Building a 120mm Rotary Table

Dean Williams (www.deansphotographica.com) has a webpage describing his projects. One of them is building a 4 in. Rotary Table for his Taig Mill. Dean used a piece of hotrolled 4 in. square tubing for part of the rotary table base. I wanted a slightly larger table so I used a piece of 120mm square tube instead. This way it should be possible to mount a 100mm chuck on the table. Unfortunately, the square tube I managed to find was rather thin-walled compared with his, so I had to find another way of attaching the top of the base to the square tube. I also deviated from Dean's description in other areas, for once I made the table from two pieces bolted together.

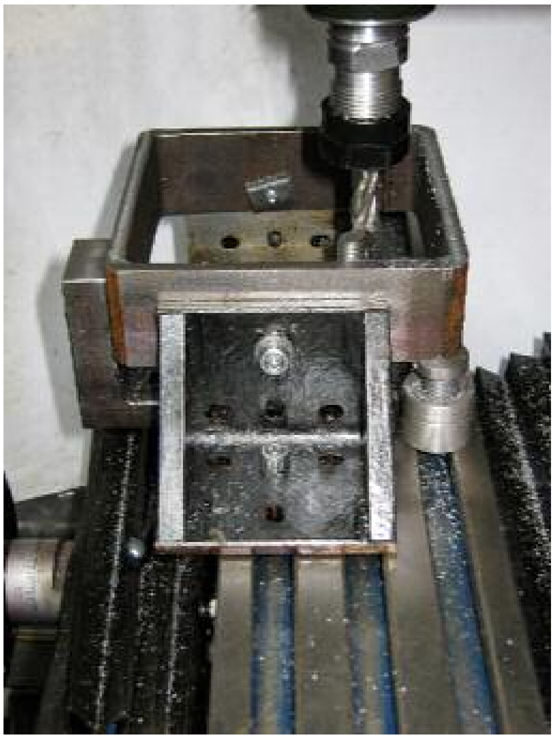
Materials

Besides the square tube I managed to get an off cut from a 120mm diameter steel rod for free, I used that to make the lower part of the table. The top of the table was hacksawed from a piece of 10mm thick steel plate. I friend gave me a piece of brass for the worm wheel and I bought a cheap ball bearing and some Allen screws. The rest was pieces from my scrap box.

Base

I started with the base, I milled the outside of the tube to get it as square as possible, I don't have any plans to mount the rotary table in the vertical position and use it as a dividing head, I already have dividing heads.

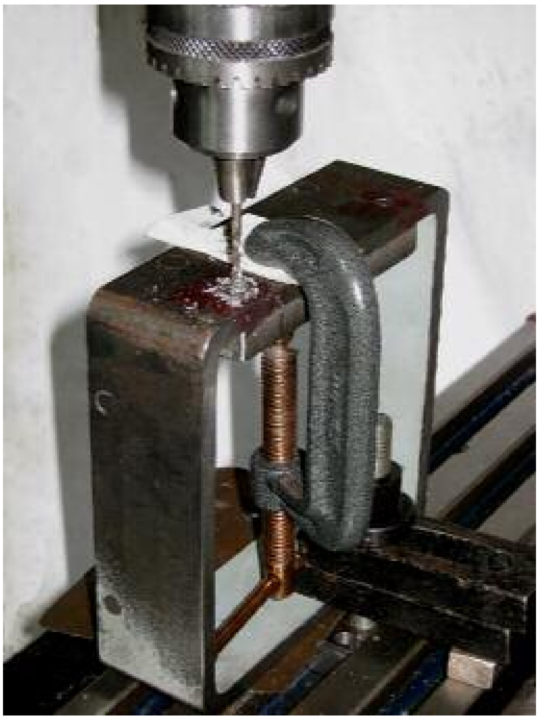
The tube was mounted on the milling machine table using three angle plates, this way the top should be square to the sides after milling – see right photo.



Since the square tube was thin walled (about 4mm) I had to screw and solder 4 pieces of steel at the top of each corner. The joints were fluxed and with the screws tight the four pieces were silver soldered (hard soldered) to the tube, just beneath the top surface.

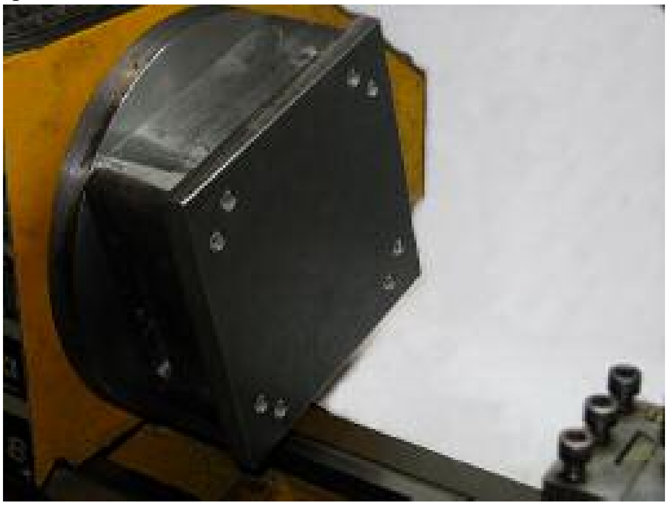
After silver soldering I could use the corner pieces to clamp the base to the faceplate – left photo. Now the

bottom could be faced parallel to the top of the square tube. The tube was now squared and the next operation was to mill a couple of slots in the lower part of two of the sides, these slots will be used for clamping the rotary table to the milling table.
To prevent swarf from entering through the slots I decided to epoxy and screw two pieces of 8mm thick steel on the inside of the tube before milling the slots – right photo.



