The first 'Build' has revealed some issues - as was to be expected - nothing particularly onerous but certainly needing attention. There seems to be no problem with the gear teeth 'binding' but there is an issue with 'wobble' - that is with the Gears not being absolutely perpendicular to their spindles, but it may be more to do with warping or cupping of the timber.

This first showed itself with the Escape Wheel where I designed in quite a small space between the Frame and the back of the Wheel - 2mm - so as it is 120mm Ø and only 5mm thick, a small warp of 1mm should not be unexpected but couple that with the fact that the head of the Latch & Finger Support Clamping Screw stands about 1mm proud of the frame and there will be no clearance :(

An easy solution to this was to re-cut the Support Pivot Bush recess 1mm deeper thus putting the screw head at least flush with the frame. In Fig-208, which is a photo' taken from the top of the frame, you can see that I haven't given myself a great deal of lea-way.


Fig-208

With hind-sight, it might be better not to rely upon the gears remaining 'flat' and finish machine them once they have been assemble on their spindles. I will have to dis-assemble the clock at least once because I still need to cross-drill the 1st Train Spindle for the pin to drive the Hour Hand Gear and the position of that needs to be determined empirically, so I still have the option to true-up the Escape Wheel - and of course there are three more clocks so I can take this new knowledge into account before I do the next build.

After the minor adjustments I was pleased to be able to turn the Main Drive Wheel and see all the Gears & Escape Wheel turn freely.

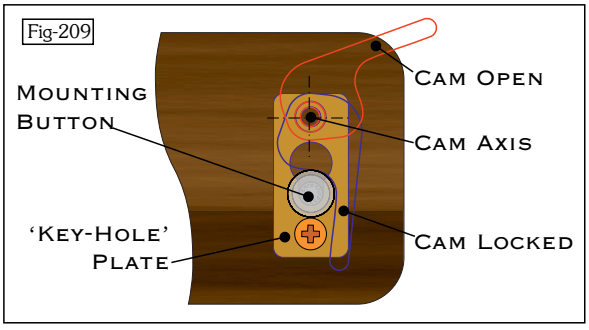
What is less gratifying is that I can only do so by pulling quite hard on the Main Drive Gear rather than pulling on the Cord. This may mean that the weight needed to drive it may be much higher than the estimated 2kg

30th - Jan

I got my Grandson to pull on the cord with me holding the Clock Frame and it seemed easier to get the Gears moving and I've now found a space in my workshop where I can fix the Wall Plate and therefore 'hang' the Clock for the next series of tests.

My first test was with a 1.7kg bottle of water which needed a little persuasion (by 'flicking' the Escape Wheel) to get any movement but it was no more than about a ¼ turn of the Main Drive Wheel. Changing to a 3kg bottle did get it to completely unwind the winding drum but it took between 4 and 5 minutes to do so. I also became aware that with that weight there is a tendency for the right hand wall anchor to lift out of the key-hole slot in the Wall Plate so I'll need to design a locking mechanism to stop that.

Finding a lump of steel weighing about 2kg I lashed that to a (currently unused) part of my Myford 7 which brought the weight up to just over 4kg. This was less than successful since the left hand Wall anchor broke ! The main reason for this was that I had been less than fastidious when gluing it to the frame so it was only held in by a tenuous 5% of the circumference with no glue on the shoulder. The fact that I didn't remove the wax polish first may also have been a contributing factor!!



Due to the right hand Wall Plate button lifting, I needed to design a locking device. It made sense to devise a 'cam' locking which could be lifted out of the way to allow the clock to be mounted and locked down again once in position. As the Brass 'Key-hole' plates are held in a recess in the Wall Plate with two screws it also seemed convenient to use the top one as the Cam axis by fitting an M4 Thread Insert where it is currently a wood-screw. Fig-209 shows the right hand end of the Wall Plate with an outline of the Cam, open & locked. This was a simple matter to CNC out of 3mm thick Tufnol but I still had to do the job twice through stupidity! ie. not checking the location of the blank after re-clamping. Now I have to re-make the Mounting Block which broke so that I can test how effective the Locking Cam is.

