Using the Sherline Headstock Motor for Clock Wheel cutting.

Background

In order to cut clock wheels on a lathe it is necessary to have a method of indexing the lathe chuck to the correct number of teeth increments and once incremented it needs a cutter to profile the tooth.

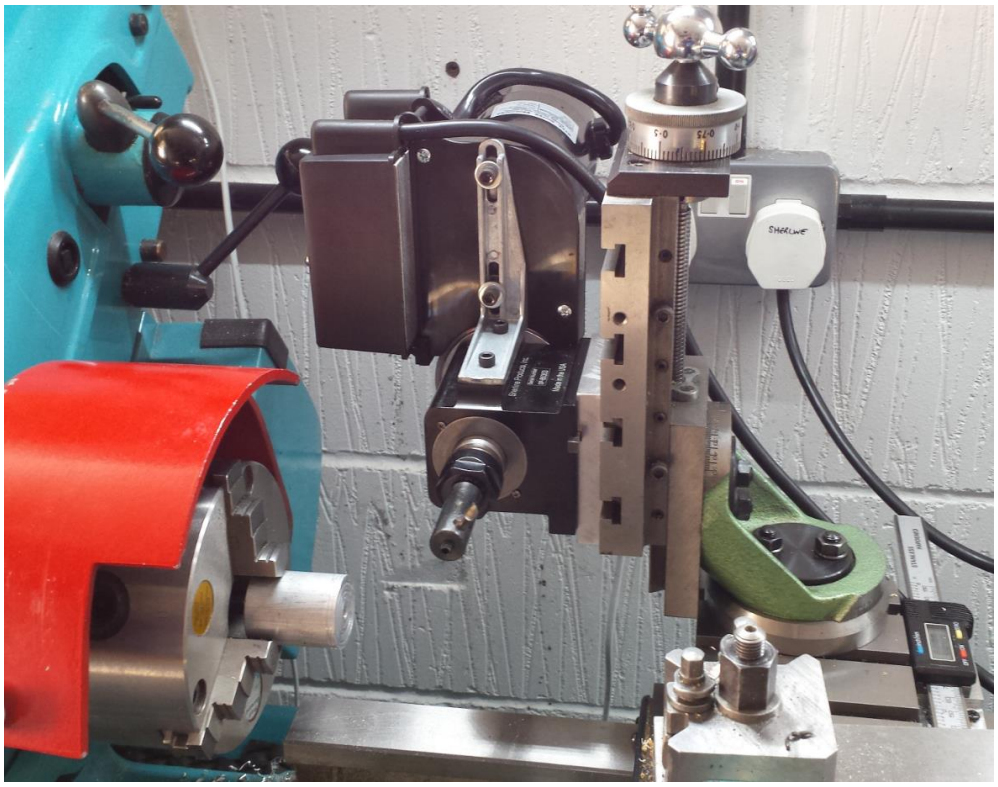
I have detailed elsewhere how the Sherline CNC Indexing Table can be mounted in the Myford lathe spindle to provide an indexing facility. I will now describe how the Sherline lathe headstock motor and spindle assembly can be mounted on a vertical slide which is in turn mounted on the Myford cross slide to provide a wheel and hole cutting facility. It should be stated that there are other methods of achieving this involving belt driven spindles but the use of the Sherline products allows one integrated assembly to sit on the vertical slide.

