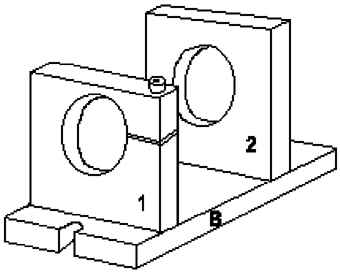
Dividing head based on Emco Unimat spindle

Tony Jeffree (www.jeffree.co.uk) describes in "A Comprehensive Dividing Capability for the Taig (Peatol) Lathe and Mill" how he uses a Taig Micro-Lathe headstock as the spindle of a dividing head. I have an old Emco Unimat that I only use as a tool grinder to sharpen toolbits and end-mills, and it is a simple operation to remove the spindle and the pulley. The spindlenose can take a small 3-jaw chuck, a small drill chuck or just a centre. There is also a tailstock with the same nose. To be able to bore the holes in the frame so they line up, I decided to give the dividing head the same centre height as the height from the crossslide to the centreline of my small lathe. The cross-slide has small T slots so it is easy to attach the frame to the slide while boring the holes for the Unimat spindle. All dimensions are metric.

Frame



The frame is made from 12 mm steel plate. It consists of three parts, a bottom part (B), and to vertical parts - 1and 2 (I later added a fourth piece between 1 & 2 to make the frame stiffer). In the bottom part, two 5 mm holes (one at each end) was drilled and tapped M6 (They were later opened to 8 mm, no thread and can be used to fasten the frame to the milling table). These tapped holes were used to fasten the bottom plate to the faceplate on the lathe using a couple of short M6 hex screws. Then the top and bottom surfaces were faced. The other parts (1 & 2) of the frame was milled square on the lower part.

The bottom plate was drilled fastened to the milling table so all holes lined up. In the bottom part I countersunk the four 6 mm holes used to screw the parts together. If you can, glue the parts together before drilling, then all holes line up (If you don't degrease the parts it should be possible to pry them loose). Use a 5 mm drill and drill through both plates and then open up to 6 mm in the bottom plate. The 5 mm holes in part 1 and 2 are tapped M6.

When the main parts of the frame are mounted, it can be moved to the lathe and the centreline of the lathe can be marked. You can just put a centre in the tailstock and scribe the lines. Make a centre punch and loosen the screws and mount each of the two frame pieces (1 & 2) in the 4-jaw chuck and bore the holes to 34 mm (1 mm less than final size).

When both pieces has been bored, the frame can be screwed together again and mounted on the crossslide. A dial test indicator can be used to align the frame with the centre line of the lathe, then the holes for the Unimat spindle can be bored out to 35 mm. This way you can make sure the spindle is parallel to the frame. See illustration. I just made a small cutter from 5 mm silver steel (drill rod), and hardened and tempered it.

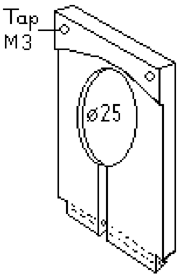
Worm drive

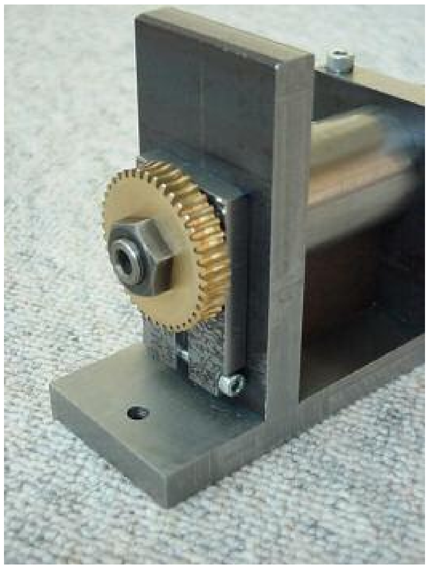
A 40 tooth worm drive can be fitted to the rear of the spindle instead of the pulley, and the spindle is then mounted in a suitable frame (drawings at the end of the document). The pulley is 18 mm thick, and fastened to the spindle with a nut. I decided to make the worm drive 9.5 mm thick, and with an additional 8.5 mm wide boss to serve as a "brake area" to lock the spindle. In this "brake area" a hole was drilled and tapped to accept M5 inhex screw (grub screw). A flat was filed on the spindle for the grub screw. The worm wheel was made from a piece of brass rod. The brass piece was mounted in the 3-jaw chuck and turned roughly to shape. Then a 12 mm hole was drilled. This hole was then bored to

