

Congreve rolling ball clock

For Marisa



Setting the steady

Steady is centred close to the chuck for accuracy then moved along to hold the outer end of the work.



Centering the end of the column

With the material held by the steady the end is drilled with a centre drill.



The scrap box taper turning attachment.



Taper turning the columns

Note sine bar controlling the angle of taper. The cross slide feed screw is removed for this operation.



Threading the top end

Using the steady the ends are drilled and taped 8mm



Marking out the top plate

After coating with marking blue the plates are marked out for cutting



Chain drilling the plate

The plates are drilled inside the line with a small drill then the holes are joined using a piercing saw.



Cleaning the rough surface

After cutting out, the edges are filed to the line.



Basic frame assembly

Trial assembly, capitol squares not yet fitted



Fly cutting the capitol squares

With the tool post removed the rough cut squares are clamped to cut a reference edge.

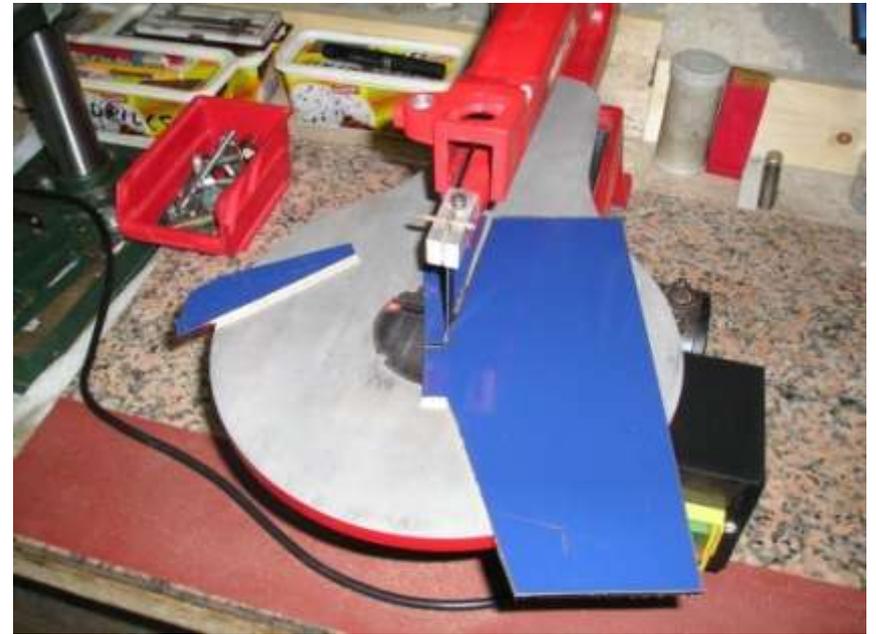


Setting the squares

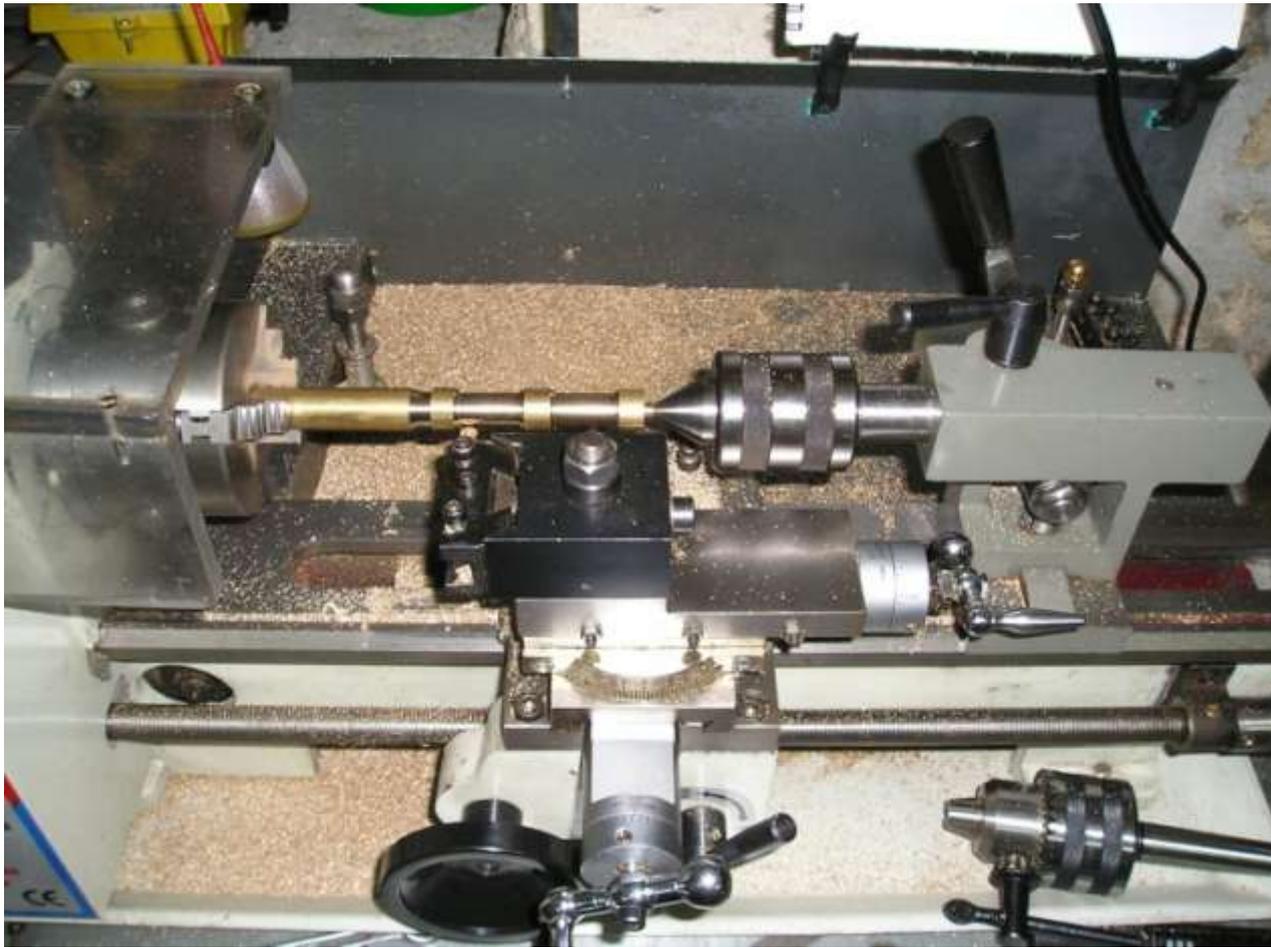
Subsequent operations are referenced to the chuck face prior to fly cutting.

Cutting the movement plates

The scroll saw is modified to take cut down hack saw blades.



Turning the frame spacers



Total frame assembly



Boring the spring barrel

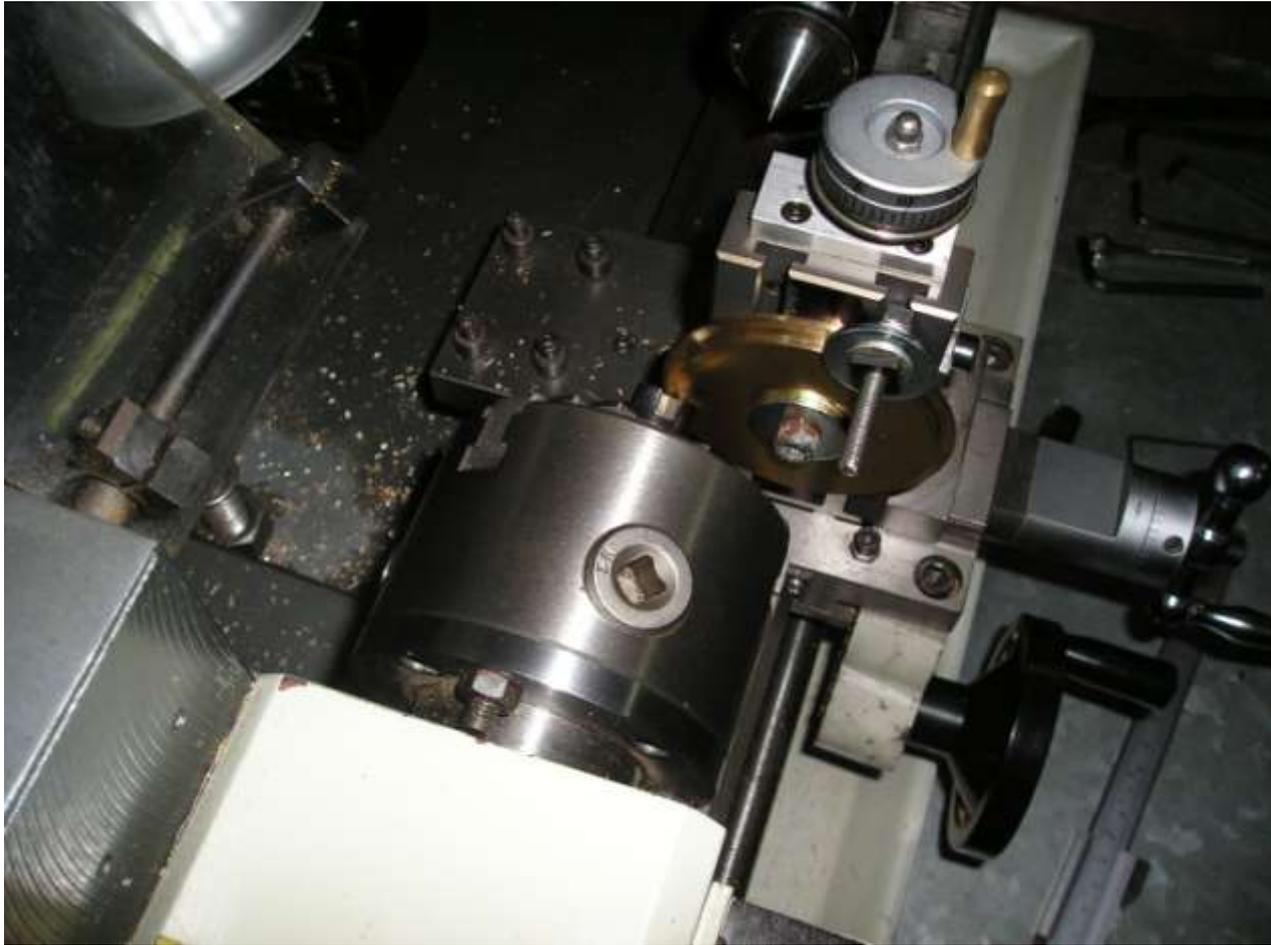
The boring tool was set higher than the centre to negate the rake saving making a special tool for brass. The brass supplier could only provide tube with a thick wall So I had to bring it to size both inside and out.