The slots were milled with an 8mm slot drill to a depth of about 8mm – left photo.

The holes in the top of the base was marked out and the holes drilled and couterbored, the top was clamped to the square tube and the previously drilled holes used to spot the holes in the soldered corner pieces. These were drilled 3.3mm and tapped M4 – right photo.
It was now possible to clamp the bottom of the base to the lathe faceplate and take a light facing cut on the top of the square tube to get top and bottom surfaces as parallel as possible – right photo.



The next job was to mark out the centre of the top plate and clamp the base top plate to the base and take a facing cut and drill a pilot hole through the centre of the top plate. On the underside of the top plate there will be attached a piece of steel 8mm thick, all sides about 65mm long. The top plate must be turned around and the hole turned to 52mm (O.D. of ball bearing) from the bottom side, as the last 3mm of the hole in the top plate will only be about 48mm in diameter. This will prevent the ball bearing from popping through the hole in the top plate should the fit be a tad too loose. The spigot on the table has the bottom end threaded for an adjusting nut, so some preload can be applied to the ball bearing.

. The Base Top Plate was removed from the base. The Table Bearing Housing was drilled close to each corner and countersunk. A pilot hole of the same size as in the Base Top Plate was drilled at the centre of the Table Bearing Housing. The pilot hole was used to line it up with the Base Top Plate so the four clamping holes could be spotted and tapped. The assem bly was mounted on the faceplate and centred using a drill in the pilot hole and a Dial Test Indicator.

The pilot hole was opened up with larger drills, I stopped at 16mm as that is the largest drill I have with a plain shank that fits in my tailstock drill chuck. The hole was then bored through, out to a diameter of about 48mm. The bottom 15mm was then bored out to52mm so the bearing was a light press fit in the hole – see right photo.

This is how it looks after the Table Bearing Housing is finish turned and bolted and glued to the Base Top Plate and the Base assembled, with the ball bearing mounted and the inside given a coat of primer.

The hole seen in the top right part of the Base is the hole for the worm shaft.

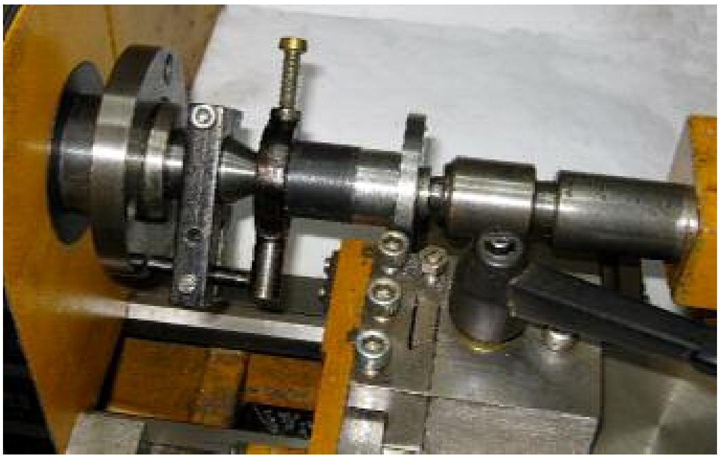
The corners of the Base Top has not been rounded yet, that was the last operation to be done on my belt sander.

Table

The table was fabricated from two parts, the bottom was an off cut from a 120mm diameter steel bar, with a 10mm thick steel plate bolted and glued on top. The "T-slots" were milled in the top part, with the future bottom facing up a slot about 15mm wide and 5mm deep was milled. The holes for the M6 screws were spotted from the lower part of the table. After the two parts and the spigot were mounted, a 10mm slot drill was used to mill the upper parts of the slots.

I started by fabricating the spigot that will be bolted and glued to the under side of the table. The spigot is made from a piece of 30mm diameter steel rod and a small piece of steel plate from my scrap box – right photo.