13.0 mm, to give a sliding fit on the Unimat spindle. A 4.2 mm hole wasdrilled in the boss and tapped M5. I then made a slightly tapered 13 mm diameter mandrel and mounted the brass piece on the mandrel. The mandrel was then mounted between the centres and the rest of the worm wheel was finished. Then I could move the mandrel/worm wheel to the old dividing head on the mini mill and cut the teeth.

The worm and worm shaft was turned from a piece of 18 mm steel rod. First the ends were faced and centre holes drilled, then the rod was mounted between centres and turned to shape. The next operation was to cut the thread. Then the shaft was moved to the mini mill and the flat for the handle was cut (the picture was taken after the flat was milled).

Brake shoe



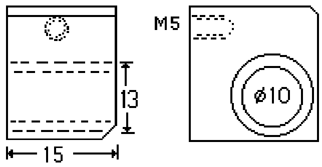


The brake shoe was made from a piece of 8 mm steel plate (35 x 55 mm). The piece was milled to shape, and then mounted in the 4-jaw chuck. On the side facing the rear part of the frame, a small (0.5 mm) recess was turned (see illustration on the left). This will give the lower part a small clearance. Then the hole for the worm wheel boss was bored to give a slightly loose fit. The brake shoe was then mounted in the drill vise and a 4 mm hole was drilled in the bottom part (dotted line in the illustration). A slot was milled from the 25 mm hole down to the bottom. A 8 x 3 mm cutout from each of the bottom corners allows the pinch bolt to be inserted in either direction through the hole. A small square nut was tapped M4, and the square cutout prevents it from turning (as Tony designed it).

In the rear part of the frame (2), two 3 mm holes was drilled to take the mounting screws for the brake shoe. The frame piece was mounted again, and the spindle, worm wheel and brake shoe fitted in place. The brake shoe was clamped onto the brake area of the worm wheel using a M4 x 30 pinch bolt. With the brake shoe in place the position for the M3 threaded holes could be marked. After drilling and tapping these holes the worm wheel and brake shoe can be mounted.

The picture shows the worm wheel and brake shoe.

Worm carrier

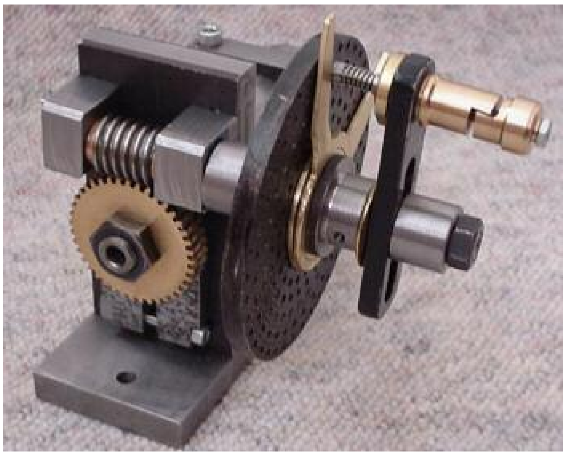


The worm carrier was made from a piece of 22 mm square steel rod, 35 mm long. A 13 mm hole was drilled through, and then I used a hacksaw to saw it into two pieces. This way the hole in both pieces lined up.

I had a small 10 mm sintered bronze bushing that I used as abearing. It was "Loctided" it to the carrier. The drawing shows the left carrier, the corner closest to the worm wheel was given a small bevel to clear the wheel.

In the rear frame (2) two 4.3 mm holes was drilled. The worm wheel was mounted and the wormshaft inserted into the bearings and clamped to the frame. The holes for the M5 screws could then be marked, and drilled and tapped. The two 4.3 mm holes in the frame was then opened to 5.5 mm, this allows the worm carrier to be adjusted.