Turning barrel end plates



Fly cutting recess for end of cable



Selection of components



Machining fusee block to size





Blocks and arbors

The blocks are bonded to their arbors with epoxy.



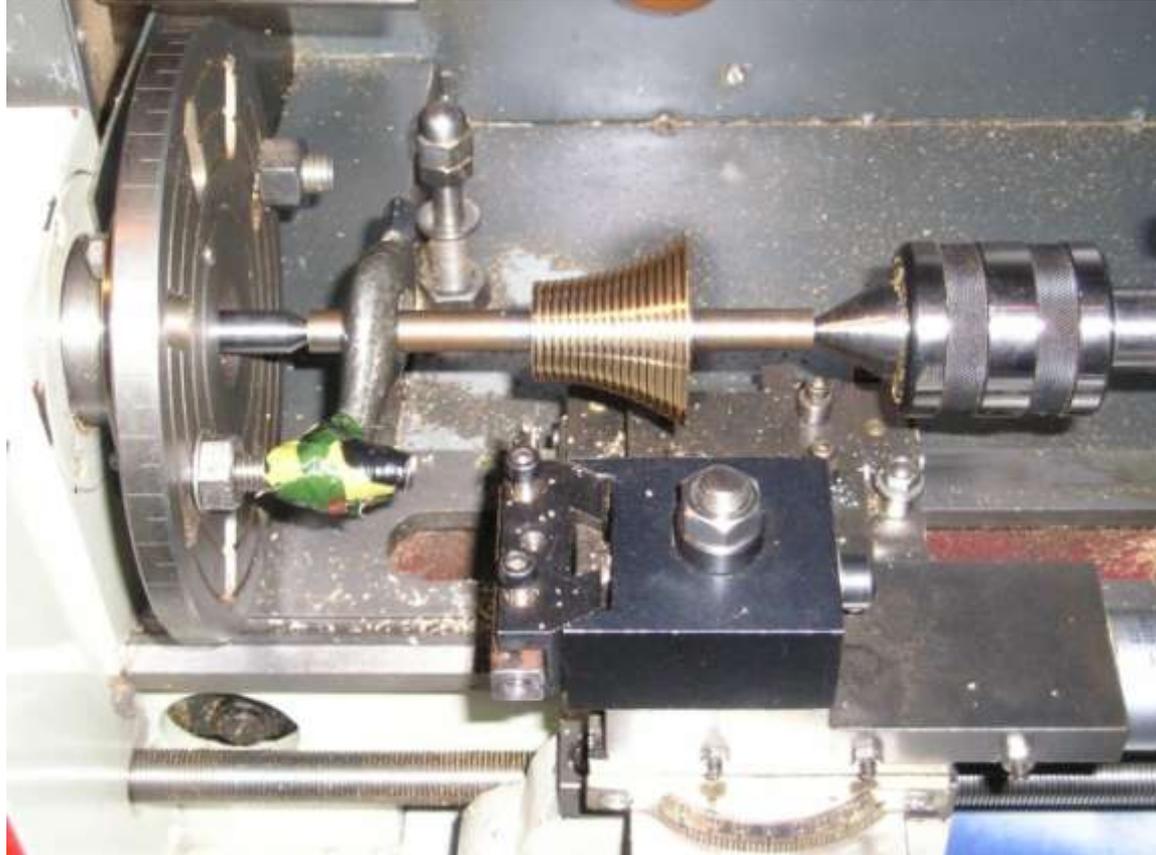
Removing excess material

The compound slide is set at a angle to turn the block to a approximate shape



Shaping the curve

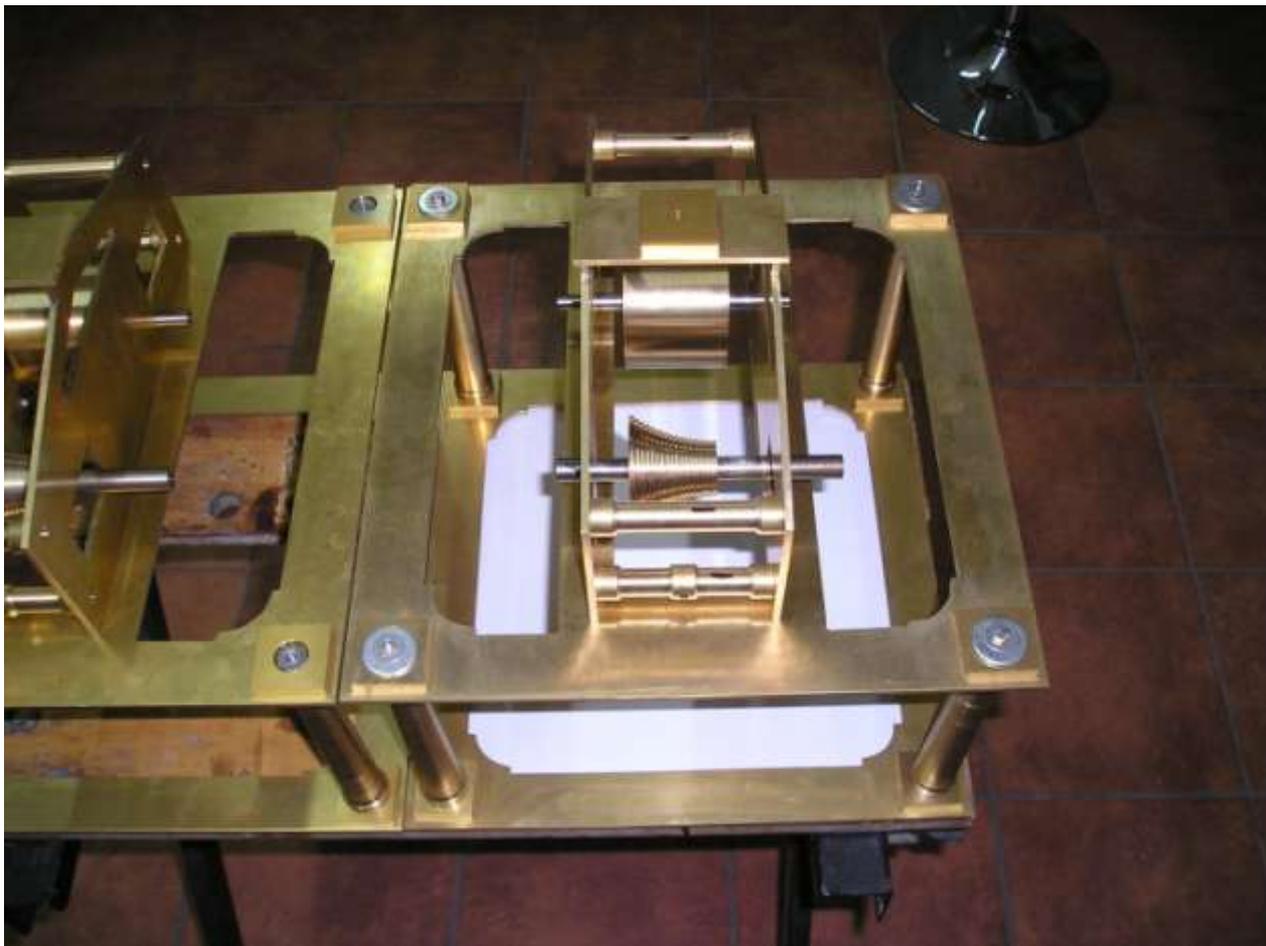
The curve is shaped by moving the cutting tool around a pivot at a set radius, by hand.



Machining the cable groove

The lathe is set to advance the tool 12 tpi. The lathe is turned slowly by hand and hand pressure applied to the tool to follow the curve . The cross slide feed screw is removed for this operation.

General arrangement

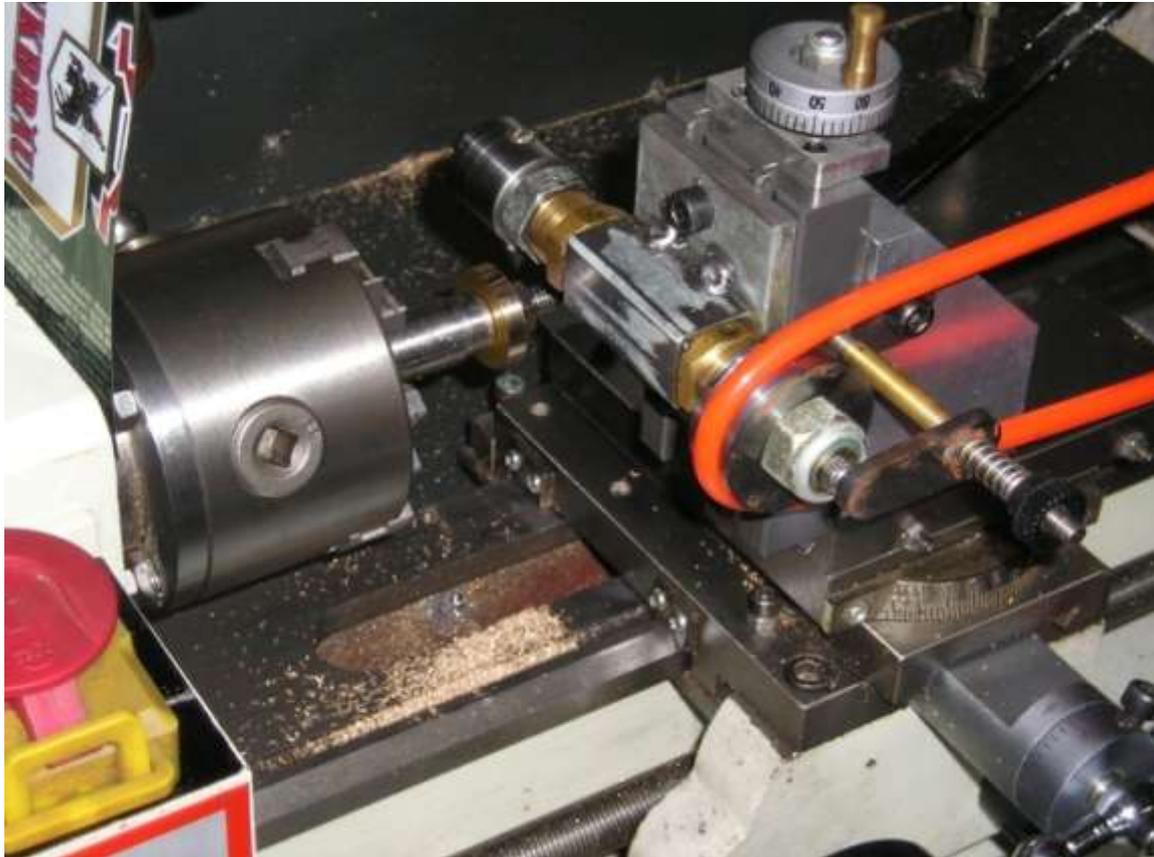




Set up for cutting ratchets

A motor drives a gear cutter mounted on the vertical slide in place of the tool post.

