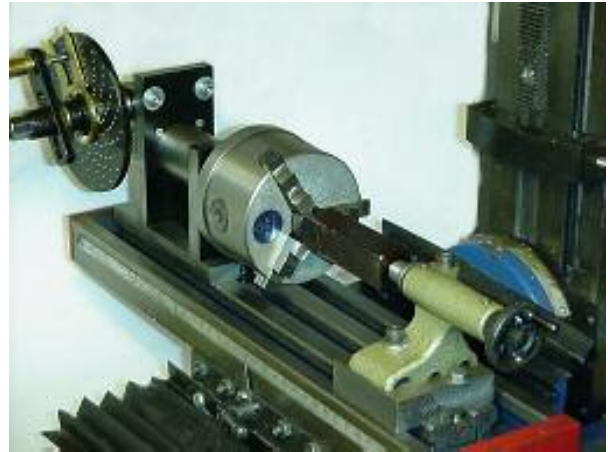
The clamping nut was made from a piece of 20-mm diameter steel rod that was chucked and faced and turned down to a diameter of 19.5-mm, then a 11-mm diameter hole drilled to a depth of around 20-mm. The outside was turned down to 16.85-mm for a length of 12-mm, and threaded with a pitch of 1-mm to match the thread in the pin vise. The nut was then knurled and parted off.

Then a piece of 16-mm diameter brass was centred in the 4-jaw and a very fine cut made so it would slide into the hole in the pin vise. The end was drilled 11-mm diameter and a taper turned with the same top slide set over as for the pin vise.



The collets are collapsed between the tapered brass piece and the taper in the front of the pin vise when you tighten the clamping nut.

To be able to register the pin vise in my grinding jig, I drilled two small 2-mm holes on opposite sides of the pin vise. This was done with a "special" collet with centre holes in the pin vise. The pin vise was mounted in the dividing head. The end with the clamping nut was gripped in the 3-jaw chuck, while the centre in the tailstock supported the other end of the pin vise. I used a square to align the side of the pin vise and used a centre drill first, then a 2-mm drill. Then the dividing head was rotated 180° and the second hole drilled the same way.



In the fixture I use for grinding lathe tool-bits I drilled a 1.6-mm hole through. The first 1.5-mm was opened up to 2-mm, the rest tapped it M2. I had a small 2-mm diameter brass rod and threaded it M2 in one end and use it to register the pin vise. The arrow points to the tiny piece of brass.

I made a clamp for clamping the pinvise to the fixture.



## Collets

The silver steel was centred using the DTI to a run out of less than 0.01-mm, and a corresponding taper turned. I did not change the position of the top-slide, so I had to run the lathe in reverse and use a short boring bar (right picture).

I used small pieces of thin aluminium as shims to avoid marking the silver steel. After turning the first taper the work was removed from the 4-jaw and the correct length (55-mm) marked before mounting it again with the unfinished part protruding a cm or so. The DTI was used again to centre the work. The work was then faced to correct length with an ordinary right hand turning tool and the lathe running in the normal direction. Then the boring tool was mounted and the taper turned as before.

Then I used a centre drill to start the hole, and then used a small diameter drill, and then larger drills and finished with a brand new drill of the correct size for the hole I wanted.