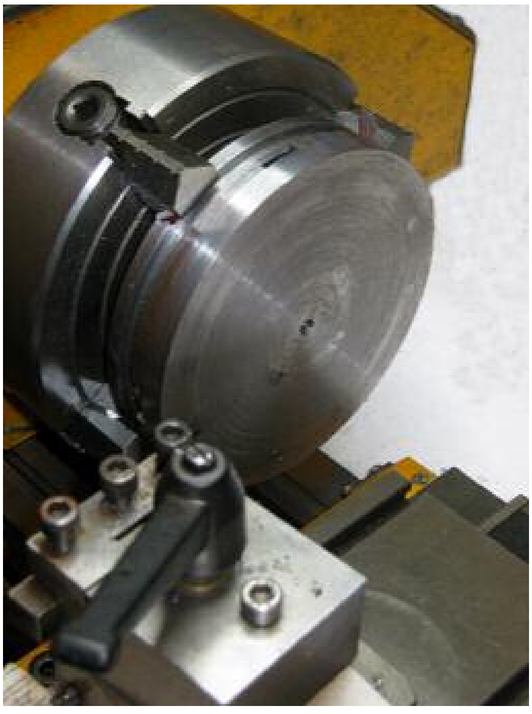
After silver soldering (brazing) and pickling the work was mounted between centres and turned slightly oversize. The flange was turned to dimension on the outside and faced to just under 5mm thick – right photo.



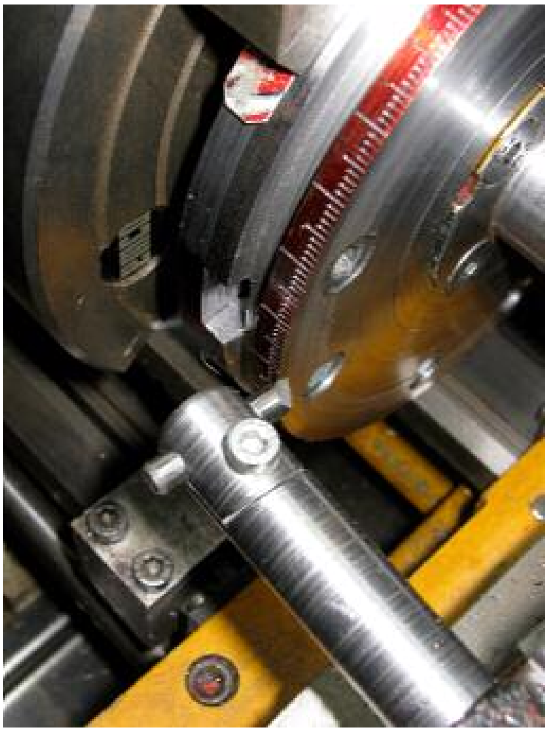
Four 6mm holes were drilled in the flange, spaced 90 deg. apart, they will later be used to spot the corresponding 5mm holes in the bottom part of the table.

The bottom part of the table was mounted in the 4-jaw and centred, one side faced. Then turned around and the other side faced and the groove was cut using a parting off tool.
After facing a recess was turned to a depth of just over 5mm so the flange of the spigot just fitted, and the four holes in the flange used to spot the 5mm holes in the table – right photo. The table was then removed from the 4-jaw and the four 5mm holes tapped M6. The 6mm holes in the spigot flange was countersunk on the spigot side.
The spigot could now be bolted to the bottom part of the table and mounted in the 4-jaw again. I had previously checked the 120mm diameter offcut used for the bottom part of the table, and it was pretty round and smooth on the outside. So after clocking it in the 4-jaw the turned part of the spigot runout was about 0.01mm. There probably is a better way of doing this, but it worked for me. The under-side of the table was given a light facing cut and the spigot turned to 25mm for a push fit in the ball bearing. The rest of the spigot not being "occupied" by the ball bearing was turned down slightly to a sliding fit in the hub that will carry the wormwheel, and slightly more at the very end where a 1.5mm pitch thread was cut for the nut that adjusts axial play.

The position of the 6mm countersunk holes were marked and drilled/countersunk, and used to spot the corresponding 5mm holes in the upper part of the table. After the two parts of the table was glued and bolted together the outside of the top part was turned to the same diameter as the bottom part of the table. The bolts were cut to a length such as they protruded about 0.5mm above the surface of the table. The top was then faced – left photo.



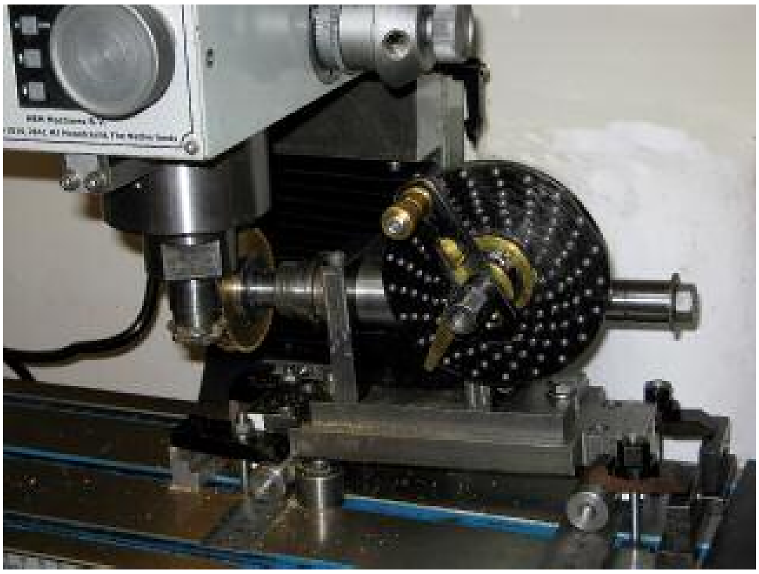
The work was reversed in the 4-jaw and I mounted my Headstock Dividing Attachment on my lathe so I could make the 360 divisions around the lower part of the table – right photo and below.