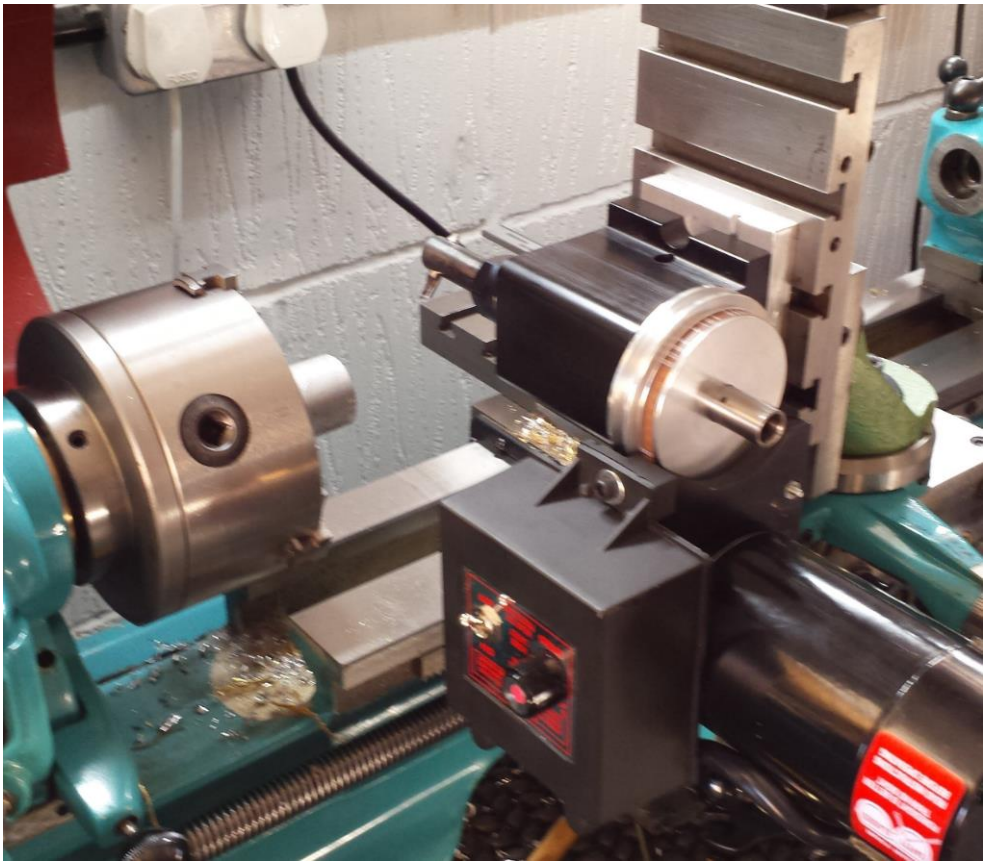
Here is a general view of the Sherline product showing the motor, the control unit and the spindle with an ER16 collet chuck.

Once again, as with the Sherline CNC rotatory table write up, I cannot claim originality for this adaptation and must honour the memory of the late William Smith who popularised the idea in his many books and videos. William Smith did not describe in detail his adaptation and I hope this write up helps others to see the advantages of his idea and the ease of adaptation.

The picture on the next page shows the motor and spindle assembly in place and the mounting block which is to be described is clearly visible between the spindle base and the vertical slide. There is a fly cutter mounted in the ER16 collet chuck.

(Note that the first picture has been artistically created to allow an unrestricted view of the general assembly when in use. In reality the motor would be mounted the other way round as clearly if used as is shown, it fouls the Myford levers before the cutter could get near the arbor being in the lathe chuck. The second image shows the usual orientation when the mounting block will need to be inverted on the vertical slide).





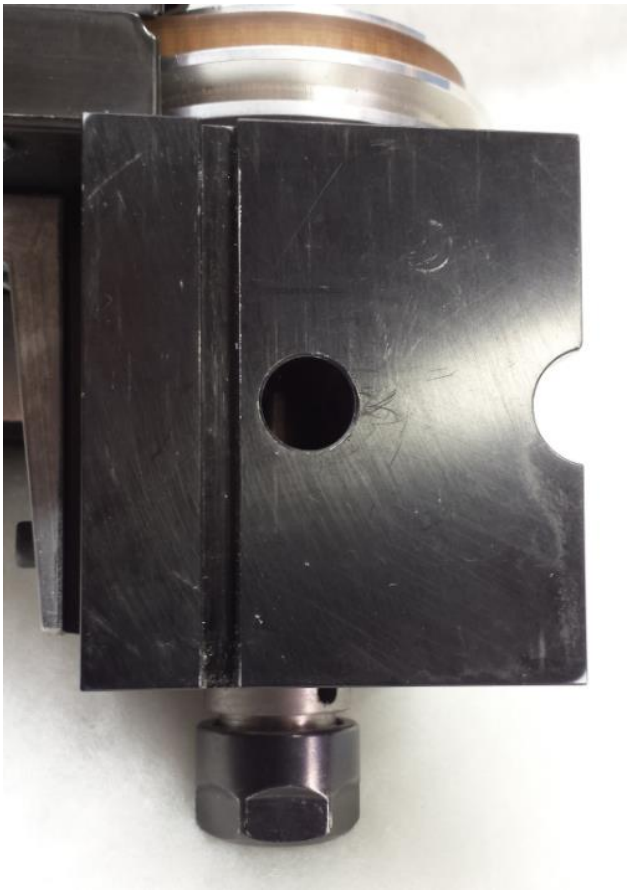
Details

Sherline offer their headstock motor and spindle and the integrated control unit in a number of versions. I opted to purchase the 3308 version with ER16 metric collet nose. The collet version would allow me to have flexibility in gripping a variety of tools and drill bits up to a diameter of 10mm.

The motor is AC mains powered and has a switch mode power supply making it suitable for both 110V and 240V operation without any changes to the wiring. The control unit cover has an ON/OFF switch and a speed adjustment control. Sherline offer a support information note for the adding of a reversing switch should this be desired. To date I have seen no need for this. Depending on which way the assembly is mounted on the vertical slide defines the motor rotation direction.

