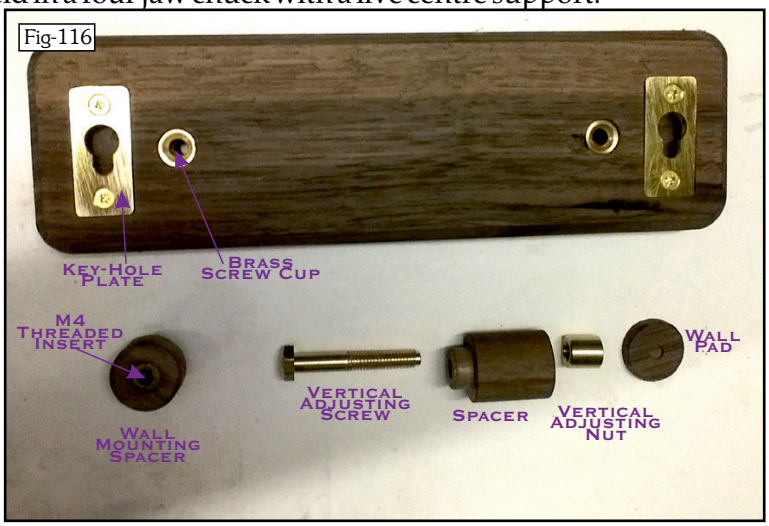
12th Nov

I seem to have done a great deal today - but little 'CNC'. It's interesting to realize (though I always knew it to be true) that selecting the best method of manufacture is not always obvious. Before I had the Denford if I needed a round wooden object with the grain running across I would automatically cut a square piece - maybe cut the corners off to make it octagonal - and mount it in a four jaw chuck. Having now made the Wall Pads and Wall Mounting Spacers from Walnut off-cuts by drawing them in a 'staggered' layout, it makes more sense to do this type of part by CNC - even for a one-off - (though naturally multiple identical parts benefit more) due to the ease of work-holding.

Having finished the last two Brass Screw Cups first operation, I re-mounted each and finished them to thickness and loosely fitted them to the Wall Plates. As I had the 10mm Ø Brass bar to hand, I then made the Vertical Adjusting Nuts. Although they are 'nuts' they are 10mm Ø but will be fixed into Walnut spacers with Epoxy. This is better than putting a thread in Walnut end grain even though there is unlikely to be much 'Adjustment' when in use - it is just there to take account of the wall (which the Clock is hanging on) not being truly vertical. The Spacers which these fit into came out of 25mm square stock held in a four jaw chuck with a live centre support.

In the meantime, the Denford had finished the Wall Mounting Spacers - well as far as could easily be done using CNC - so they could be mounted in a pre-bored chuck on the lathe where they were drilled and counter-bored to suit an M4 Threaded Insert. This was the reason that the grain needed to be across the part rather than along its length - you should never screw into end-grain.

Fig-116



The last part I made a start on today was the 'Key-hole' Plates from 1.5mm Brass plate. I did think about making them on the Denford but decided that the Mill was a better option since they are just oblong flat parts with a 'Key Hole' and two countersunk holes for screws and the Mill is more robust and can take a 1.5mm cut with a 5mm end-mill in one pass whereas I would have to let the Denford take 8 - 0.2mm cuts.

13th Nov

Fig-116 will give you a better idea how each of the parts I've been working over the past few days fit together. They are all concerned with fixing the clock to a wall. The Wall Plate screws to the wall via the two holes with the Brass Screw Cups to provide two 'hooks' (via the 'Key-hole Plates') for the Mounting Buttons (not yet made) to lock into. The Wall Mounting Spacers will be glued into recesses in the back of the Rear Frame 'B' section and the Mounting Buttons screw into the M4 threaded inserts.

The Vertical Adjusting Screw, Spacer, Nut & Wall Pad go at the bottom of the Rear Frame 'A' Section so, along with the two Mounting Buttons, provide a three point fixing.

The first operation of the 8 Mounting Buttons is now done (left hand image of Fig-117) so tomorrow I should be able to turn them around and machine the M4 thread.

Fig-117

14th Nov

Well that didn't go well, or rather I struggled with cutting the M4 threads - not with machining down to 4mm Ø but die-ing the thread. Had I been using En1a material rather than 304 Stainless I'm sure it would have been a breeze but only being able to hold on a 2mm long x 8mm Ø, the stresses involved in cutting even an M4 thread were 'challenging' and the part was slipping in the chuck. The fact that I wasn't feeling 100% health-wise, the workshop was quite chilly and there was both F1 and 'Strictly' to watch during the day, meant that I gave up after two had taken me the best part of an hour.