I just mounted a V shaped tool in my boring bar and used a carriage stop to get the length of the divisions correct. I marked the 36 ten degrees marks first, then the 5 degrees arks slightly shorter and so on. The result is shown in the upper left photo.
After making the clamps and the hub that carries the wormwheel and the adjustment nut I could

mount the table on the base and mount the hole on the milling machine table and mill the upper part of the T slots using a 10mm slot drill. A slot drill might not produce as accurate a slot as a slot drill, but I wanted the slot slightly wider than 10mm so I took a light cut along each side after cutting the slot. I had made a simple Pillar Tool inspired by the one George Thomas made and used that to punch the numbers – left photo.

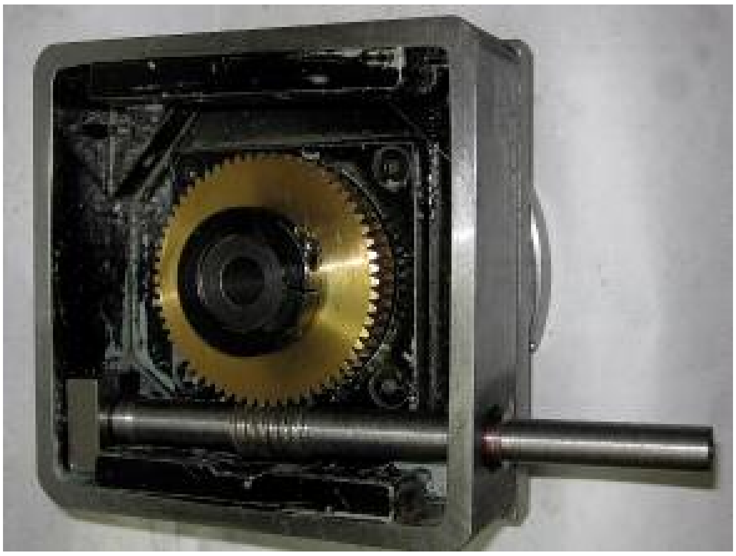
Worm and Worm wheel



The worm wheel (60 T module 1) should have been made by hobbing, I cheated and just used an ordinary home made gear cutter and plunged it into the brass disc I used to make the wheel. This doesn't produce a proper worm wheel but in my shop the Rotary Table will not see daily use so I guess it will last my lifetime.

To get the centre line of the worm wheel at 90 deg. to the centreline of the worm the teeth on the worm wheel must be angled, same angle as the worms helix angle. To achieve that I used a Sine table I made earlier and mounted my dividing head on the sine table.

Since the piece of brass used for the worm wheel on the thin side it would end up too close to the ball bearing and wouldn't leave enough room for the worm, I made a hub/spacer and mounted that together with the worm wheel to get the width needed. I also made an arbor with a MT 2 shaft so I could mount it in the dividing head – right photo.



The worm was turned from a 15mm diameter mild steel rod – right photo.

