## DREMEL BASED TIG TUNGSTEN GRINDER

### Introduction

Not being the most proficient TIG welder I sometimes dip the tungsten in the weld pool and contaminate it. This means a re-grind of the tip. I don't have a dedicated grinding wheel so the grinding process has the potential to fundamentally contaminate the tungsten from the wheel while re-grinding. This got me thinking whether I could use my Dremel with a dedicated grinding wheel that would be reserved just for tungsten grinding.

I decided that my design would be based around my most used two tungsten diameter sizes (1/16" and 1/8") and I would aim for 15°, 30° and 60° inclusive grinding angles.

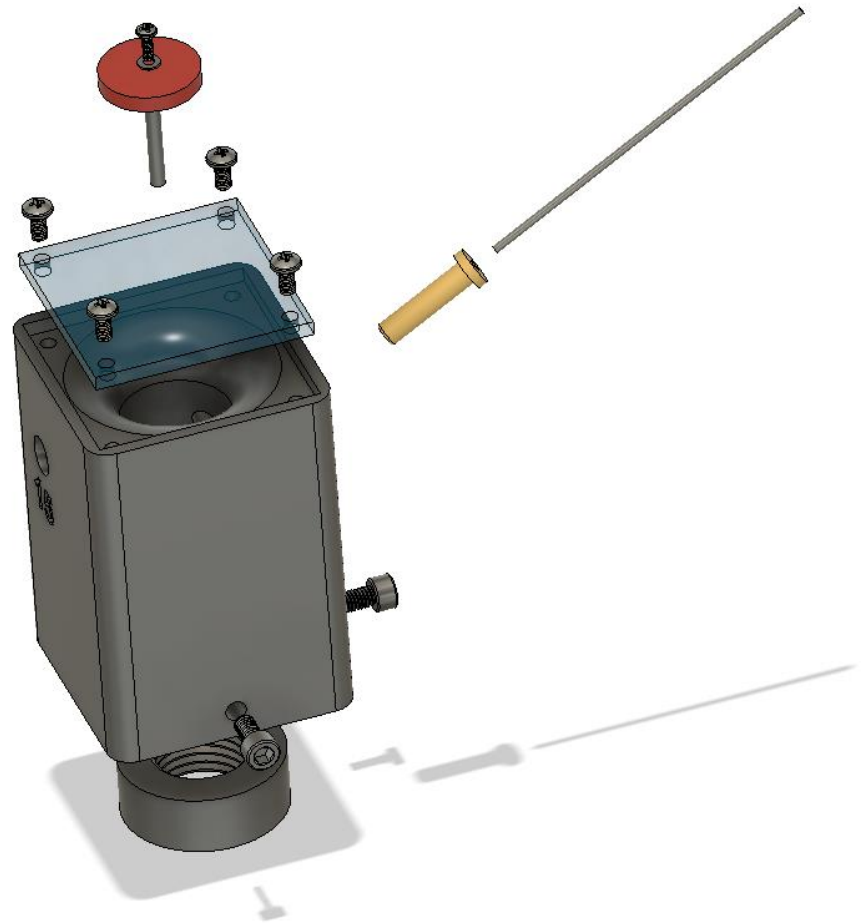
I have always been nervous about tungsten dust and even more so knowing that some tungsten materials are radioactive so my design would enclose the grinding process and a viewing window would let me see what was going on.

The design is not ideal because the recommendation for grinding tungsten is to have the grinding striations running in line back down the cone of the point and not around the point. The final result depends on the speed of the Dremel and the speed of rotation of the tungsten being ground.

After some sketching it was obvious that using a 3D printed design would ease the headache of manufacturing the angles involved correctly. This would involve the need to brush up on my school geometry.

### Construction

The body of the grinder guide is a rectangular block. This mounts onto a 3D printed adapter ring that fits onto the Dremel using the M19 x 2 thread tool mounting feature. Here is a Fusion visual.