Indexing is provided by a HHV 150 Dividing head attached to the main spindle.



Cutting winding ratchet

The cutting tool was turned at 3000 RPM. And passed through the ratchet blank, the chuck was then indexed to give 32 teeth.



Cutting 2 barrel ratchets.

The barrel ratchets where cut onto a piece of bar ,then parted off.

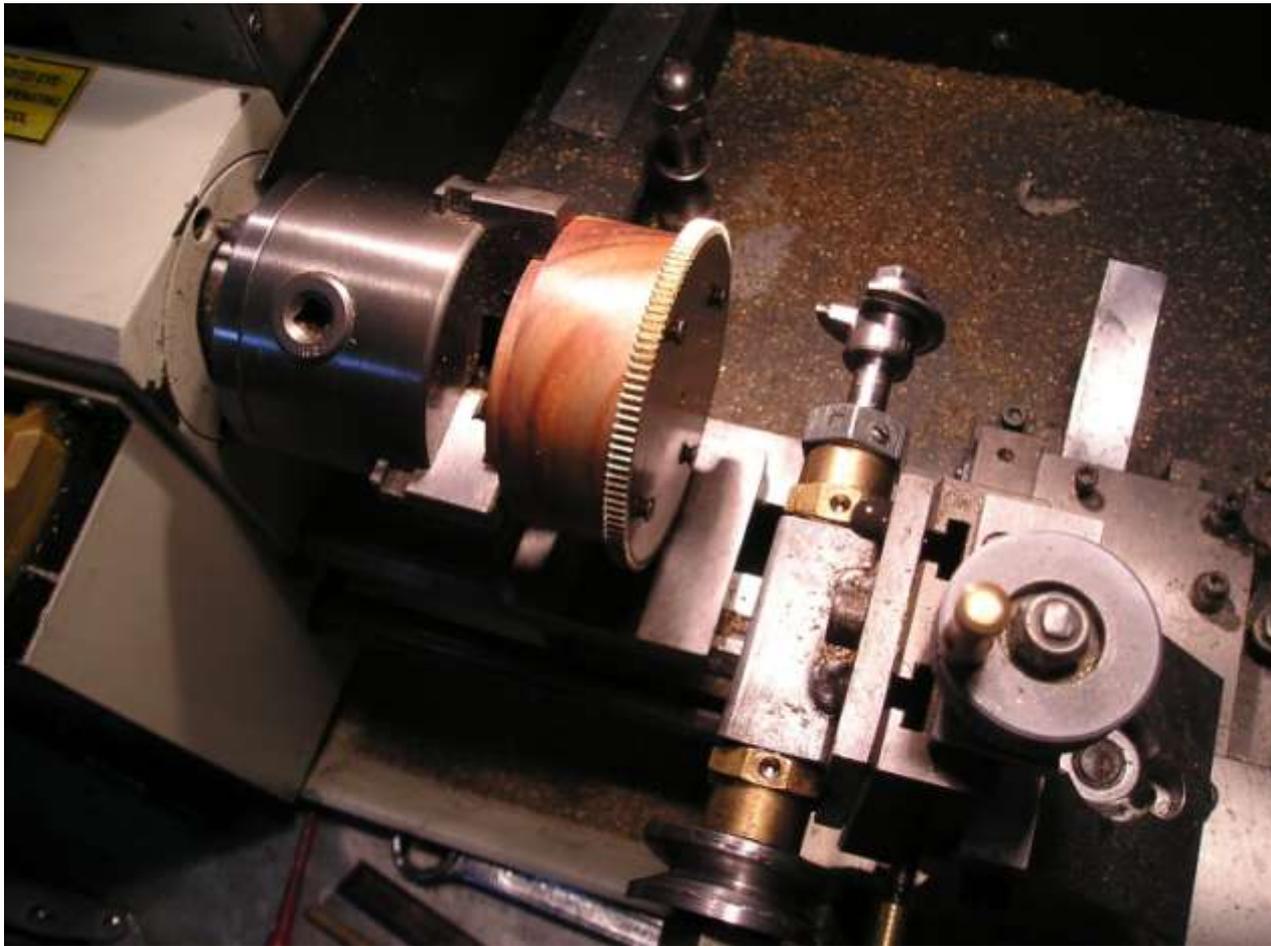
Centering the cutter for the great wheel