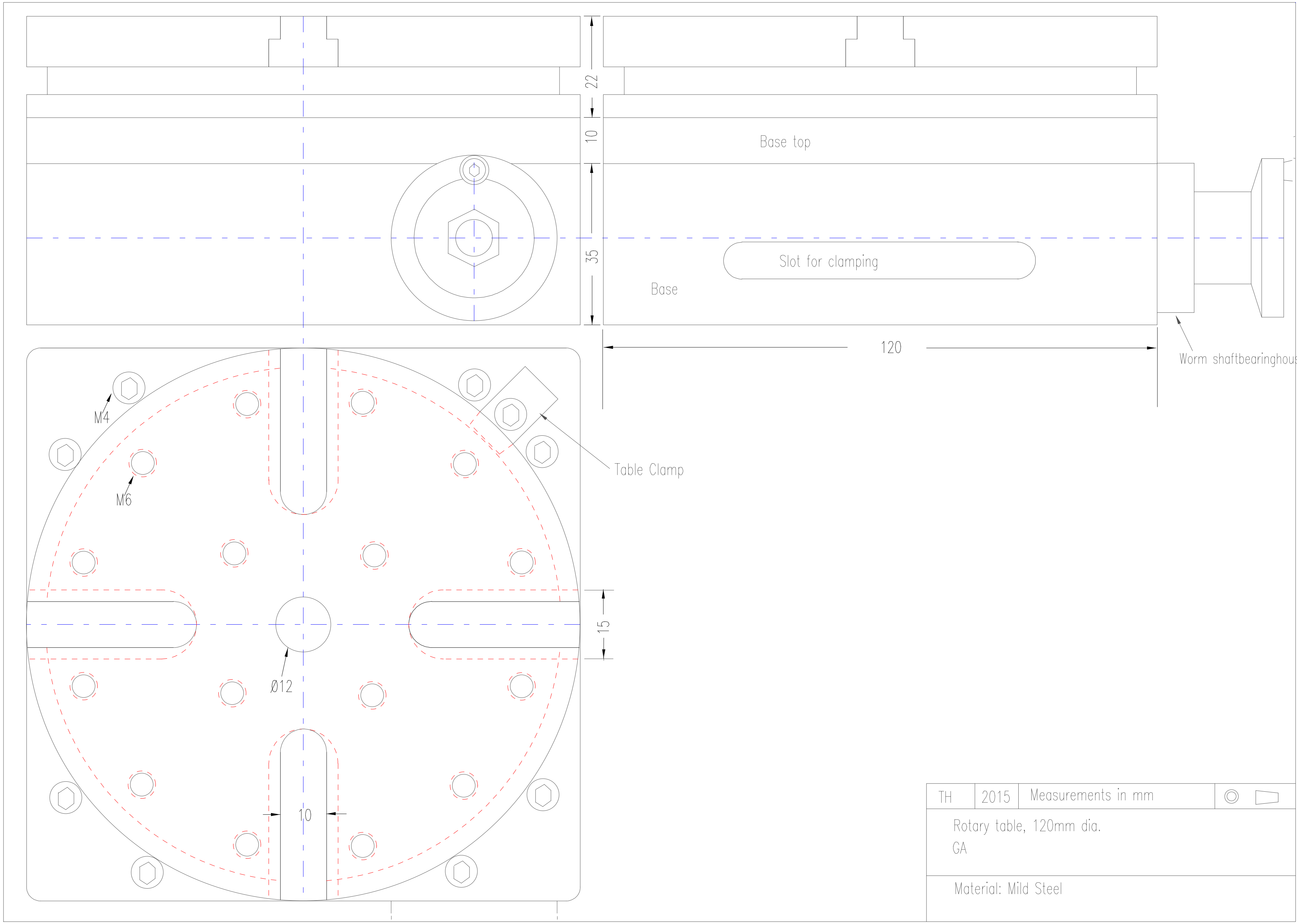
I made the worm in one piece and turned it between centres. The length was just measured out to fit the pieces from my scrap box that was used for the bearing housings. Each end is turned down to 10mm, to fit into the Oilite bushes.

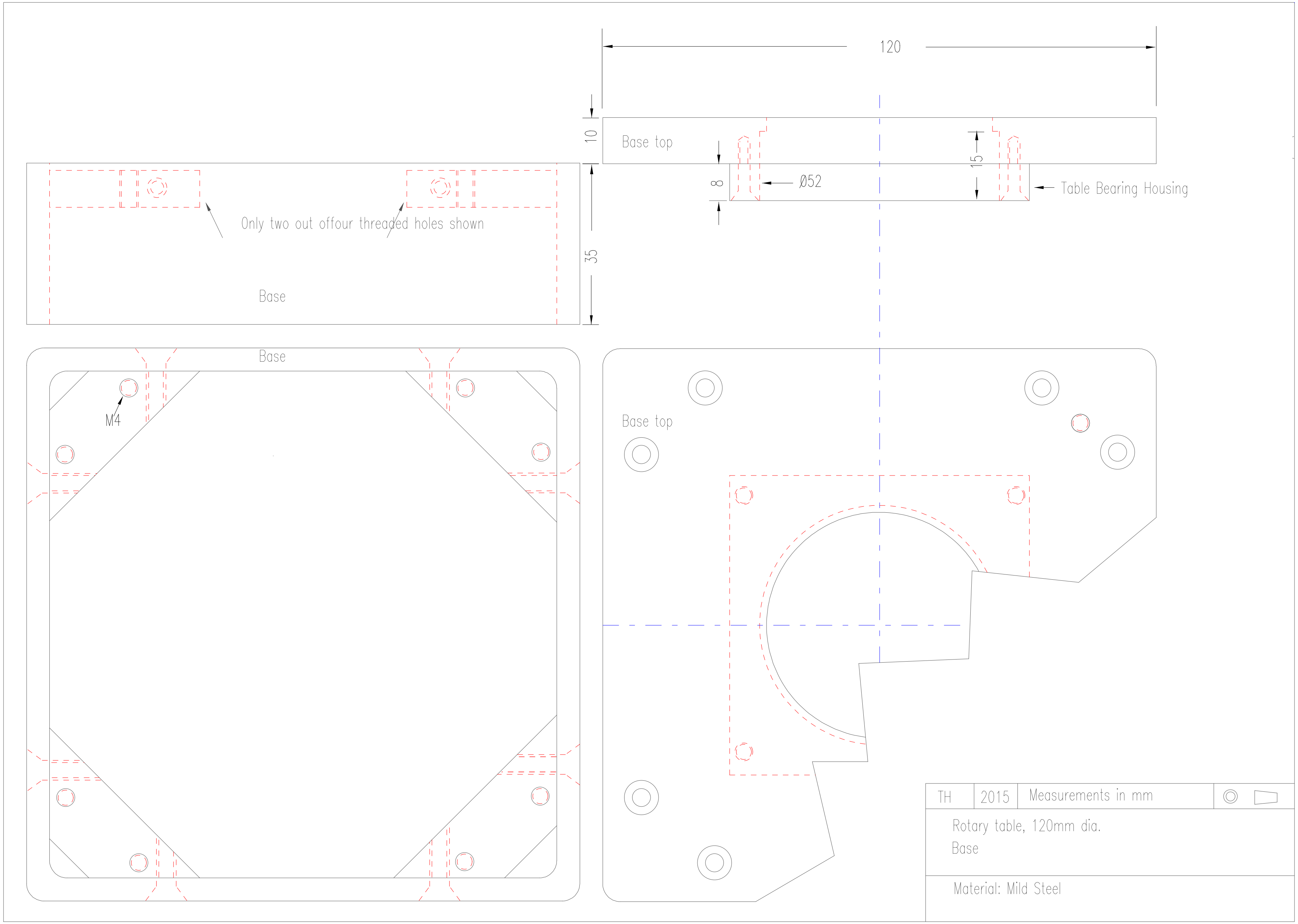
I used Oilite bushes pressed into the steel bearing housings. I drilled oversize holes in the bearing housings and used these holes to spot the holes in the base before drilling and tapping them