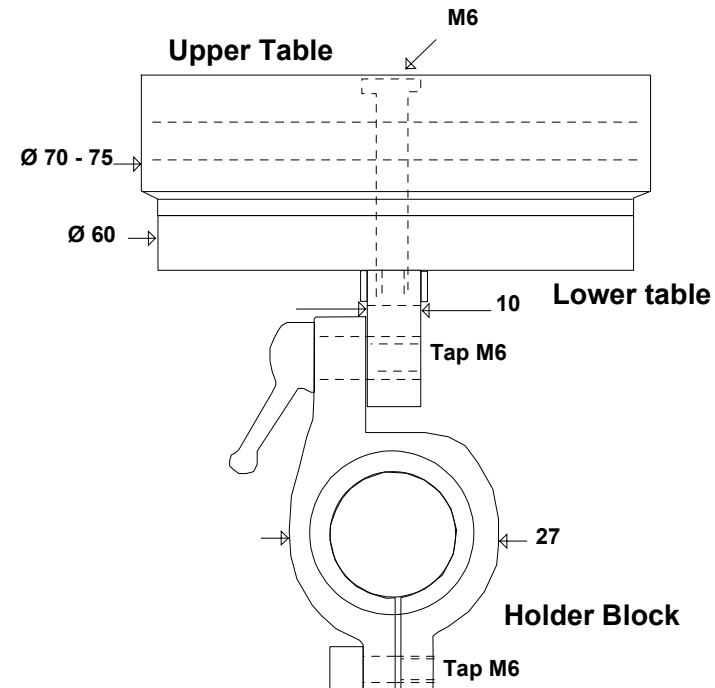
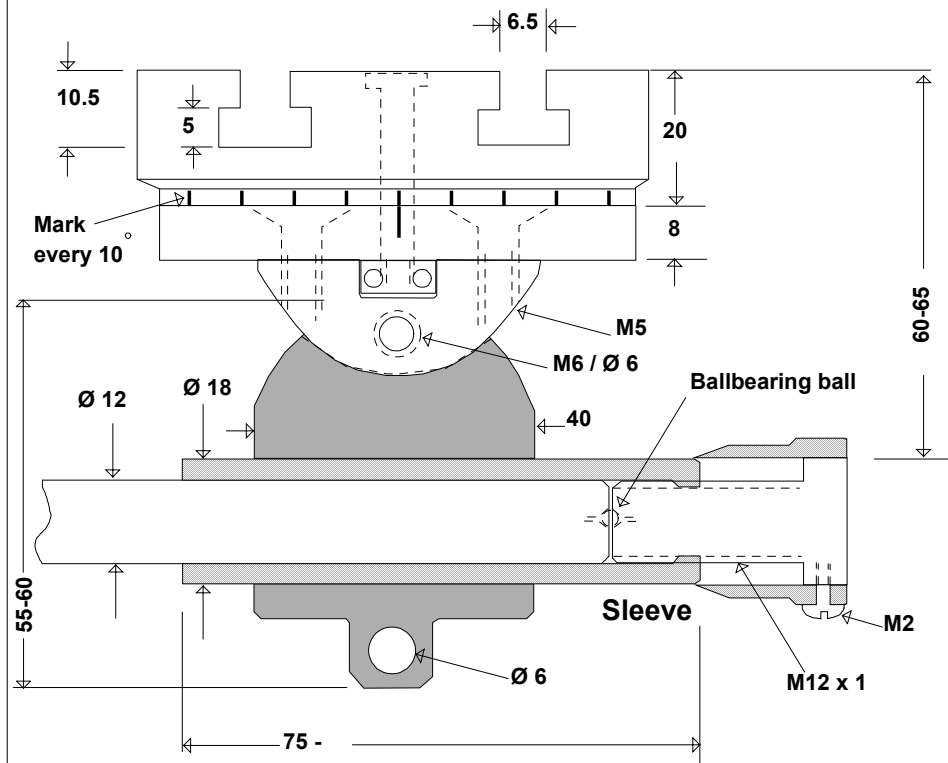
After drilling the hole the next operation is to slit the collets. I mounted the collet in a 3-jaw chuck in my dividing head for slitting the collets. I used small pieces of aluminium to protect the collet. Since only a small part of the collet is held in the chuck, I used a slow feed. After the first cut the dividing head is used to turn the collet 180° to slit the opposite side of the collet. A 90° turn for the third slitting and then 180° for the last slitting cut on this end of the collet.

The collet was then removed from the chuck and turned around. The shank of the drill used to drill the hole was inserted a short way inside the collet to prevent the clamping pressure from distorting the collet. The first slit from the other end was placed midway between the slits already cut, this makes the slits interleaved by 45°.

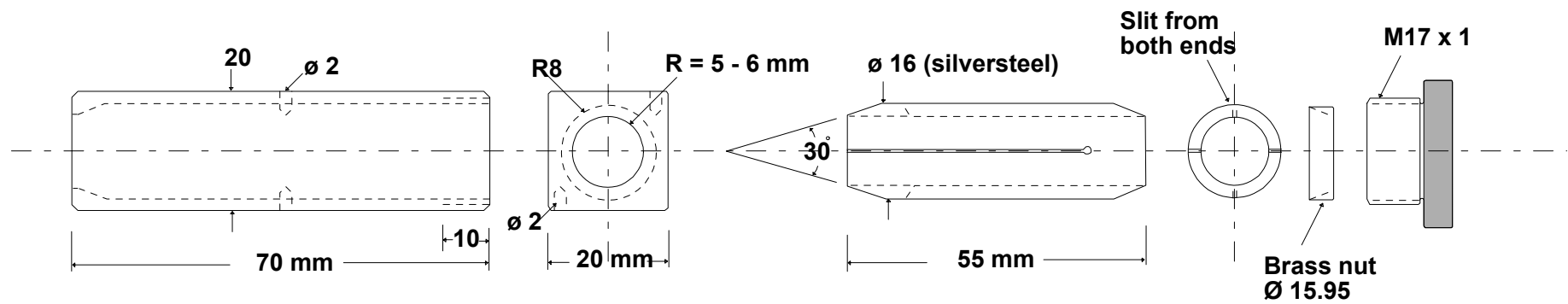



You can use a small hacksaw for the slitting process. Since the jaws of the chuck prevents the slitting saw from making the cut to the wanted length I used a hacksaw to get the slits to the length I wanted.





Dato:	Tegner	Material:	1 : 1
2004	TH		
Grinding jig for bench grinder			



Dato: 2006	Tegner T.H.	Materiale: <b>Mild Steel and silver steel</b>	
<b>Drill grindig jig</b>			