# Boring Head

I wanted a boring head, but they are a bit expensive. I searched the net and found Patrick Okeeffe's drawings of the boring head he made for the Taig. He made his boring head to fit the Taig spindle. I wanted a slightly larger boring head and found most of the dimensions at Ishimura's excellent website (http://homepage3.nifty.com). He made a nice boring head with a MT 3 shank. I made my boring head with a MT 3 shank to fit my Mini-Mill. The upper end of the boring head has a M20 x 1.5 female thread, matching the threaded lower end of the shank, this way I can make a new shank if I get a different milling machine.

## Materials

I used a piece of 50 mm diameter steel rod for the body and for the slide. For the MT 3 shank I used a piece of 25 mm diameter steel rod. I also used various other pieces from my scrapbox. I also used some Allen head screws.

## Body

The body was mounted in the 4-jaw and I used a dial indicator to centre it. Then I faced both ends as parallel as possible, to a length of 45 mm.

After facing the last end, I centre drilled and drilled a 13 mm diameter hole to a depth of 20 mm. This was opened up to 20 mm for the first 3 mm, the rest was bored to 18.5 mm. See picture to the right.

The 20 mm in diameter unthreaded part will act as a register for the shank. At the bottom of the hole a recess was turned to a diameter of 20 mm. Then I cut the female M 20 x 1.5 thread to match the shank.

I also turned a 5-mm chamfer on the body.

The body was then clamped in the milling vise and 5-mm removed from each side (see drawing at the end of this document). This will reduce the weight of the boring head, and make it easier to clamp the body in the vise.

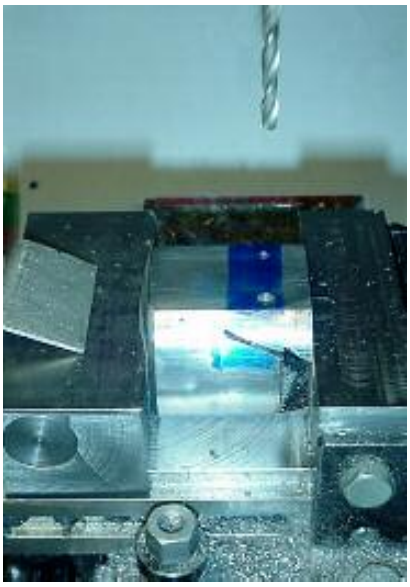
The body piece was turned around and mounted in a slightly bigger vise to mill the dovetail.
Firs I milled a 16-mm wide slot to a depth of 8-mm using an end-mill. Then I used a 60 deg. dovetail cutter to cut the dovetail. I had to take many light cuts, less than 0.5-mm for each cut.

The slide has a brass nut, and the body must have a slot for this nut. I started by drilling a 12-mm deep hole near one end of the dovetail. Then I used a 10-mm end-mill to cut the bulk of the slot to a depth of 10-mm, and a short section a little over 12-mm deep. I finished with a 4-mm end-mill to make the corners as square as possible.
Then the body was turned 90 degrees and a 20 x 20-mm flat was milled from the bottom of the dovetail towards the top. Then I drilled two 3.3-mm holes at two of the corners and threaded them M4. I used the feedscrew bearing plate as a jig for this operation. This way the feedscrew bearing plate can be attached to the body with two countersunk M4 screws.

The last operations on the body was to use a hacksaw and make a cut from the bottom of the dovetail almost to the surface, and drill and thread two holes. These holes will receive Allen head screw that will be used to clamp the body and slide together. I started with marking where I wanted the cut and used a new hacksaw blade for the cutting operation.

Before starting the cut with the hacksaw I drilled two 2-mm diameter pilot holes. The holes will guide the 4.2 mm drill for the bottom part of the hole, the upper part was opened up to 5 mm. The hole was then tapped M5.

The picture to the right shows the almost finished body, only the threading operation left to do. The hacksaw cut is clearly visible.



## Slide

The slide was made from another part of the 50 mm diameter steel rod. It was faced the same way as the body to a length of 33mm. Then a little over 5 mm was removed from each side (as the body).

Then I mounted the slide in the milling vice and milled a little over 7 mm away at each side with an 8-mm end-mill. Then the dovetail was cut with a 60º dovetail cutter. See picture to the right.

In the picture you can see a small recess at the top, it is for the feedscrew nut so it can't move or rotate. I will also use a small M3 screw to attach the feedscrew nut to the slide.