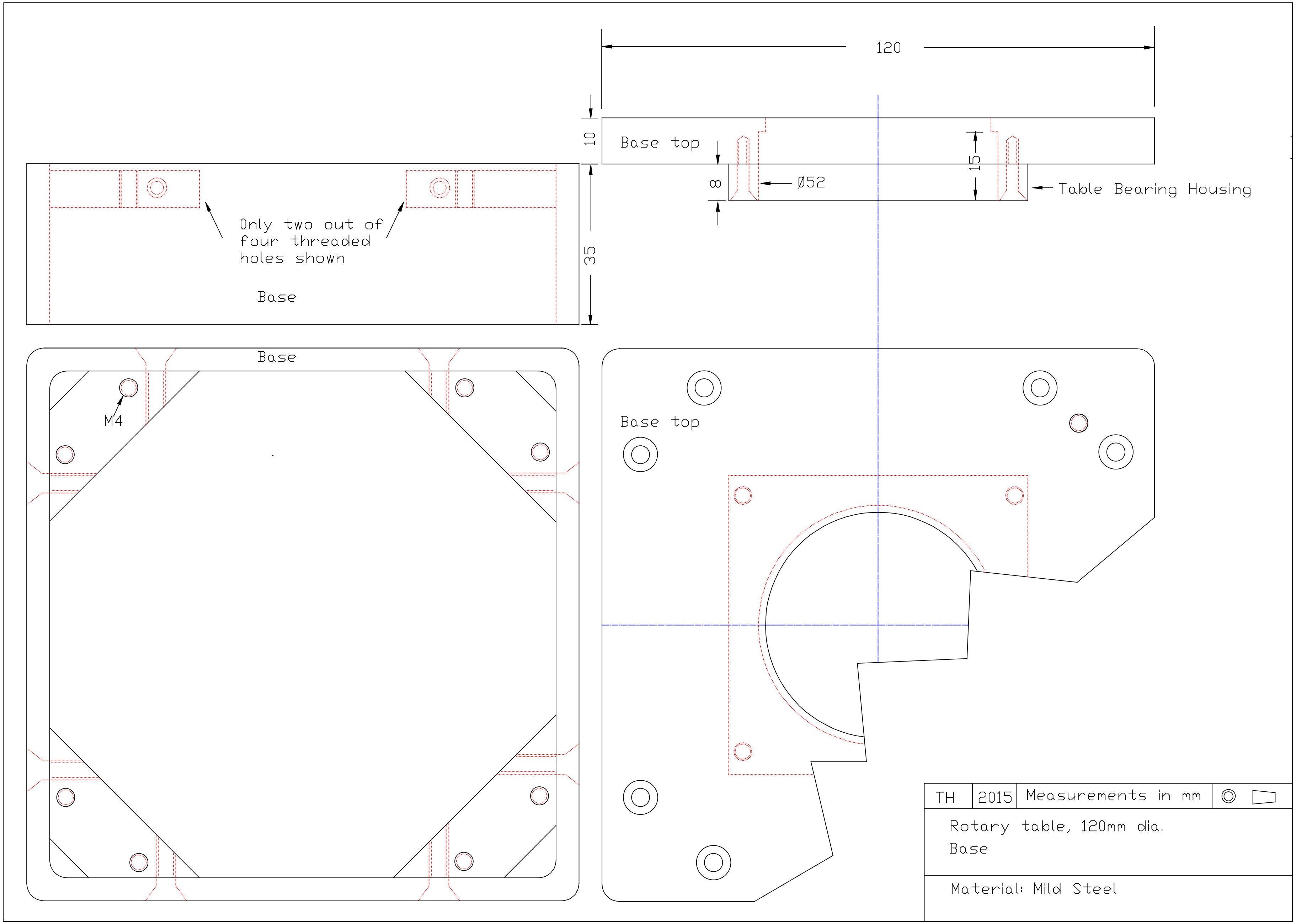
M4. Since the holes in the bearing housing are oversize it is possible to make small adjustments and take up wear in the worm and wheel.