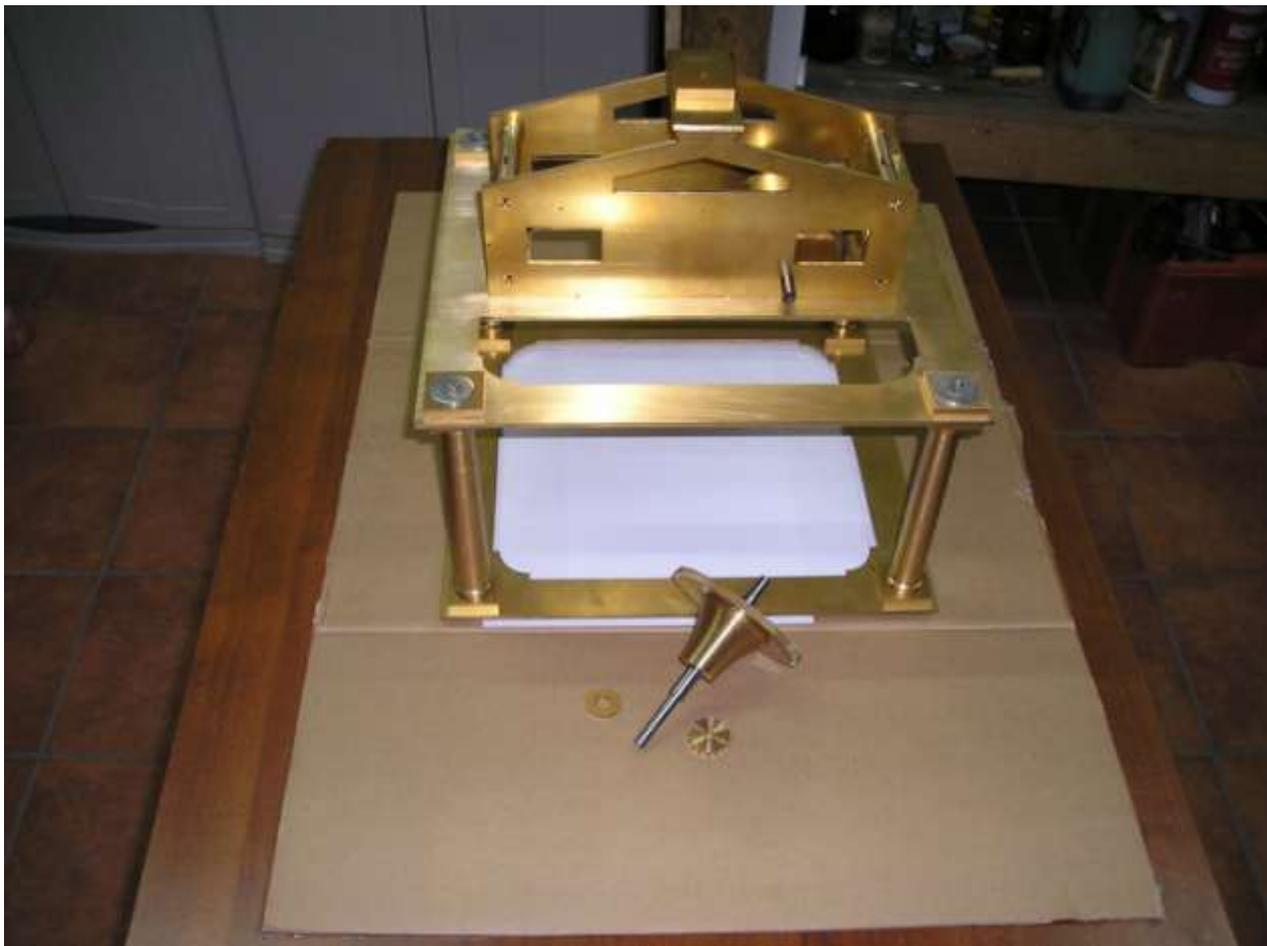
Final cut



Finished teeth of Great Wheel



Great wheel in position



Hour wheel being cut



Hour wheel complete



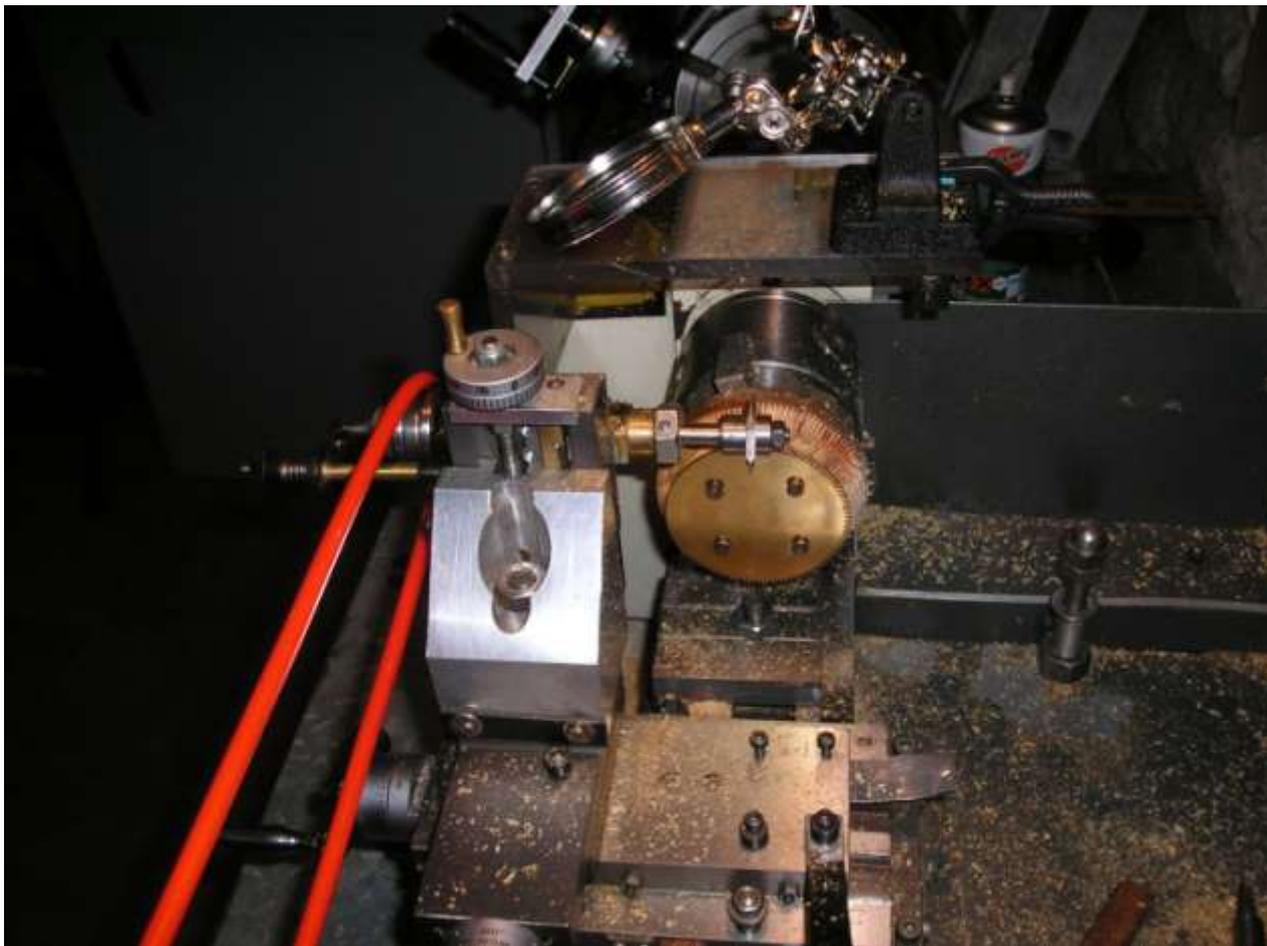
Hour wheel in position



Gear assembly



Number 3 wheel being cut



2 sets of gear wheels



Tool to prove gear mesh



Proving a pair of gears

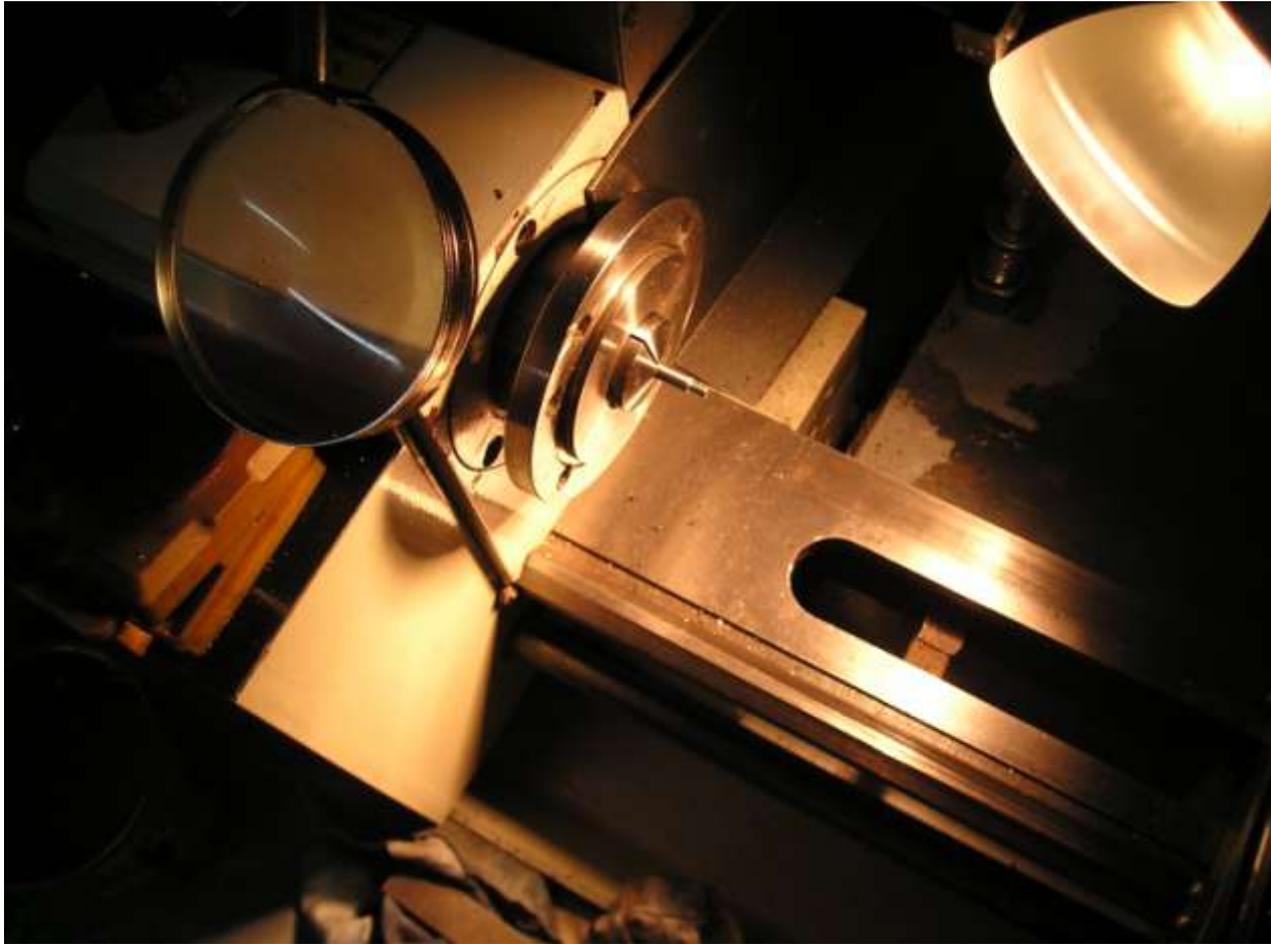




Drilling the collets

A home made tool post drill was satisfactory for drilling the gear locating holes for the 10BA screws.