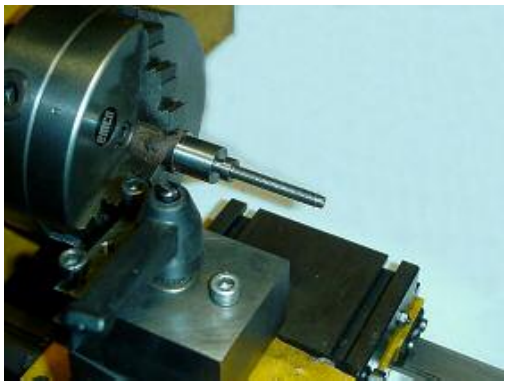
When taking the final cuts of the dovetail I frequently tested the slide and body and tried to get a sliding fit with as little clearance as possible. With a little grease on the sliding surfaces it is easy to move the slide, and just a slight turn of the two Allen screws locks the slide firmly.

After finishing the shank the boring head was mounted in the lathe spindle and the slide locked in centre position. A small pilot hole was drilled to a depth of 22 mm. The slide was moved 16 mm and the operation repeated. The slide was then removed from the body and mounted in the vise and a pilot hole was drilled at right angle to the two other holes and then opened up to a diameter of 11.8 mm. The hole was then reamed to 12 mm. The slide was mounted back on the body and locked in position and the two pilot holes opened up to 11.8 mm and reamed to 12 mm. Two 5 mm holes was drilled into the short 12 mm holes, and tapped M6 for set-screws. The set-screw for the long 12 mm hole is M8, and positioned directly opposite the recess for the feed screw nut. The hole (with a diameter of 3.2 mm) continues all the way to the recess, and is countersunk so the small screw clears the reamed hole.

## Feed screw Bearing Plate

The feed screw bearing plate was made from a piece of 3-mm brass plate, 20 x 20-mm. I drilled two 4-mm holes in two of the upper corners, and countersunk them. These holes were used as a jig to drill two 3.3-mm holes in the 20 x 20-mm flat on the body. The holes was tapped M4.

Next a 5-mm hole was drilled in the bearing plate a little over 5-mm from the bottom. I continued drilling through into the body. Then I used a 6-mm end-mill to open the hole to the bottom of the bearing plate.



## Feed Screw

The feedscrew is made from a piece of 16 mm diameter steel rod. One end was turned to a diameter of 5-mm for a length of 3-mm. From the 5 mm part the diameter increases to 6 mm for a length of 38-mm. The 6-mm portion is threaded M6 x 1.

I used a parting-off blade to cut the recess for the bearing plate.

The picture to the right shows the almost finished feed screw. What is left is to mount it in the dividing head and mill 10 equally spaced marks around the 16 mm part. After parting off the feed screw it can be mounted in the mini-mill and a small elongated recess for the head of a M4 Allen cap screw can be milled. The head is filed on each side so the head can be squeezed in. A small drop of epoxy glue will hold it in place. The head will take a hex key and the slide can be moved in relation to the body.

## Feed screw nut

The nut was made from a piece of 12 mm diameter brass rod. It was milled to 10 mm square for a length of 12 mm. This made the corners rounded fitting nicely into the recess in the slide. I just clamped the nut in place while marking the position of the hole for the retainer screw. The hole was drilled and tapped M3.

The nut was placed in the deepest part of the slot milled into the body and the slide put in place. By inserting a M3 screw through the hole for the M8 set screw I could lift the nut into position in the recess milled into the slide. With the nut in it's final position I could mount the body and slide in the mini-mill and use the hole in the bearing plate and body as a jig for drilling a 5-mm diameter hole through the feedscrew nut. By moving the slide and nut as far as it would go I drilled a short 5-mm hole in the other end of the slot. The nut was then tapped M6.