31st - Jan

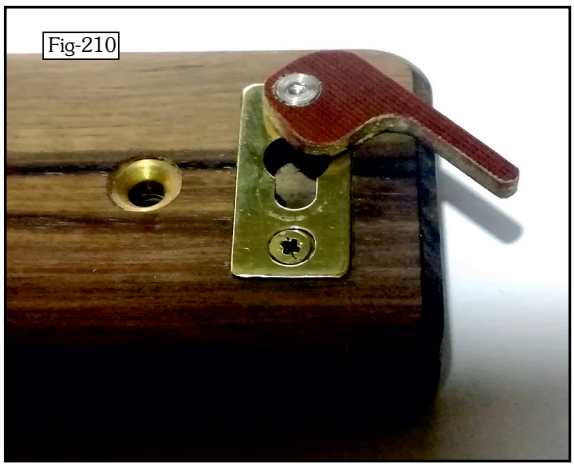


Fig-210

Since the new 'Locking Cam' is only 3mm thick and the recess for the screw head can therefore sensibly be only 1.6mm deep, I can't use standard button head screws, the standard head is 2.3mm thick and 7.7mm Ø so I had to modify them – a simple matter on the lathe but still taking time.

Cutting the hole for the M4 Thread Insert was also a simple matter, using the existing countersunk screw-hole in the Brass plate gave ample positional guidance and once that had been opened up to 4mm I could remove the plate and drill the 5.5mm Ø hole and 8mm counterbore needed for the Insert. One small bone of contention is the depth of the hole - - - I need the screw to 'bottom out' before the Cam is clamped tight and can't swivel and that could be a matter of just a few tenths of a millimetre. There seems to be two ways to deal with this, either trimming the length of the screw or adding a small piece of steel or brass to the bottom of the hole.

Before I deal with that, I'm thinking about why it seems that I need a 4kg weight to drive the clock. One thing that occurs to me is that there may well be a pressure on the ends of the spindles created by the spacers being just a little short - or possibly that the Bearing recesses have been cut a little too shallow - either scenario would have the same effect. The fact that the Frame Clamping Rods seem just a bit too long seems to bear this out.

An easy way to test this would be to add a 'washer' under each Spacer. It cannot be too thick so a sample of Formica at 0.7mm thick might just be enough, but I could add two if one made little improvement.

1st - Feb

An interesting morning, discovering some of the errors made early on in this project! The addition of the thin washer did wonders for the 'weight' issue – along with a small adjustment to the Escape Wheel to correct some of the 'wobble' - and I had a complete unwind of the drum with a 1.5kg weight.

I said 'some' of the wobble - - the Pins were meant to go in 4 of the 5mm thickness but I'd obviously been a bit too heavy handed and taking just about ½mm off exposed some of them. In case that ½mm wasn't enough, I decided to take a further ½mm out of the Spindle shoulder. The potential repercussions of this would be a possibility that the Pinion wouldn't align with the Gear but since they are both 5mm wide, pushing it ½mm along the spindle is not a serious issue.

After re-building the clock I mounted it on the Wall Plate and a further 'free-fall' test proved positive with no 'rubbing' between the Escape Wheel & the Latch/Finger Support.

Now came the acid test - with the pendulum.

Not 100% - in fact I had to increase the weight to 2kg before I got any useful power and even then it was very 'hit & miss' getting no more than about 15 seconds. After some investigation it seemed that there wasn't enough power being past to the 'Finger' which is what the Pendulum needs. There was also an issue with the Latch not lifting quite enough to release the Escape Wheel. This last point is exacerbated by the fact that the Escape Wheel is not perfectly concentric with the Spindle -- it's no more than ¼mm but that is a huge amount when the total lift on the Latch is only 1mm!

Stripped the clock again and mounted the Escape Wheel - on its Spindle - in the lathe and trimmed the top until all the teeth had been affected. I took off about 0.3mm from the highest tooth. Whilst I had it in the lathe I took the opportunity to apply some pressure to the Pins since some of them are just off being perpendicular.