Machining the spindles



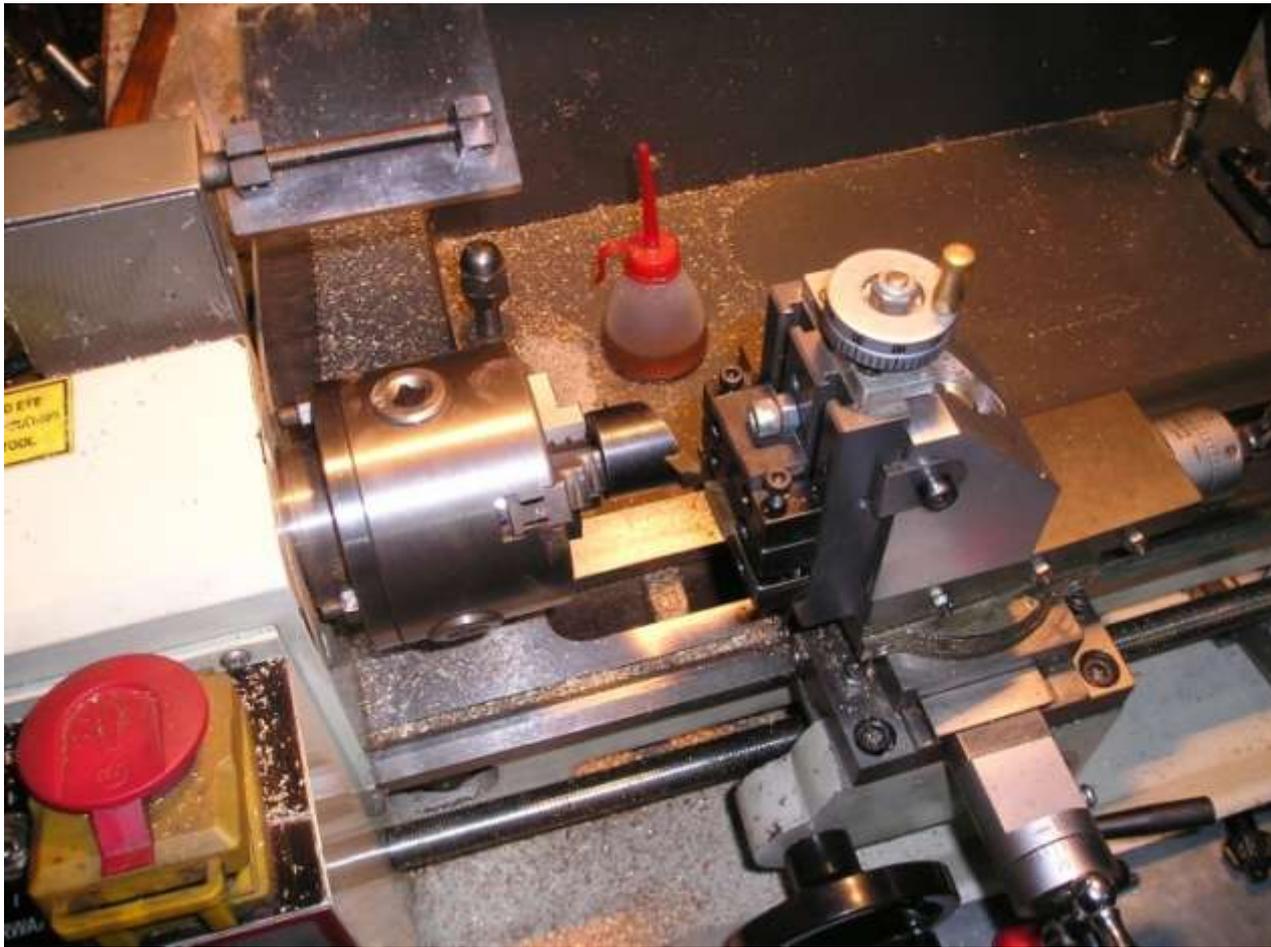
Cutting the fly blades



Silver soldering the blades



Cutting the small Capitol squares



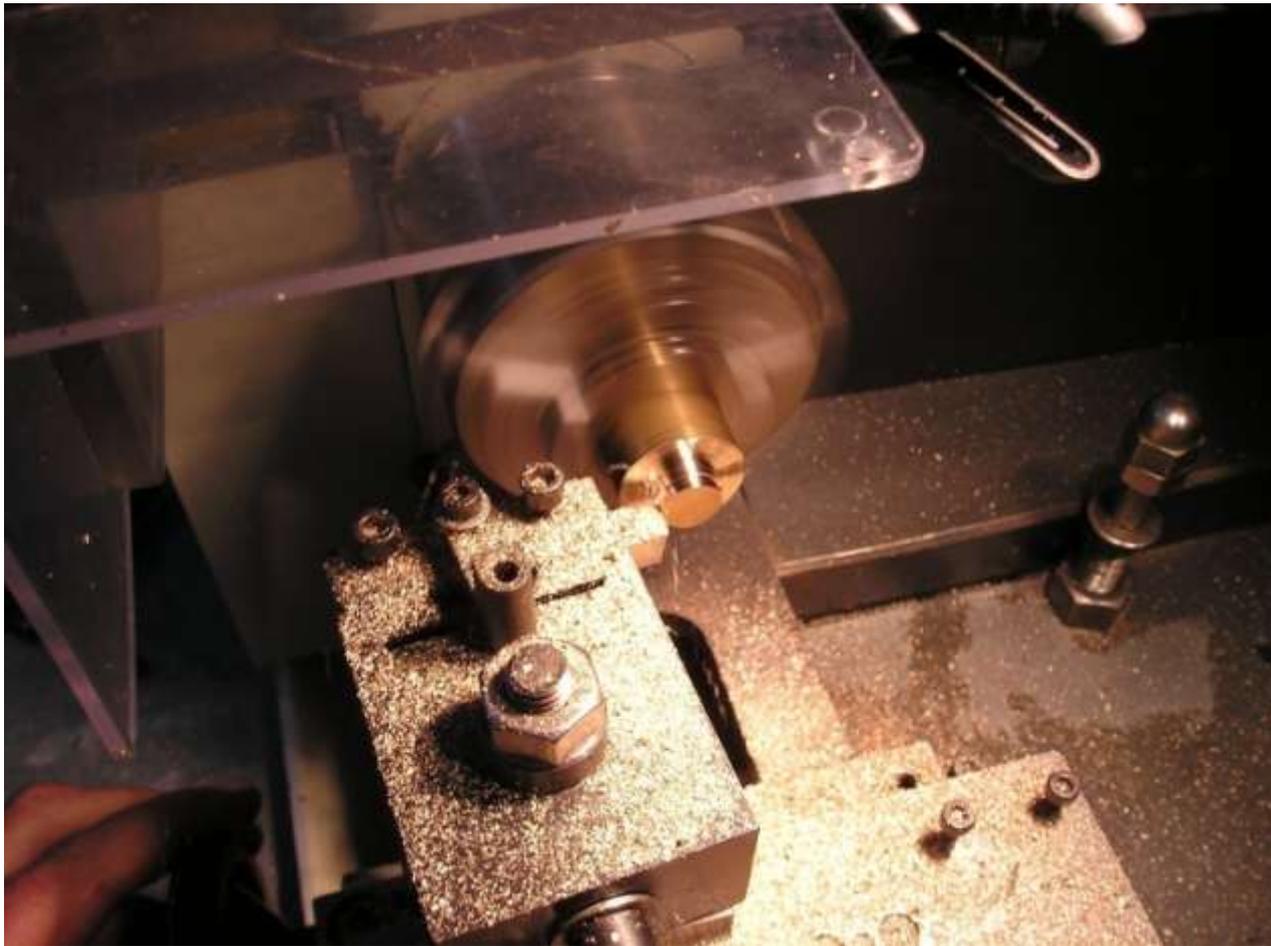
Capitol squares & Fly's



2 Sets of gears on spindles



Turning the arm of the crank



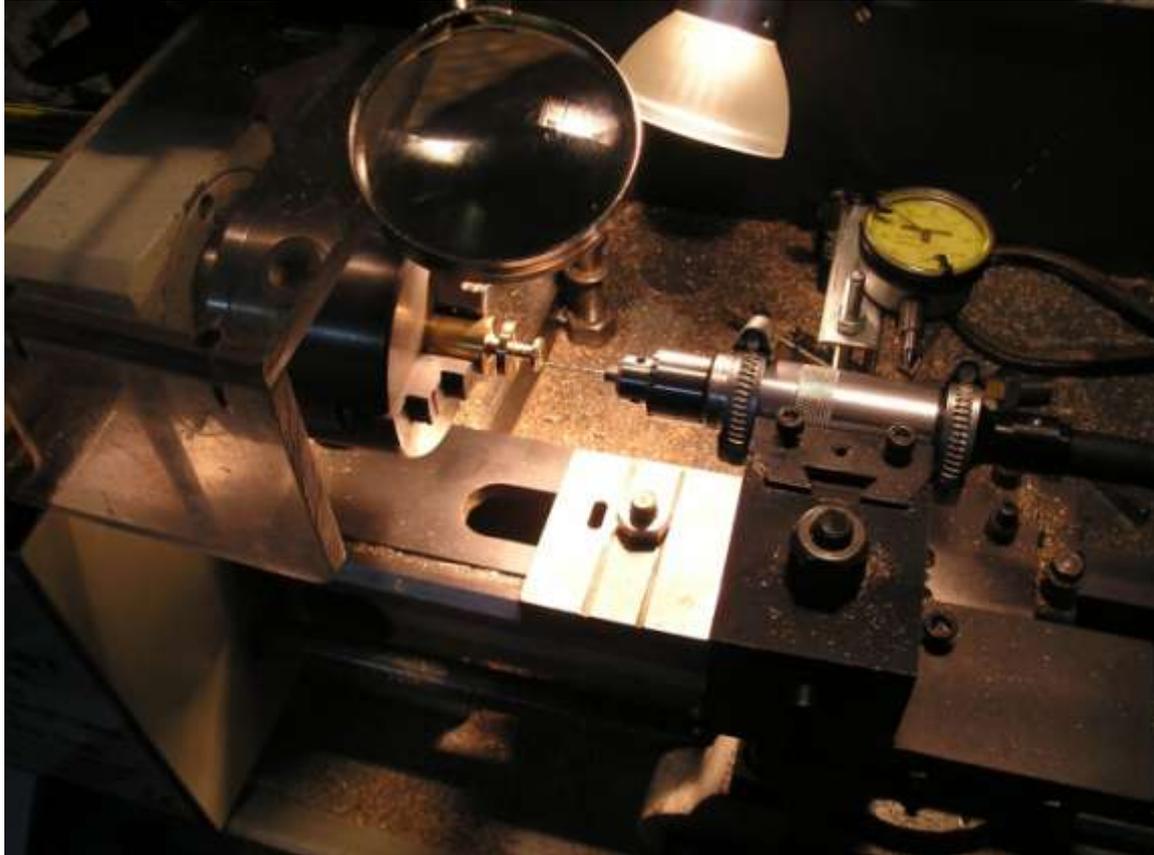
Adjustable crank and stop posts



Feet and Finials

Stopped work on Number 2 to prove one movement





Drilling the Pinions .79 mm

A Chester flexi grind drill was mounted in the tool post. And the chuck indexed as in the gear cutting.



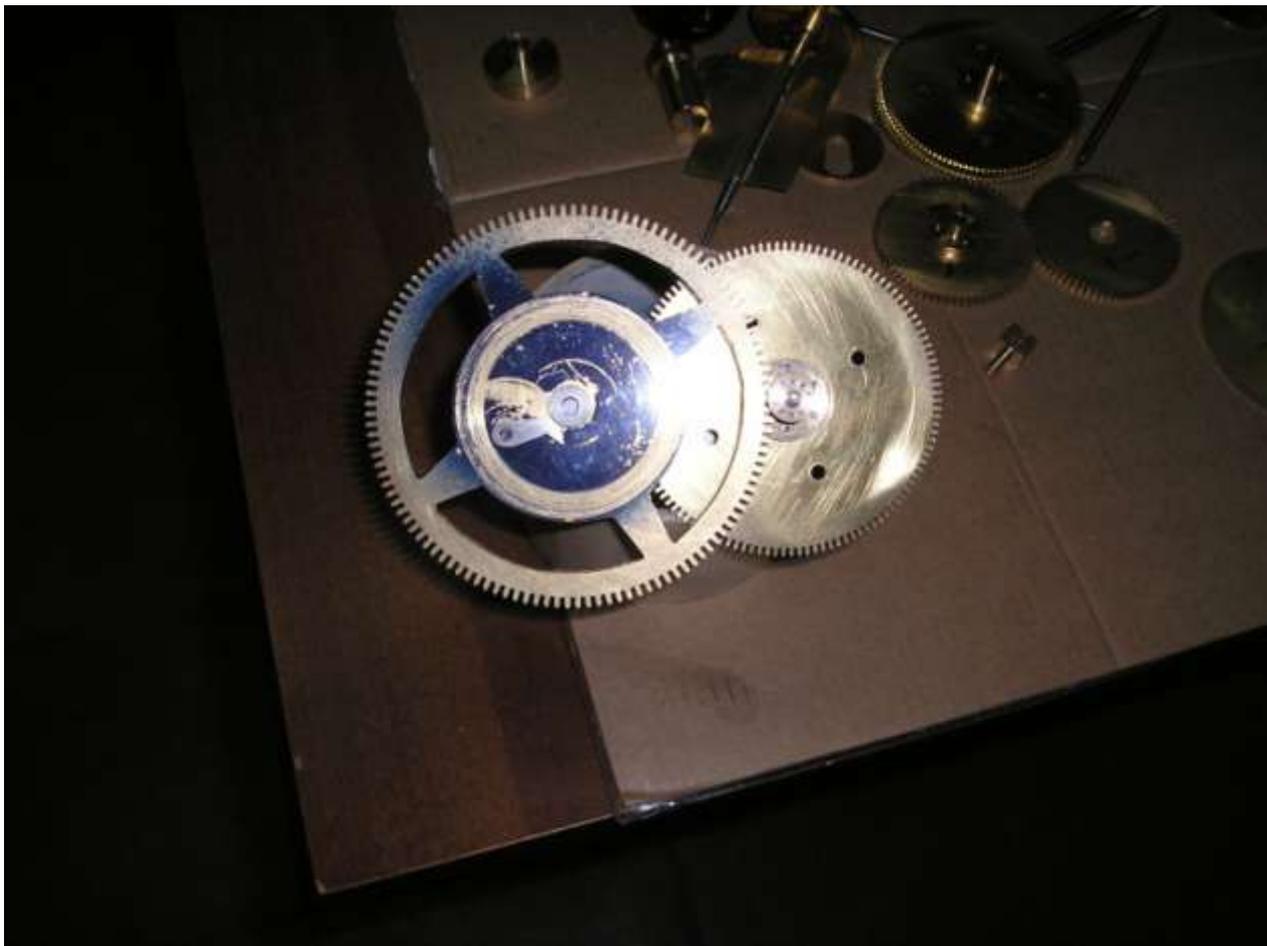
Trimming the pins

The chuck was turned at its slowest speed and the disc turned at high speed and fed in slowly producing a very close cut with a good finish.