Indexing and sector arms



The main part of the indexing arm was made from 6 mm steel plate, the detent knob from brass and the detent pin from 4 mm silver steel. I used a spring from an old ball pen.

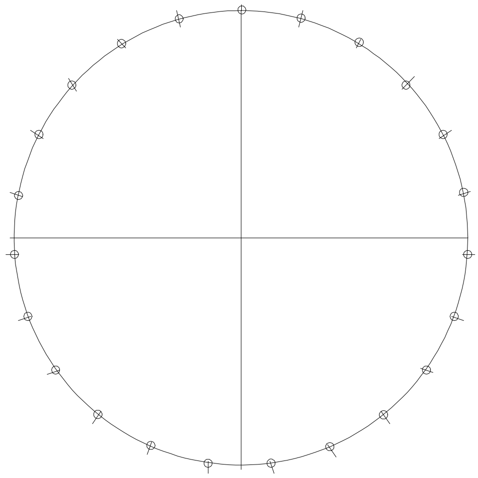
The sector arms was made from 1.5 mm brass plate, these parts are similar to Tony's design.

Division Plates

Tony explains how you can make your own division plates. If you have a drawing program or CAD program on your computer it is possible to make accurate drawings of the hole circles. These drawings can then be imported or pasted into a Word document and resized to fit the size of your division plates, and printed on paper. The paper print can then be glued onto a round piece of metal and the positions of the holes can be punched and drilled. The centre is marked as well, making it easy to drill the centre hole.

IntelliCAD 2000

Is a CAD program you could download for free from various websites. Start a new drawing and draw a cross, the length of each line should be eqaual to the diameter of your division plate. Type in the command CIRCLE, and for centre of circle type INT (and press the Enter-key), and click in the intersection of the two lines. For radius, give the radius of the hole circle you want to draw. Next draw a short line on top of one of the long lines making up the cross, from just outside the circle to just inside. The type the command CIRCLE, then type INT and click the intersection of the short line and the circle. For radius type 1, or just move the mouse a little to create a small circle (diameter around 2 mm). Click with the mouse just outside the small circle and drag around it and click hte left mouse button. This will select the small circle and line.