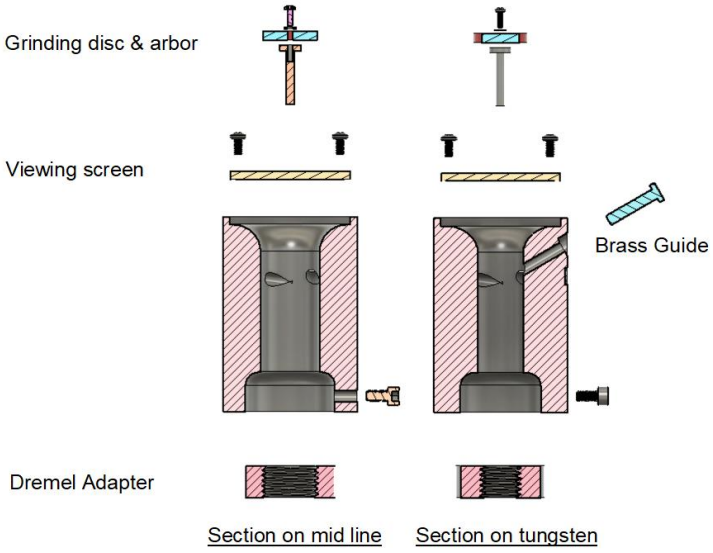


There are grinding three holes, each on a different outside wall and these are set at the three grinding angles. Their position is set relative to the face of the grinding disc. The holes are 5mm diameter and a removable brass adapter bush is used in these holes to match the diameter of the tungsten. The three holes are spaced from their adjacent parallel side wall to be 8.75mm spaced from the centre line of the grinding disc.

Inspecting the block from the bottom surface upwards, there is a section to grip the Dremel adapter, a section that is 22mm wide to be just larger in diameter than the grinding wheel and then a wide cone shaped section to give visibility of what is happening to the tungsten via a viewing window.

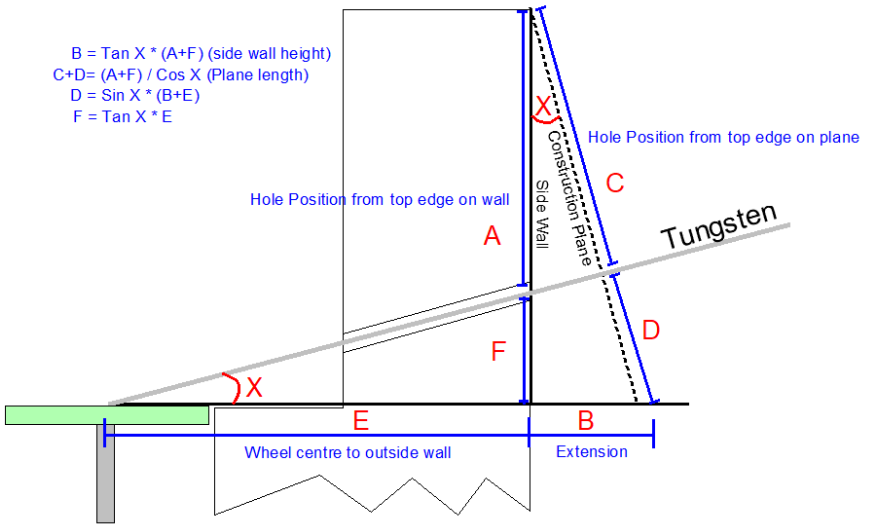
The top surface of the grinding wheel sits level with the top of the middle section. This is a critical dimension in working out the geometry. It is essential to know the distance from the grinding wheel surface to the top of the block in order to fix where the constructed plane will 'hinge'. The arbor is dimensioned to make the grinding wheel sit consistently at the same height flush with the end of the chuck on the Dremel. There are nylon grub screws to hold the device securely to the Dremel.

Here are two cross section views. The left hand one is a mid- line cross section and the right hand side view is at 8.75mm back from the centre line of the arbor to be central on the brass guide.




## Calculations

The following diagram shows the geometry involved.



A construction plane is created at the grinding angle from the top edge of the block. This correctly aligns the grinding holes. The construction plane allows the extension B to be calculated knowing the height of the block (A+F) above the top surface of the grinding wheel. This is simple to construct in Fusion using the top edge of the block as the 'hinge' point of the plane.