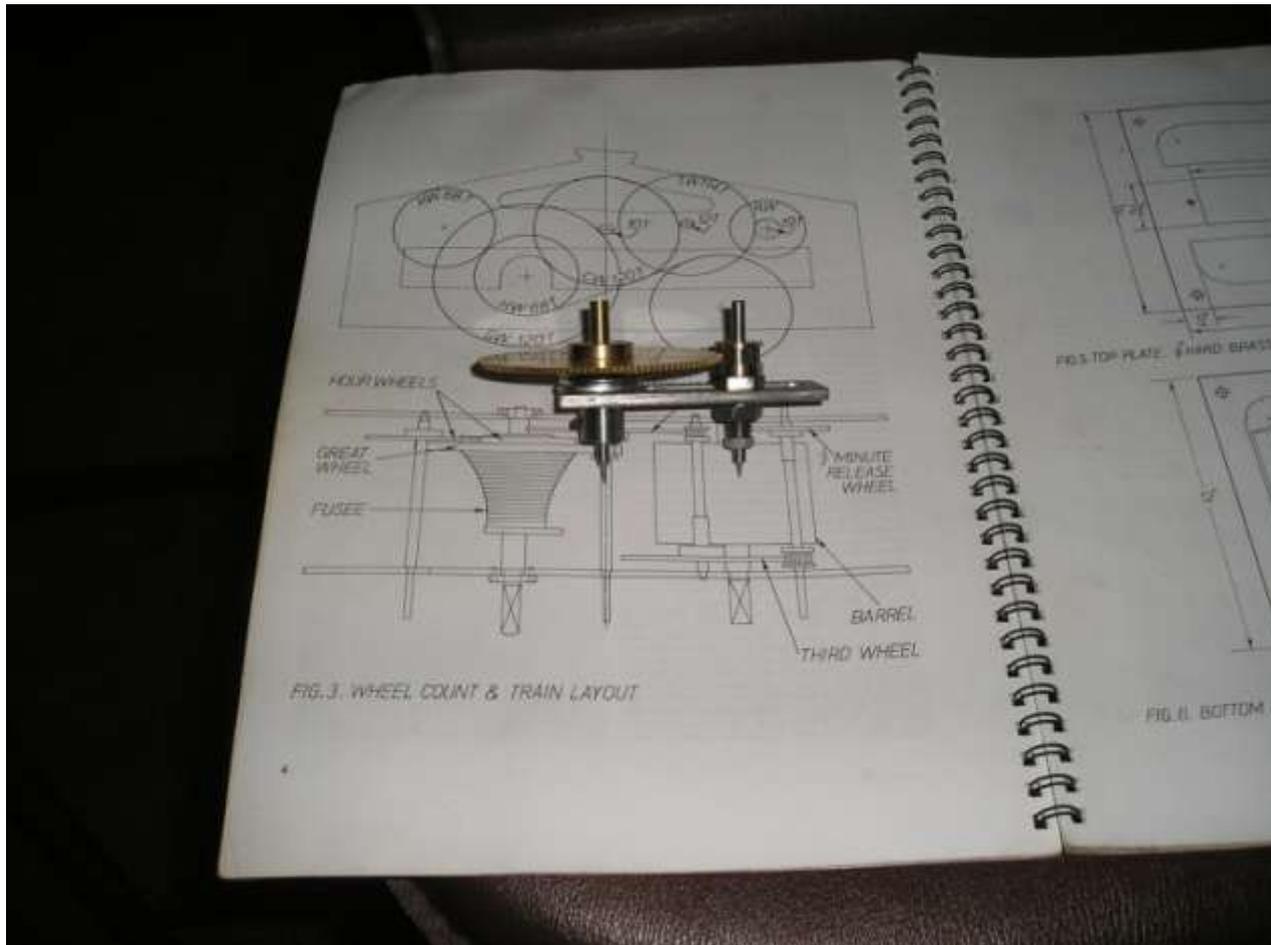
Centre wheel and pinion



Proving Great wheel & pinion



Proving 3rd wheel & 1/2 minute pinion



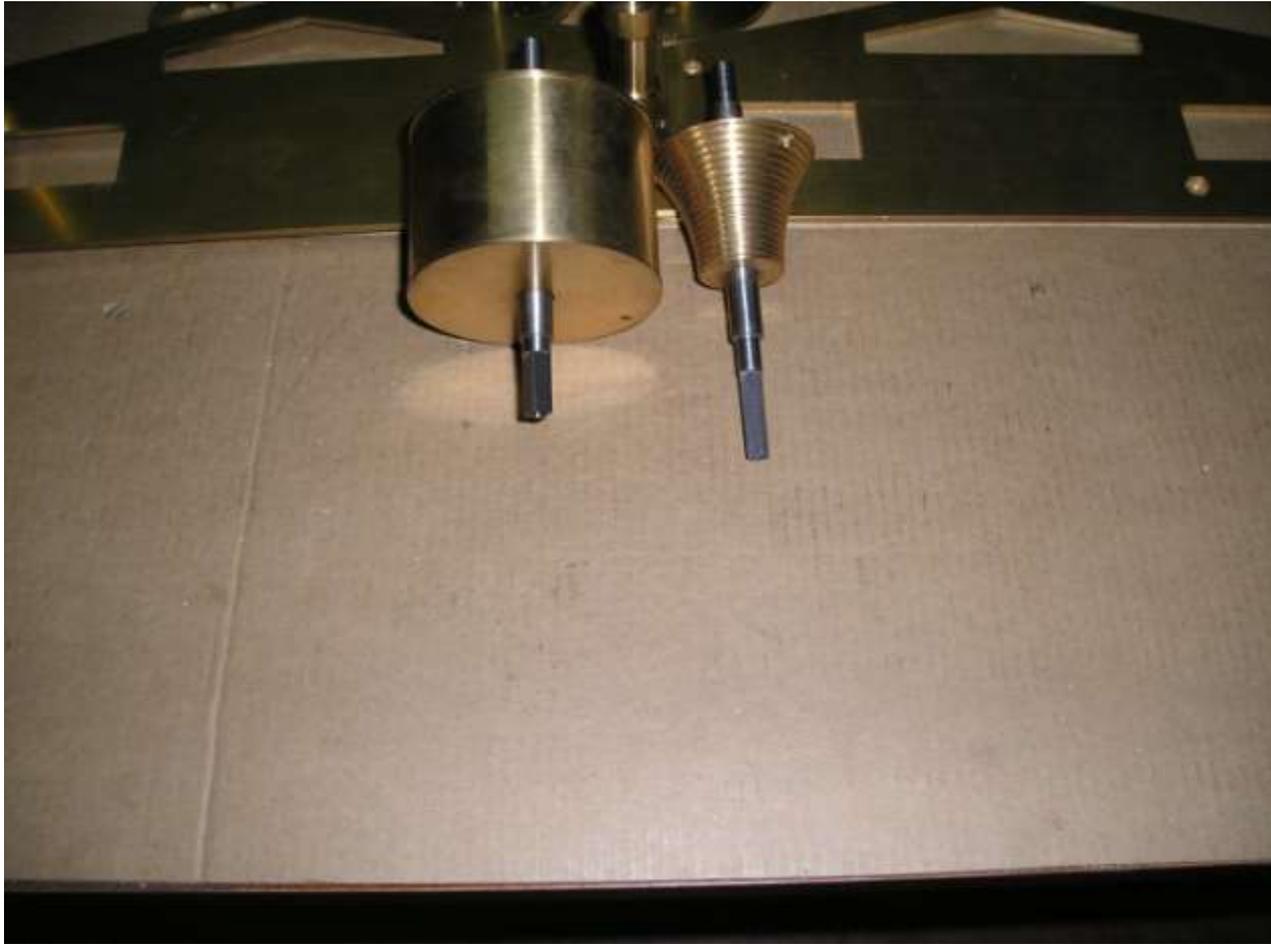
A complete set

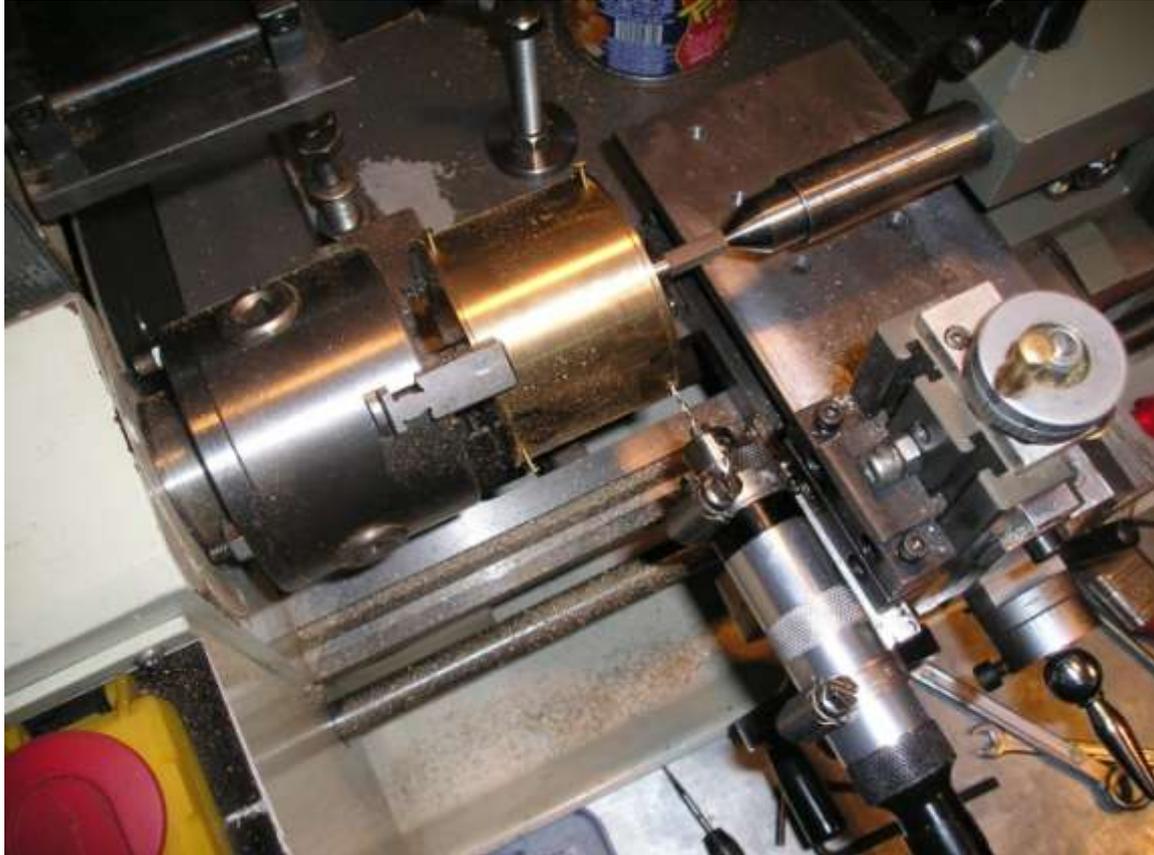


Fileing the winding square



Winding squares on fusee & barrel arbors





Using the Flexi drive to drill holes for the end cap retaining screws.



Barrel parts ready for assembly.



Spring installed.

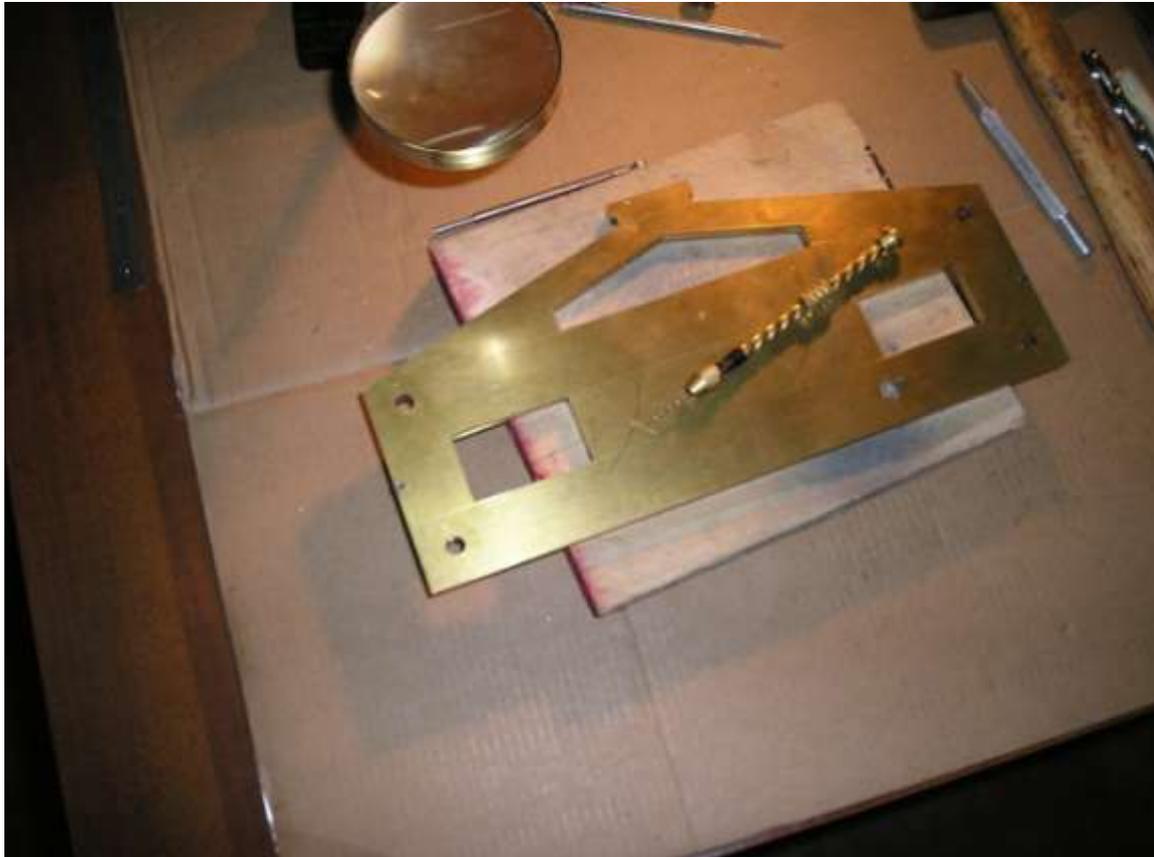


Click spring assembly

The spring is made straight then bent to fit. This also improves its springiness.

Marking spindle positions





Deepening the punch marks

An Archimedes drill with a .5 mm drill bit is used to enlarge the centre punch marks, this also allows correction of any error.

