AN INTERESTING APPROACH TO CENTRING A 4 JAW CHUCK

Introduction

One of my favourite additions to the workshop has been a laser centring tool for use on my Tormach PCNC milling machine. The tool consists of a low cost laser diode mounted on a 3D printed disc and with a 19mm steel shaft. The tool is held in the Tormach spindle power drawbar. The laser is angled inwards towards the spindle axis at approximately 20 degrees. The 3D print has facilities for a battery supply and ON/OFF switch such that when the laser disc is pulled into the power tool bar collet it switches on the diode.

In use, as the spindle is raised or lowered, the rotating diode creates a circle of light on the milling table which can be used to locate and centre the spindle on features of the item being machined. This might be to locate the centre of a hole or the centre of a block depending on need.

A full write up of the mill related item is available on the Woody's Workshop site : -

http://altrish.co.uk/laser-centring-tool-tormach-tts-power-drawbar/

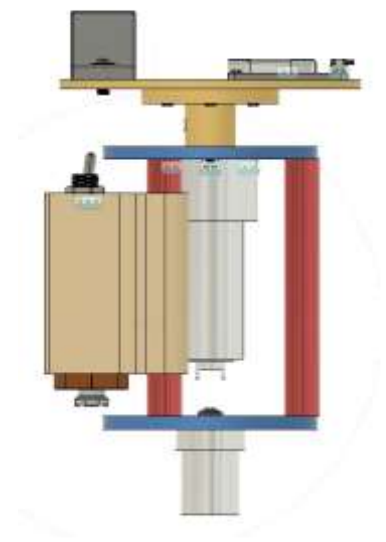
I recently had the need to use my four jaw centring chuck on my Myford lathe. Usually I duck and dive to avoid having to use the 4 jaw as I find it frustrating to set up. This recent bout of frustration lead me to wonder if I could adapt my laser centring tool for use on the lathe such that it would give me a guide ring of light to show where the material was sitting relative to chuck centre.

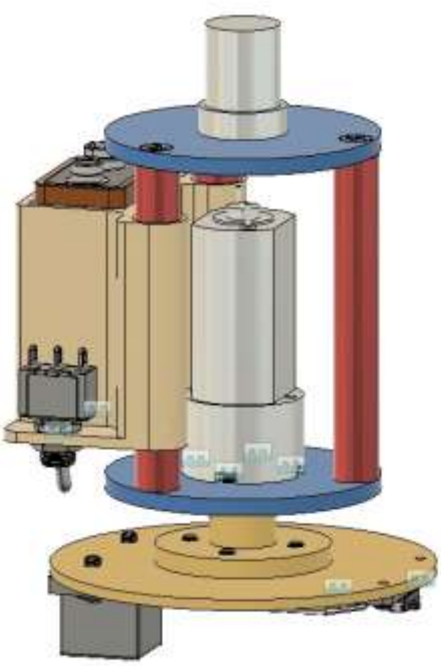
On the milling version the laser rotates and the job stays fixed. On a lathe version this would be similar. The chuck would be stationary and the laser would rotate in the tailstock.

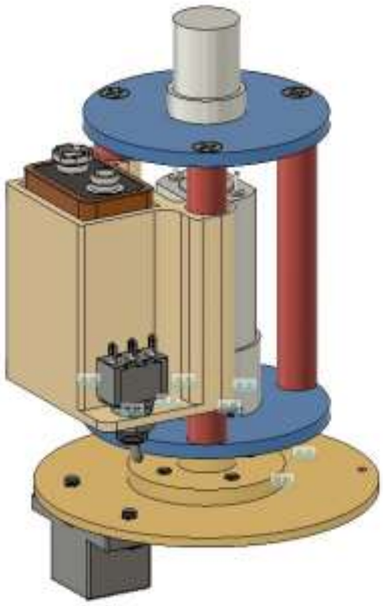
Details

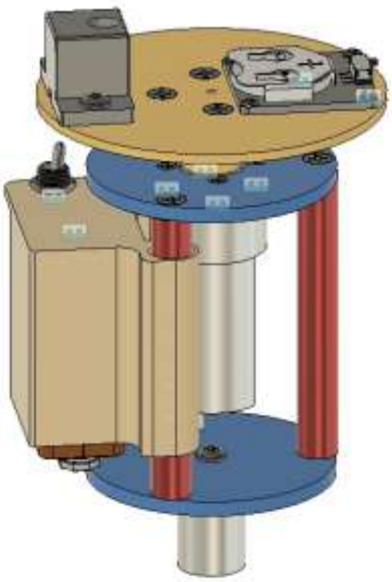
In order to get the laser to rotate I needed it to be mounted on a motor which in turn would be mounted in the tailstock. Ideally the motor should not consume too much power so it could be battery powered. I also needed the laser to be have its battery supply on the rotating disc.