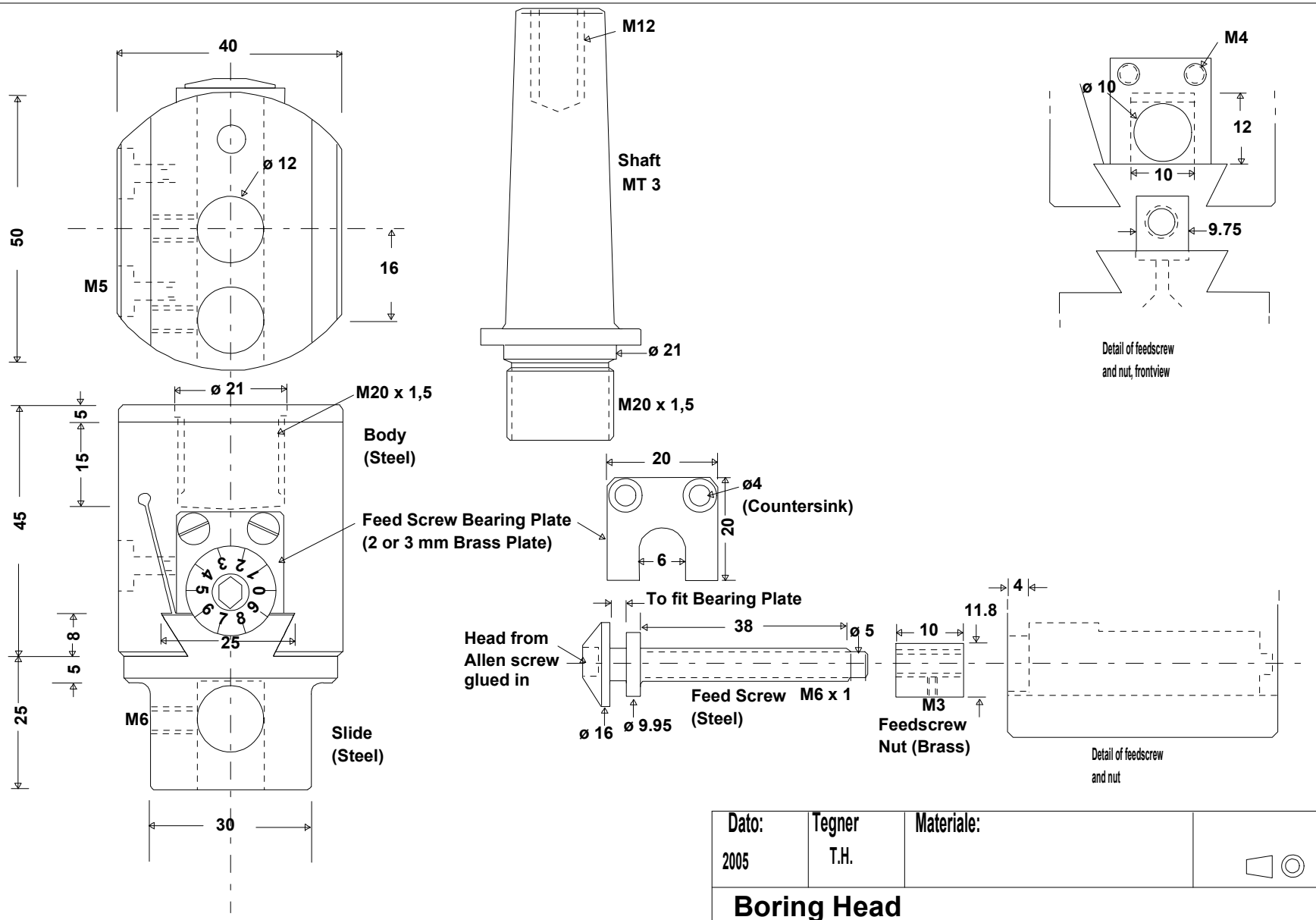
## Shank

The shank was turned from a suitable piece of 25 mm diameter steel rod, and a piece of 8-mm steel plate. I started by mounting the steel plate in the 4-jaw and turning a 22-mm diameter hole in the centre of the plate.
Then I mounted a MT 3 centre (with the rear end facing the tailstock) in the lathe chuck and centred it with the tailstock centre. Then I adjusted the topslide to move parallel to the MT 3 centre using a dial indicator. I drilled centre holes at each end of the steel rod and mounted it between centres. The MT 3 part was turned using the top slide. The opposite end was still cylindrical (25-mm). Then the shaft was chucked using the cylindrical part and a 10.2-mm hole was drilled and tapped M12 (for a draw bar).

Then the shaft was mounted in the lathe spindle hole and secured with a draw bar. Most of the cylindrical part was turned to a diameter about 0.04 to 0.05 mm over 22 mm. The shaft was put in the refrigerator and the steel plate heated to about blue colour using a gas torch. Then the shaft was put into the hole, and when both had the same temperature they stuck together. The shaft was mounted in the spindle again and the shaft turned to it's final dimensions, and the tip threaded M20 x 1, see picture above.

## Finished

I heated the body and slide with a gas torch and had some linseed oil on to make a black rust-resistant finish.

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