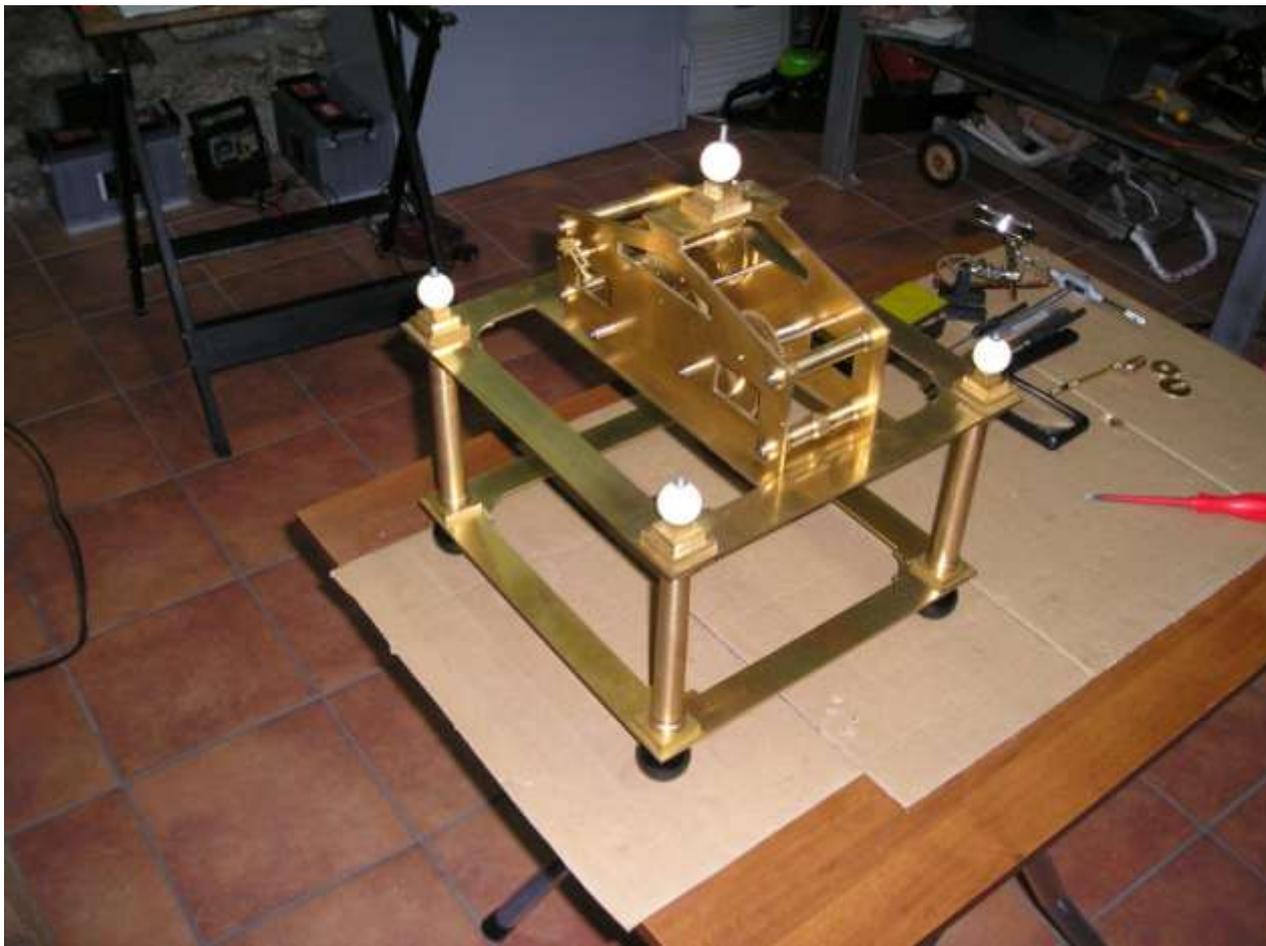
Holes drilled



Trial assembly



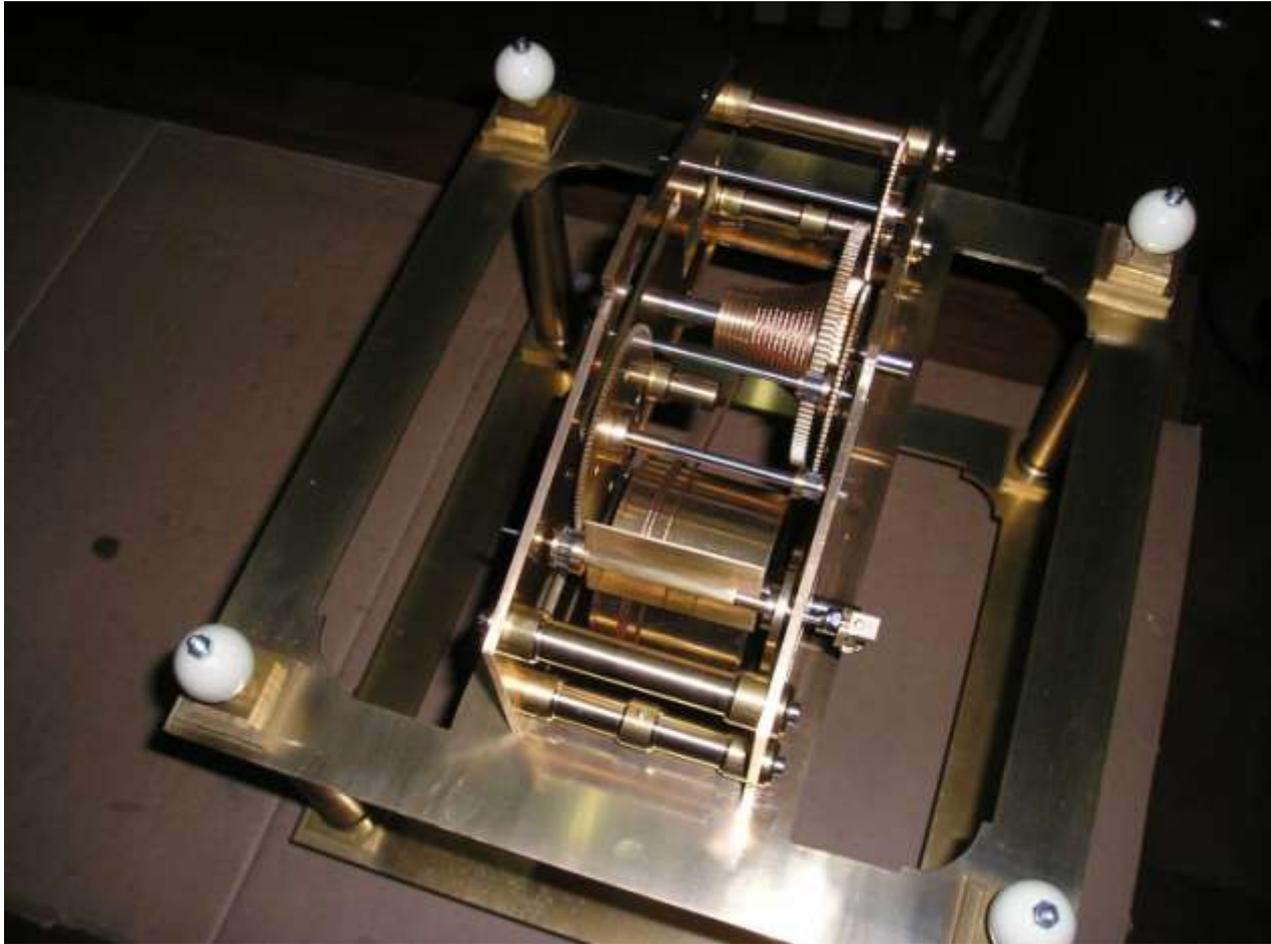
Rear view



Front view



Cable fitted: short run to test alignment.