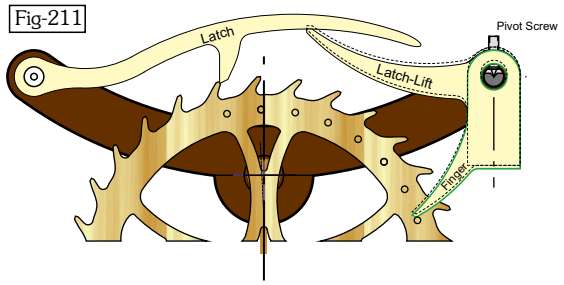
With this 'hind-sight' knowledge, I think that rather than drilling the holes for the pins at the same time as I cut the teeth on the Denford, it would be better to leave that until the Wheel is mounted on its spindle and drill them on the lathe using an index wheel or on the Mill using a dividing head - it would be more work but guaranteed to be accurate. If the Escape Wheel were made of Brass I suspect that there wouldn't be any problem.

Now I've done the same adjustments to all four Escape Wheels, it's interesting to note that two of them had virtually no 'wobble' but one of them had nearly 3mm ! and that one is the first one I made! It was built from the 5 segments which I did thinking that it would be a way to eliminate some potential problems - obviously not!

I did lots of 'fiddling' with the Latch-Lift/Finger by adding bits to both and trimming the added bits back but still no real improvement. The one thing that did make a difference - and effectively changes the position of both the

Finger & Latch-Lift - was to adjust the Pivot Screws. By screwing them further in, both the Latch-Lift and the Finger are raised changing the relative position of the Finger 'tip' to the Escape Wheel Pins and this certainly had a positive affect and I got a Pendulum swing lasting about 4 minutes.

Fig-211



2nd - Feb

After a few attempts at cajoling the Pendulum to swing longer by increasing the Weight to 3kg and further adjustments to the Pivot screws I took a more pragmatic approach and made a pencil mark on the Gear Teeth when the Pendulum stopped. By now I had fitted the hands so that I could judge how long the Clock had been 'going' and it had achieved over 7 minutes.

It was good to find that it stopped exactly at the same position on three occasions which meant that there is certainly some binding between the Second Train Gear & Escape Train Pinion so I stripped the clock yet again and trimmed the 10 teeth either side of the one that was marked. I also mounted the Gear & Spindle in the lathe to check that the O/D was concentric and it turned out that the tooth with the pencil mark was about 0.3mm higher than the lowest tooth and was soon trimmed to concentricity. Likewise, I tested, and corrected, the First Train Gear which had a smaller difference.

After re-building the clock and mounting it for further tests, adding the weight seemed perfectly normal but after a few swings of the Pendulum it plummeted to the ground!!! It was disappointing to discover that two of the retaining pegs on the Pawls had broken away allowing the Winding Drum to 'free-wheel'.

Fig-212

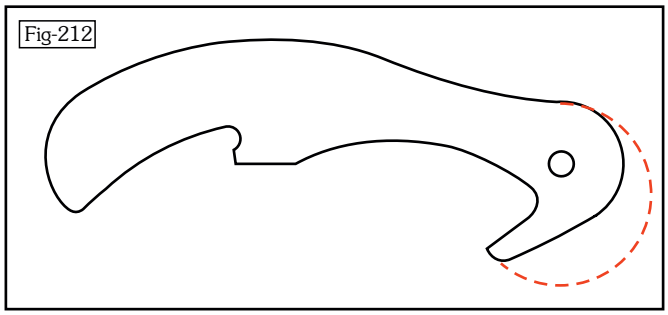


Fig-213

Fig-212 is the outline drawing of the Pawl and Fig-213 is the broken Pawl.

Since the Pawl is such a small component I suspect that I could have foreseen this possibility -- it doesn't make it any more palatable -- but I think that making the replacements from Tufnol may be a better option, though increasing the size of the retaining peg (al la Fig-212 dotted red line) could be a way to maintain the 'Wooden' element. I'll make that decision tomorrow.