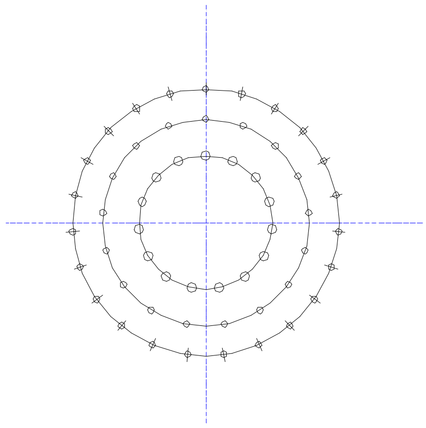


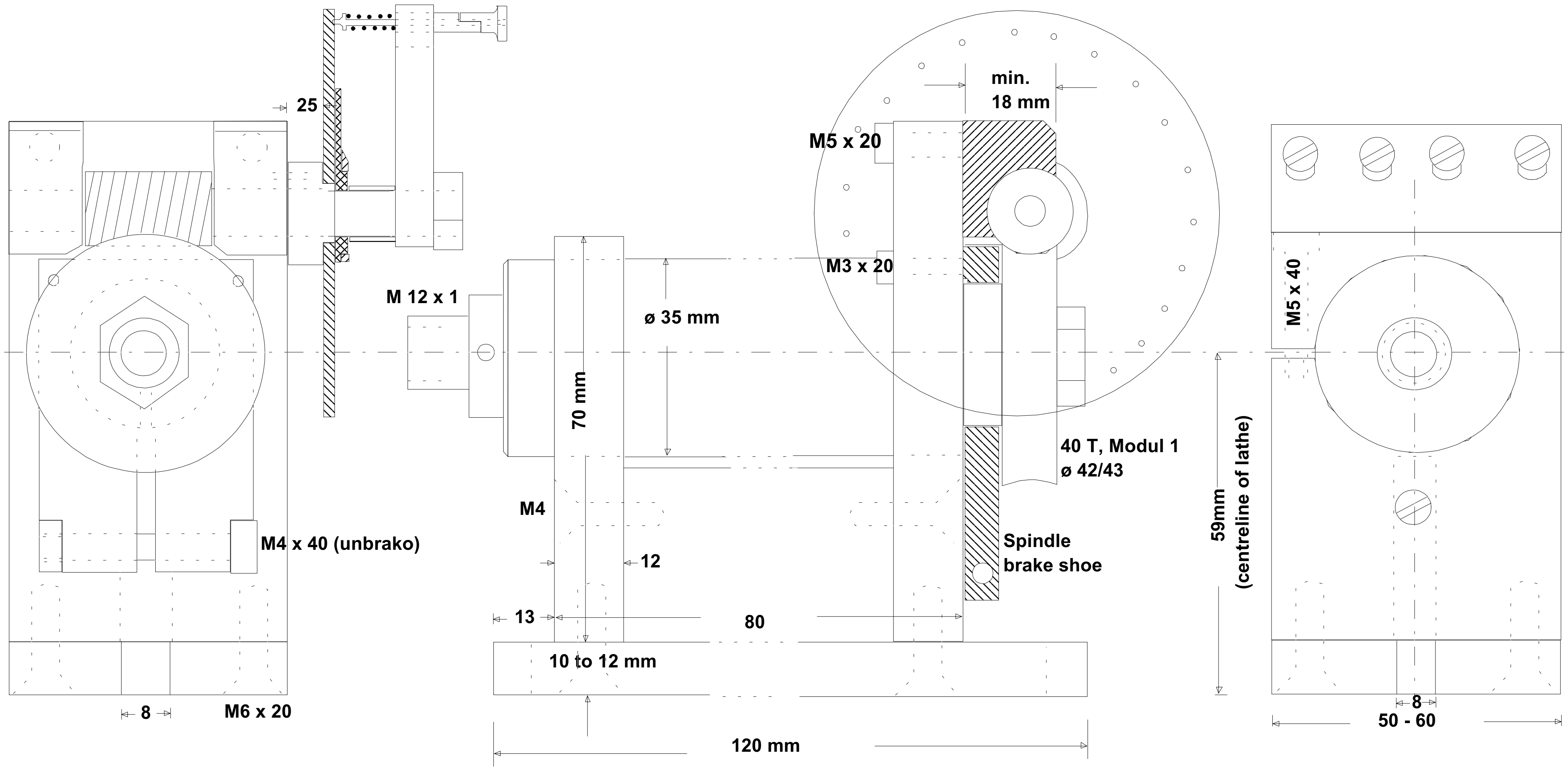
Select Modify, Array and click on Polar. For centre, type INT and click on the centre of the large circle. For number of elements, type in the number of holes, say 23 (and press the Enter-key of course). Press the Enter-key to accept the 360 degrees suggested, click Yes – Rotate entries.

I have exported the drawing as .DXF, and imported it into this document.

Autocad rel. 12

In Autocad , start by drawing a cross (blue lines in example drawing).
Then give the command:
CIRCLE
As centrepoint write: INT
And click on the intersection of the two blue lines. For Radius you can type in the radius, or just move the mouse pointer and click when the circle is the right size for your hole circle.
Now repeat the circle command, but use the intersection of the upper part of the circle and the blue line as the INTersection that defines the centre of the new circle. Give the new circle a small radius (1 or two millimetres). You can draw a small line just through the small circle. Drag the mouse pointer around the small circle (and short line) and click so it becomes selected.
From the menu select: Construct, Array
Select Polar array (P).
Select INTersection of the two blue lines as the centre of the Polar array.
Type in the number of items – 23 (and 360 i.e. full circle).