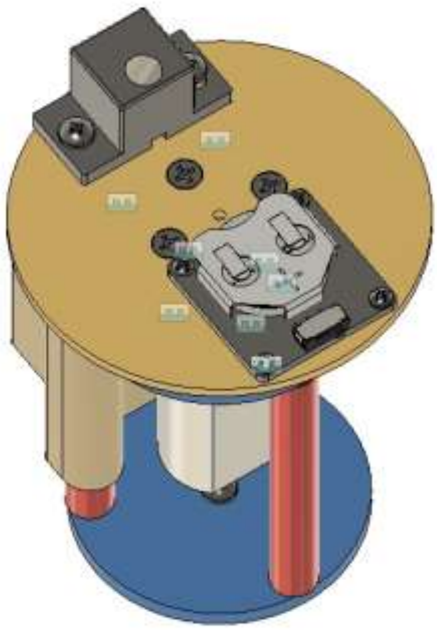
The assembly concept was modelled in Fusion 360 and screen shots follow for this. Note that I opted for using the tailstock chuck rather than a Morse taper mounting.











To facilitate mounting in the 3 jaw tailstock chuck there is a boss mounted on the back plate of the assembly. Moving forward in the drawings there are three pillars mounted on the back plate that enclose the motor. The other end of these pillars mount onto the front plate together with the motor. From experience the motor needs to rotate at over 1000 RPM in order for the eye to best integrate the light circle being created. A suitable low battery consumption motor was source from MFA COMODRILLS and this had a 4mm shaft.

The motor is powered from a 9V battery and a holder for this was 3D modelled and printed. For convenience this holder includes the ON/OFF switch for the supply to the motor. It is a slide fit onto two of the pillars.

Initially I 3D printed the laser mounted spinning plate but was not happy with its concentricity. The second version has an aluminium disc mounted on a boss. The small laser housing is 3D printed and sets the 20 degree angle. The CR2032 battery pack and switch is mounted on the plate to power the laser. The source for all these materials is given at the end of this write up.

Setup

It is important to check that the laser diode, when mounted on the disc, is beaming through the central axis of the lathe. If this is not the case then as you move the tailstock in and out the spinning red circle will never converge to a dot. Likewise if the motor assembly is not concentric with the central axis similar problems will arise.

When the whole assembly was completed the first test was to make sure the laser beam converged to a dot. Initially it was slightly out and the diode mount position had to be slightly adjusted. Elliptical slots in the 3D print allowed for this adjustment.

While the laser now converged to dot it was not at the centre line of the lathe chuck. To allow fine adjustment I changed the modelled design to have three springs on the pillar mounts. These allowed me to adjust the centralisation of the dot.

The final problem was that the low cost motor was not very tolerant of the unbalanced spinning disc. This created a slow wobble on the red laser circle. Judicious placements of weights on the disc cancelled this and gave a much more stable red laser circle.

The resulting final item is shown below. If differs from the Fusion model in that centring springs have been fitted on each of the supporting pillars. The Adafruit battery boards is not as per the modelled one but fulfils the same function with a CR2032 battery holder and miniature switch.

Use

In use the spinning diode creates a circle of red laser light that when incident on the chuck will provide a guide image to allow quicker movement of the workpiece to centre in the four jaw chuck. The chuck does not rotate. The tailstock is moved in and out to set the circle size. See the image above (yes I know it is a 3 jaw chuck but it was a good reference for checking the centring of the laser beam).

If the workpiece is non circular cross section then the laser circle is simply enlarged to be the correct size to be incident on the corners of the material. If the material is being offset from centre then the circle of light is changed to impinge on the workpiece's most eccentric peak.

Conclusion

The device is not aimed at being an absolute accurate centre finder but a simple aid to get the material 'somewhere near' centred and then accurately finished using a dial gauge or similar. Using this device in conjunction with two chuck keys working against each other across the diameter of the 4 jaw chuck makes this very quick and easy to achieve.

Parts Sourcing

Item	Description	Source	Code
1	Laser Diode (Red light, 3V operation)	EBay	Various
2	CR2032 Battery card with switch	Adafruit	#1871
3	Motor	MFA Como Drils	944D41
4	Laser mount	3D print	See Downloads page
5	9V battery holder	3D print	See Downloads page