The length of the construction plane (C+D) is also calculated using the block height and the cosine of X.

The value of B can now be added to E (the distance from the centre line of the grinding wheel to the edge of the block). Using B+E the length D can be calculated and from this the value of C. This will be the distance down the construction plane for the hole location. This can be entered in Fusion to create the model. This can be cross checked with F on the actual side wall of the block.

There was one further consideration. As the cone point is reduced, the side length of the cone increases. This would slightly vary the ideal contact point on the grinding wheel. This was factored into the calculations but soon became immaterial.

These calculations were input to a spreadsheet to allow all the variations to be seen in a table of values. As can be seen the variations due to cone length (green shaded) become immaterial on the overall result and an average value can be taken.

The position of the holes on the constructed plane can be checked for correctness on the actual body of the block against dimension F.

**Grinding Angle Block Calculator**

| Point Angle | X | 60 | 60 | 60 | 30 | 30 | 30 | 15 | 15 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|
| Tungsten Diameter | | 1.588 | 2.381 | 3.175 | 1.588 | 2.381 | 3.175 | 1.588 | 2.381 | 3.175 |
| Half Angle | | 30 | 30 | 30 | 15 | 15 | 15 | 7.5 | 7.5 | 7.5 |
| Half Angle in Radians | | 0.524 | 0.524 | 0.524 | 0.262 | 0.262 | 0.262 | 0.131 | 0.131 | 0.131 |
| | | | | | | | | | | |
| Block Height | A + F | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| Distance from wheel centre to block exterior | E | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 |
| | | | | | | | | | | |
| Sine of Angle | | 0.500 | 0.500 | 0.500 | 0.259 | 0.259 | 0.259 | 0.131 | 0.131 | 0.131 |
| Cosine of Angle | | 0.866 | 0.866 | 0.866 | 0.966 | 0.966 | 0.966 | 0.991 | 0.991 | 0.991 |
| Tangent of Angle | | 0.577 | 0.577 | 0.577 | 0.268 | 0.268 | 0.268 | 0.132 | 0.132 | 0.132 |
| | | | | | | | | | | |
| Point cone slope half distance | | 0.794 | 1.191 | 1.588 | 1.534 | 2.300 | 3.067 | 3.042 | 4.560 | 6.081 |
| New centre point of disc | | 25.794 | 26.191 | 26.588 | 26.534 | 27.300 | 28.067 | 28.042 | 29.560 | 31.081 |
| | | | | | | | | | | |
| Height of Hole from top surface of wheel at angle | C | 20.114 | 20.312 | 20.511 | 8.601 | 8.799 | 8.998 | 4.090 | 4.288 | 4.487 |
| | | | | | | | | | | |
| Slope Length | C + D | 28.868 | 28.868 | 28.868 | 25.882 | 25.882 | 25.882 | 25.216 | 25.216 | 25.216 |
| Angle Extension to base | B | 14.434 | 14.434 | 14.434 | 6.699 | 6.699 | 6.699 | 3.291 | 3.291 | 3.291 |
| New base length | B + E | 40.228 | 40.624 | 41.021 | 33.233 | 33.999 | 34.766 | 31.333 | 32.852 | 34.372 |
| Distance up slope | D | 20.114 | 20.312 | 20.511 | 8.601 | 8.799 | 8.998 | 4.090 | 4.288 | 4.487 |
| Distance down slope | C | 8.754 | 8.555 | 8.357 | 17.281 | 17.082 | 16.884 | 21.126 | 20.928 | 20.729 |
| Distance up enclosure wall | F | 14.892 | 15.121 | 15.350 | 7.110 | 7.315 | 7.520 | 3.692 | 3.892 | 4.092 |
| Distance down enclosure wall | A | 10.108 | 9.879 | 9.650 | 17.890 | 17.685 | 17.480 | 21.308 | 21.108 | 20.908 |

## Conclusion

This has been an interesting project with a useful end result. It now means that future tip grinding can be more repeatable, reduce tungsten contamination induced by my main grinder and the resulting dust is contained for safer disposal.

For anyone wishing to emulate the construction I can make full drawings and STEP files available.