Dato:	Tegner	Materiale:
2003	T.H.	Frame: steel worm wheel, detent knob : bronse/brass

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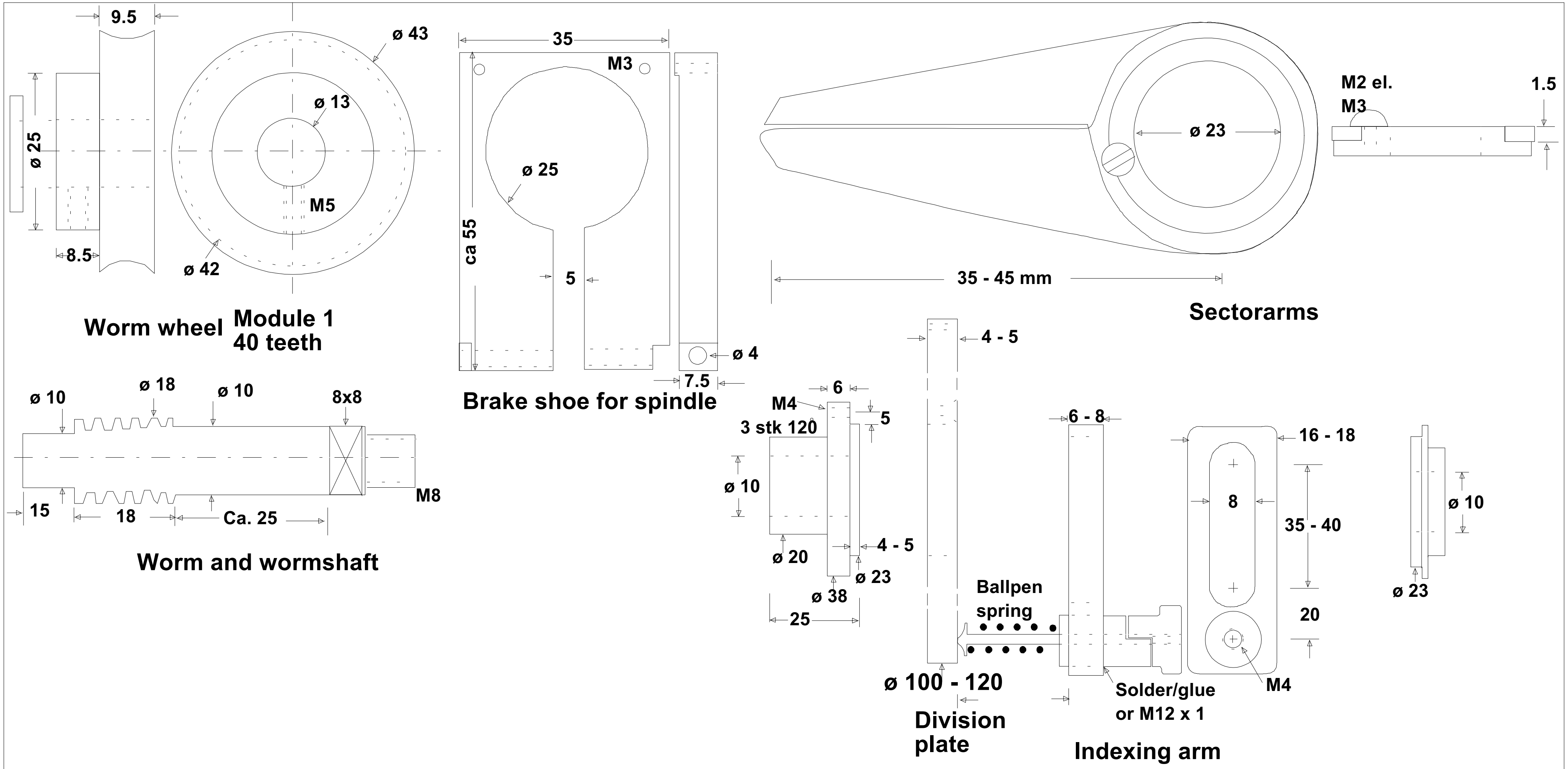

Dato:	Tegner	Materiale:
2003	T.H.	Sectorarms, worm wheel, parts of arm : brass worm wheel and shaft: steel

Details for dividing head based on Emco Unimat spindle