The handwheel was turned from a piece of 40mm diameter mild steel rod from my scrap box. If I find time I might turn a sleeve to make a dial.

The finished handle, bearing housings, worm and worm wheel.


22
10
35
Base top
Slot for clamping
Base
120
Worm shaftbearinghous
M4
M6
Table Clamp
15
Ø12
10
TH
2015
Measurements in mm
Rotary table, 120mm dia.
GA
Material: Mild Steel


120
10
Base top
15
8
Ø52
Table Bearing Housing
Only two out offour threaded holes shown
35
Base
Base
M4
Base top
TH
2015
Measurements in mm
Rotary table, 120mm dia.
Base
Material: Mild Steel


120
10
Base top
8
Ø52
15
Table Bearing Housing
Only two out of four threaded holes shown
Base
35
Base
M4
Base top
TH
2015
Measurements in mm
Rotary table, 120mm dia.
Base
Material: Mild Steel

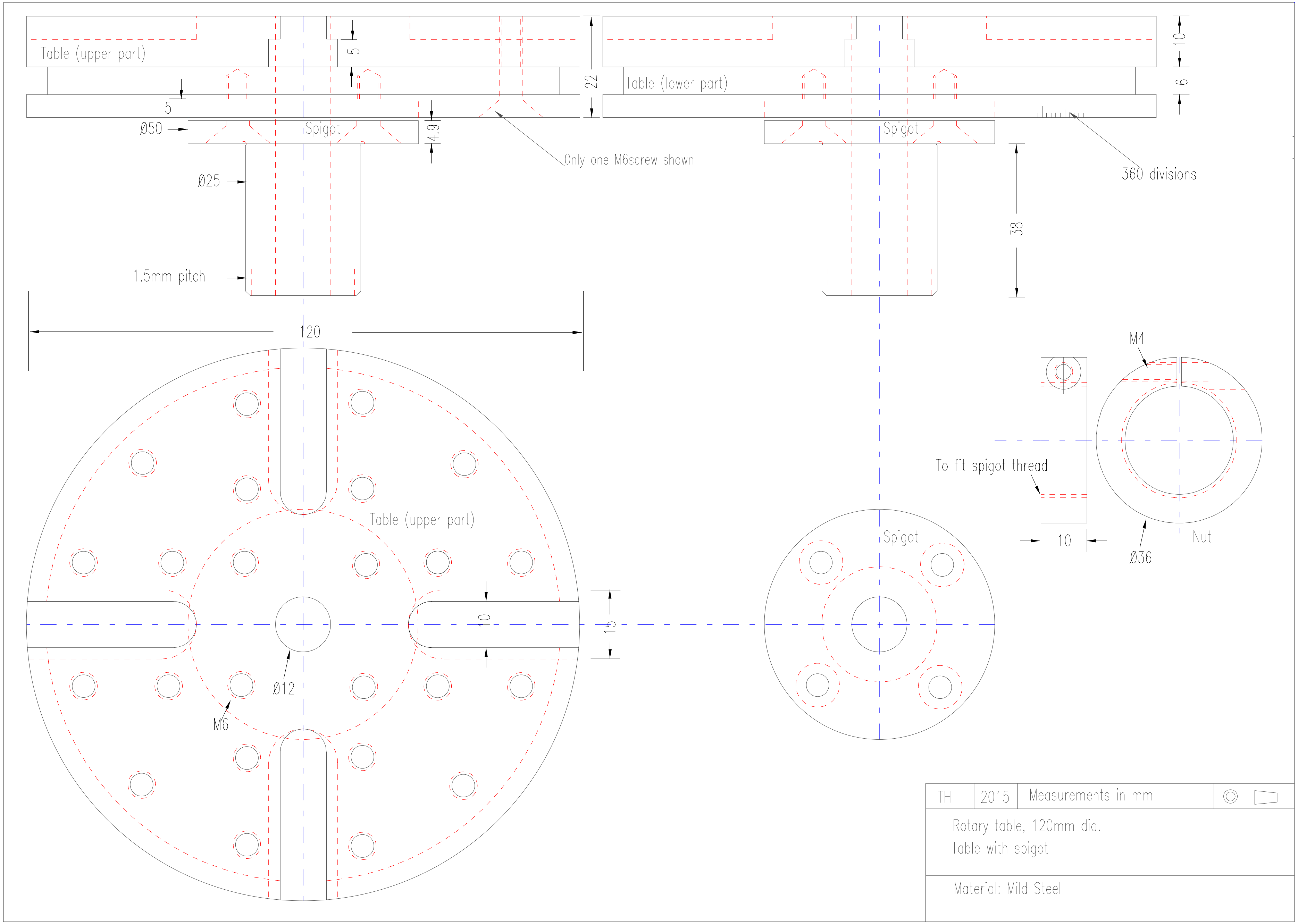


Table (upper part)
5
22
10
6
Table (lower part)
5
Ø50
Spigot
4.9
Only one M6screw shown
Spigot
360 divisions
Ø25
38
1.5mm pitch
120
M4
To fit spigot thread
Table (upper part)
Spigot
10
Nut
Ø36
10
15
Ø12
M6
TH
2015
Measurements in mm
Rotary table, 120mm dia.
Table with spigot
Material: Mild Steel