As standard the assembly comes with a 2800 RPM rating but there is a 10,000 RPM upgrade pulley set available for higher speed operation.

The base of the spindle block matches the Sherline proprietary method of mounting onto their lathe bed which has a 1/2" spigot and an associated 3/16"location slot. The mounting hole and alignment slot are clearly seen. Once in place there is a grub screw on the the spindle body that grips down onto the spigot profile.



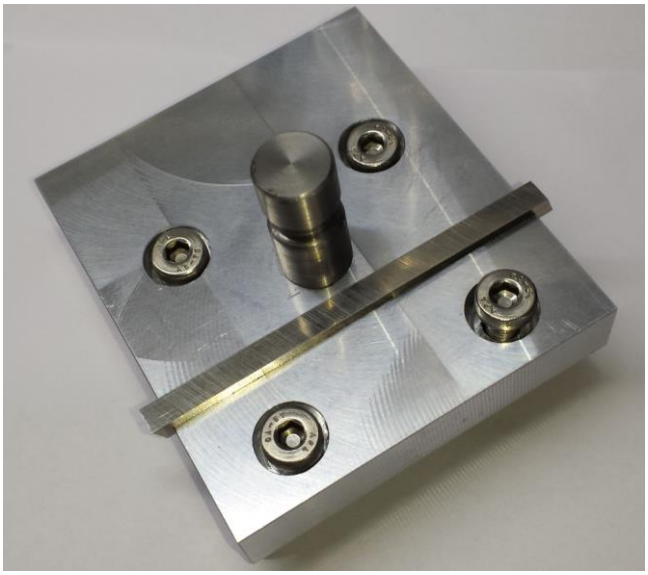
This write up details the geometry of an adapter block to allow mounting the motor on the Myford vertical slide.

Mounting Block

There are two aspects of the block to consider. First of all it must mate with the Sherline spindle block mountings and secondly it must have a matrix of holes to match the T slots in the Myford vertical slide.

The mounting block is made of aluminium and can be machined either manually or using CNC. I have a Fusion 360 drawing of the block and a CAM program for running on the Tormach machines for those interested.

Note that rather than trying to cut a raised rib on the mounting block to fit into the groove on the spindle base, I opted to cut a matching slot and to then use a length of 3/16" tool steel as a loose component that sits in the slot. The steel therefore and is half in the Sherline locating slot and half in the mounting block slot. In this manner it replaces the locating rib as normally seen on the Sherline lathe body.



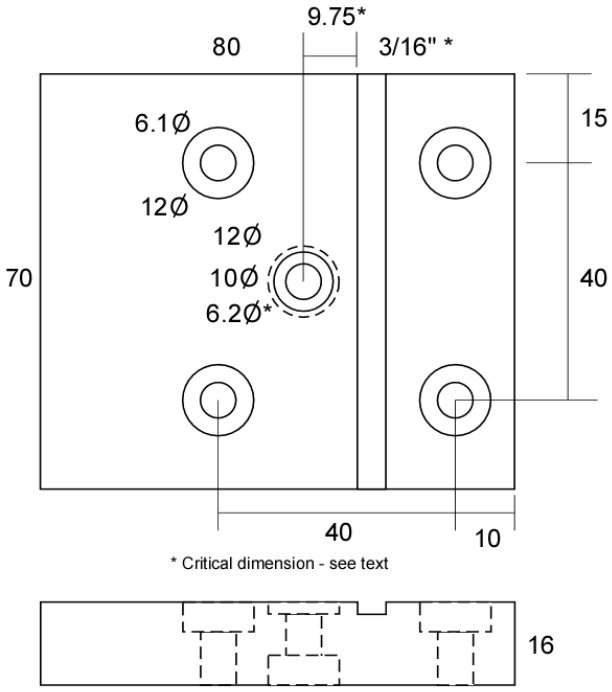
The mounting spigot is ½" in diameter and must be accurately positioned on the block to match the spacing to the slot. I opted to allow for some adjustment by making the 6mm mounting hole slightly larger on clearance and made the spigot mounting shoulder to be slightly less than the 10mm counter bore. This allows the block to be put in place on the Sherline spindle body mounting face, the tool steel slid into place in the slot and then the spigot moved back and forth before being tightened in place. Once this is done there is no need for further adjustment of the spigot position.

The slots in the Myford vertical slide are 40mm apart and for convenience I made the related T Nut holes sit on a 40mm matrix. It is important to make sure that all the top slide mounting holes are parallel with the tool steel mounting slot for the spindle body.