The right hand image in Fig-117 is the finished 'Button' and Fig-118 shows it attached to the Wall Mounting Block.

Fig-118

15th Nov

Feeling somewhat better, I tried again this morning but wasn't happy with the first M4 thread which I could only die about 5mm of the 8 but it did fit in the mating part so can be used. I should have understood from past experience that having only a small section to hold on to would cause problems - with Stainless Steel. Free-cutting En1a would not be such an issue.

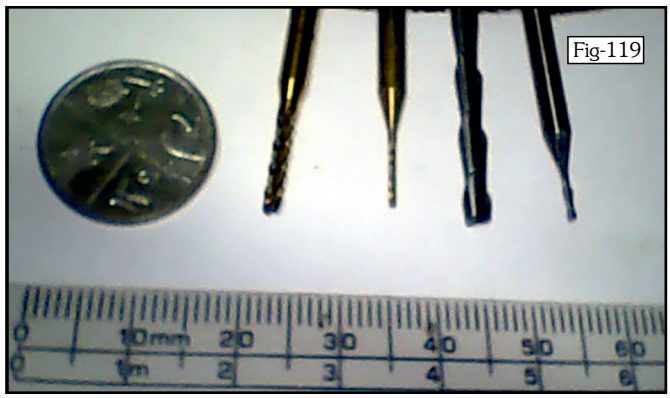
The upshot was that I bit the bullet and decided to re-make the Mounting Buttons and cut the M4 thread first. The first two off the lathe was relatively easy and the prospect of holding on the thread - even screwing it into a 'nut' - would make second op. machining of the Button face a doddle.

Machinery/components always want to assert their authority though and the third thread I cut made sure I knew who was in charge when I was a little too keen to make sure the thread was fully up to the shoulder — there really is no need for that to be the case since the threaded insert has a 3mm deep clearance — but the last 1/3 turn of the work sheared the thread off - naturally leaving the thread in the die :(Drilling that out was going to be 'fun', so I anticipated all the potential problems and started with a 2.2mm Ø drill which did cut about 6mm deep before I turned the die over to work from the other side – that's when the drill broke !!

I finally did get the stainless steel out of the die by using a short 3.2mm Ø drill and a variety of pin punches to deform the remains of the thread. Can't show you how or what the problem was because in my ire I simply got the thread out rather than taking photo's of the mess. The next 5 all went without incident and I've now machined the front faces as well.

16th Nov

Today I returned to making gears - well more of the 72 tooth main drive gear - making small modifications to the G-Code in the light of further experience as well as taking account of the fact that I no longer have a 3mm TCT router bit. Knowing that the 2mm Ø Burr will easily stand up to a 1.5mm cut, I didn't bother doing two roughing cuts for the tooth outline, I did one cut leaving 0.3mm to be removed by a 0.8mm Ø burr. Looking at the first one I made (a month ago!) I decided to increase the speed to 20k rpm (was 15k) and reduce the feed to 80mm/m (from 120). This meant that the final cut of the teeth took 45 minutes but I'm not concerned about time - there plenty of other work to do :)



It's suddenly occurred to me that you may not be familiar with the type of 'Burrs' or 'Up-Cut' end mills that I'm using so in Fig-119 I've put 4 of these alongside a 5 pence piece (18mm Ø) and a ruler marked in mm - essentially to give you a sense of scale. From Left to Right they are 2mm Burr, 0.8mm Burr, 1/8" up-cut End Mill and 1mm up-cut End Mill. They all have a 1/8" Ø shank.

You can see that the flutes on the 1mm End Mill are quite short - in fact it can only cut 6mm - possibly 7mm - deep, that is why I'm using the 0.8mm Burr to finish off the gear teeth because the 72T Main Drive Gear is 8mm finished so needs to be cut 9mm deep. I would prefer to use End Mills because they are stronger and will do so for the smaller gears which have still to be cut.

Earlier today I said that I'd increased the speed to 20k from 15k but after finishing the first gear I noticed a little 'burning' on some of the teeth so I changed that again to 18k - I also fitted a brand new 0.8mm Burr since the one in use was showing signs of heating. I had occasion to go past the Denford after about 7 minutes into the run and noticed that the new burr had broken!! After fitting yet another, I reduced the depth of cut by 50% as well. That still didn't stop the new burr breaking so I re-jigged the G-Code to use the 1mm End Mill for the first 7mm and finally the 0.8mm burr for the last 2mm but in 1mm increments.