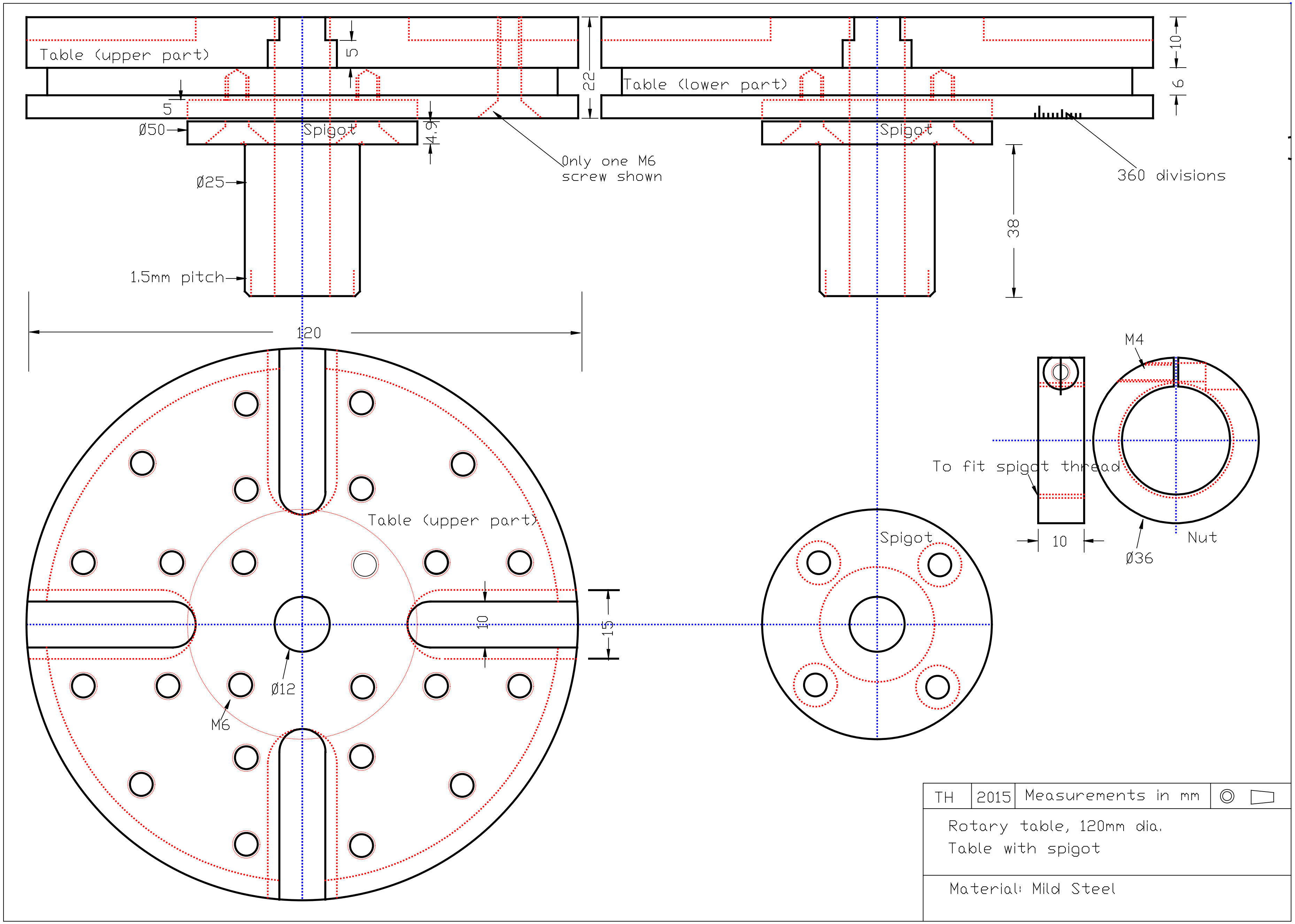


Table (upper part)
Table (lower part)
Spigot
Ø50
Ø25
1.5mm pitch
5
5
4.9
22
10
6
38
120
Only one M6 screw shown
360 divisions
M4
To fit spigot thread
10
Ø36
Nut
Ø12
M6
15
TH
2015
Measurements in mm
Rotary table, 120mm dia.
Table with spigot
Material: Mild Steel