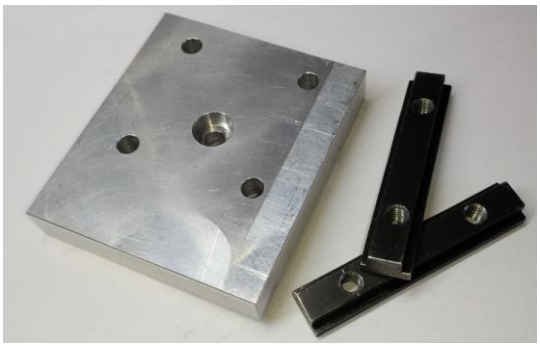
I had stock of M6 cap head screws with reduced head. This meant the counter bores could be reduced in depth to 5mm. Standard head screws are deeper than this and will require the counter bores to be increased in depth. There is enough material in the block depth (16mm) to allow for this.

A dimensioned sketch follows on the next page.

Sherline Head Mounting Block



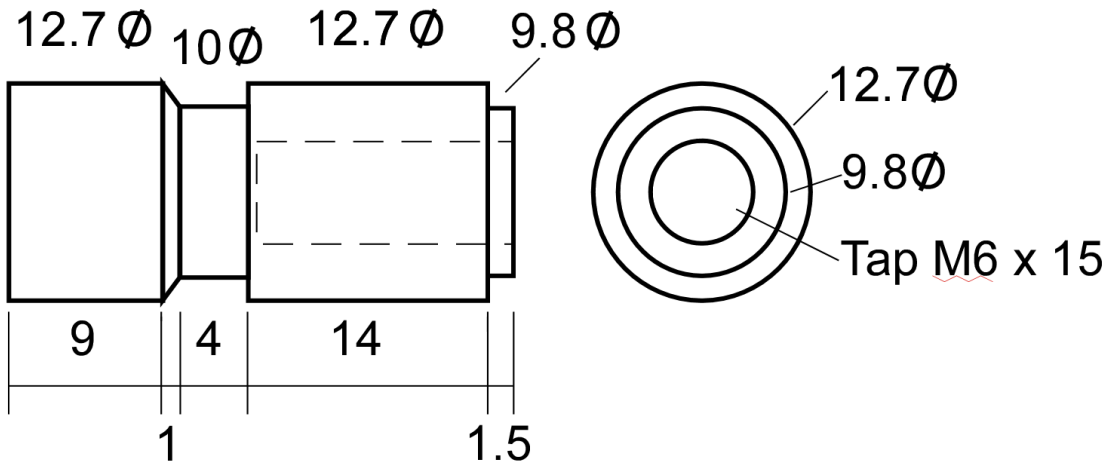
Counterbores to suit heads of screws
except mounting boss shoulder =2mm



The Mounting Spigot

The spigot is a straightforward turning operation on the lathe and can be made easier if ½" silver steel stock is used. There is nothing critical to the shaping of the grub screw groove.

Mounting Spigot



T Nuts

In addition to the block and spigot detailed above, it is will be necessary to have T nuts to match the Myford pattern vertical slide slots. These can be bought in items or can be made for purpose. I opted and recommend that these are single piece strips with two mounting M6 holes to match rather than four individual T nuts. (It is less fiddly to mount).

Mounting the Complete Assembly

1 If not already mounted, fix the spigot on the mounting block and leave slightly lose.
2 Offer the mounting block to the spindle base and position the 3/16" tool steel rod into the matching slot on the mounting block and the spindle body.
3 Once snug in place tighten the screw holding the spigot. The block is now ready for use and this operation should not need repeating.
4 Remove the mounting block from the spindle assembly and fit either four individual or two double hole T Nuts to the rear of the mounting block and slide the block in place on the Myford vertical slide. For most operations I have found the bottom two slots on the vertical slide are the most suited. Tighten down the T nuts to hold the block firmly in place.
5 The motor and spindle assembly is now re-fixed to the vertical slide using the spigot and the tool steel slot locating rod. When in snuggly in place, tighten the grub screw in the side of the spindle base to grip onto the spigot.
6 The motor is now ready to be used as a secondary cross slide mounted cutting source.
7 For most operations the vertical slide will be positioned in the first T Slot on the cross slide surface and this will necessitate the removal of the tool post. (See the second functional view on page 2). Be sure to protect the tool post mounting hole in the top slide from the ingress of swarf.

Cutting a Wheel

1 The wheel blank must be mounted in the lathe using a SuperGlue arbor or similar technique and turned to the calculated size. Do not remove the blank from the chuck until later when all the teeth have been cut.
2 An indexing method must be mounted on the lathe spindle. This could be a traditional indexing plate or it could be a more modern approach with a CNC rotary table.
3 A cutter needs to be mounted in the Sherline motor spindle collet. This could be a fly cutter cross mounted in an arbor in the motor shaft collet or it could be an Involute cutter on an arbor or a drill bit for cutting wheel arbor fastening screw holes.
4 The process of alignment and depthing can now be carried out as per normal procedures published elsewhere in various horological documents and websites.