End view



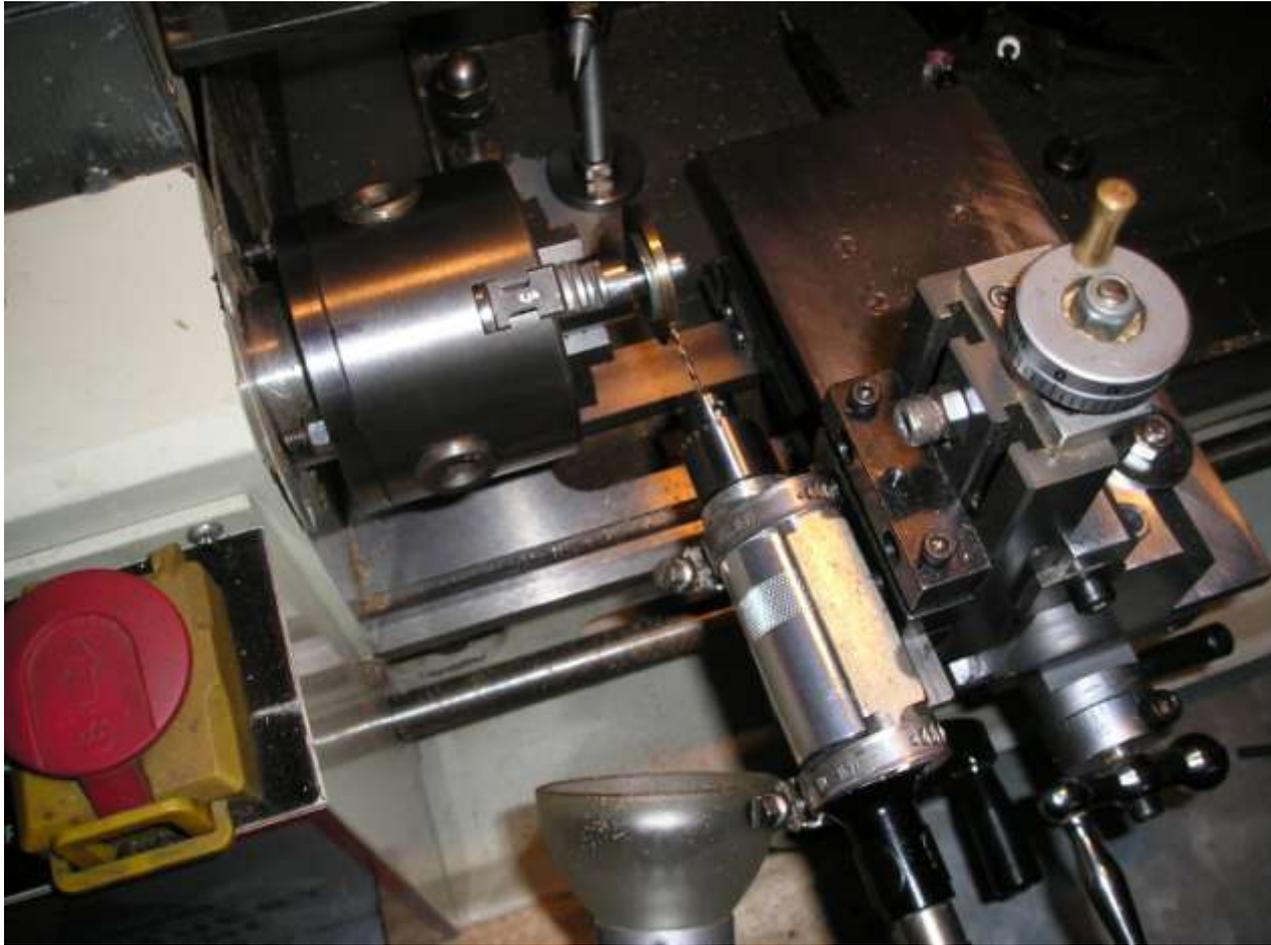
Correction of alignment



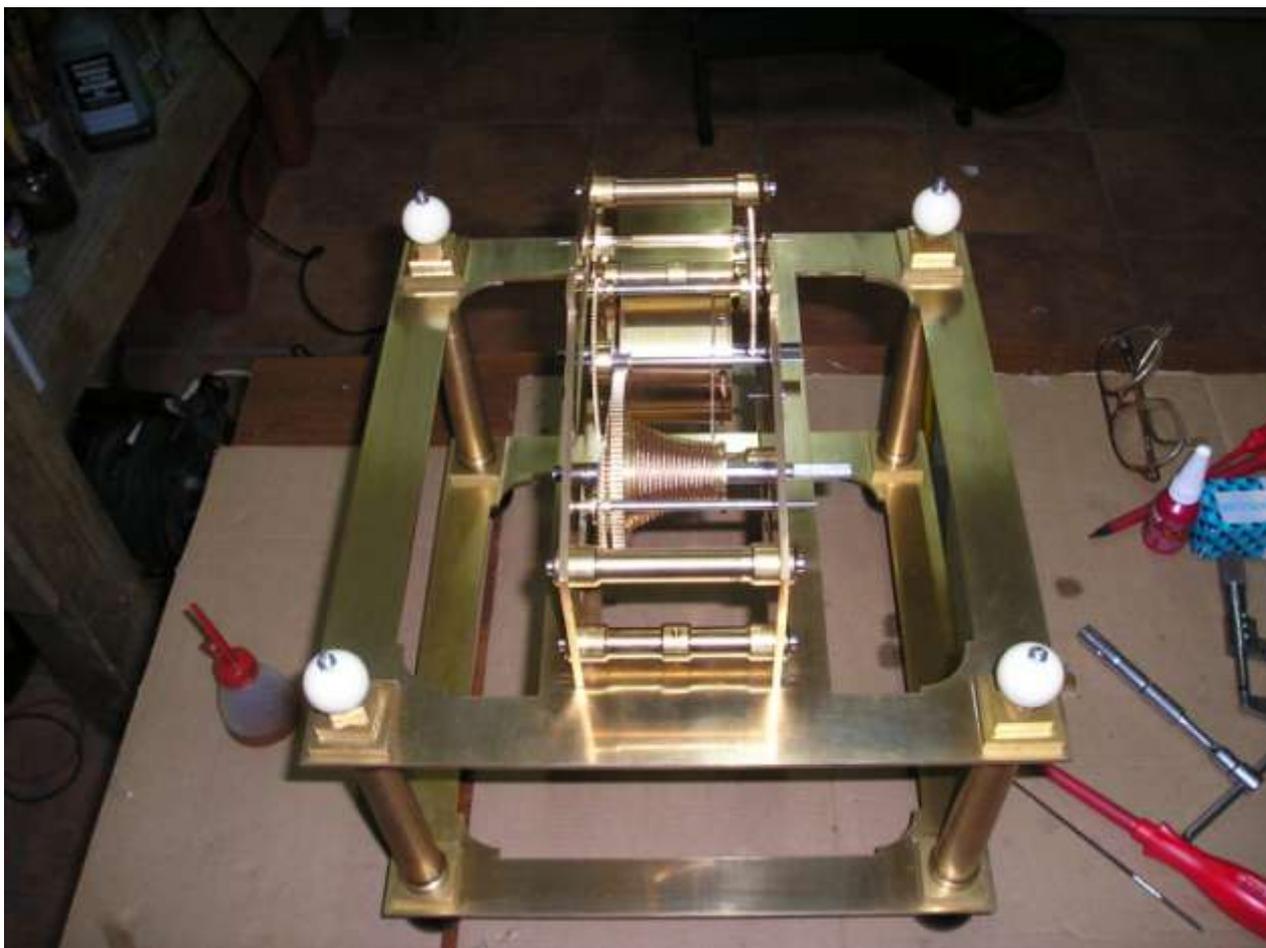


Spacer made to correct centre wheel position.

Drilling holes for stop pins



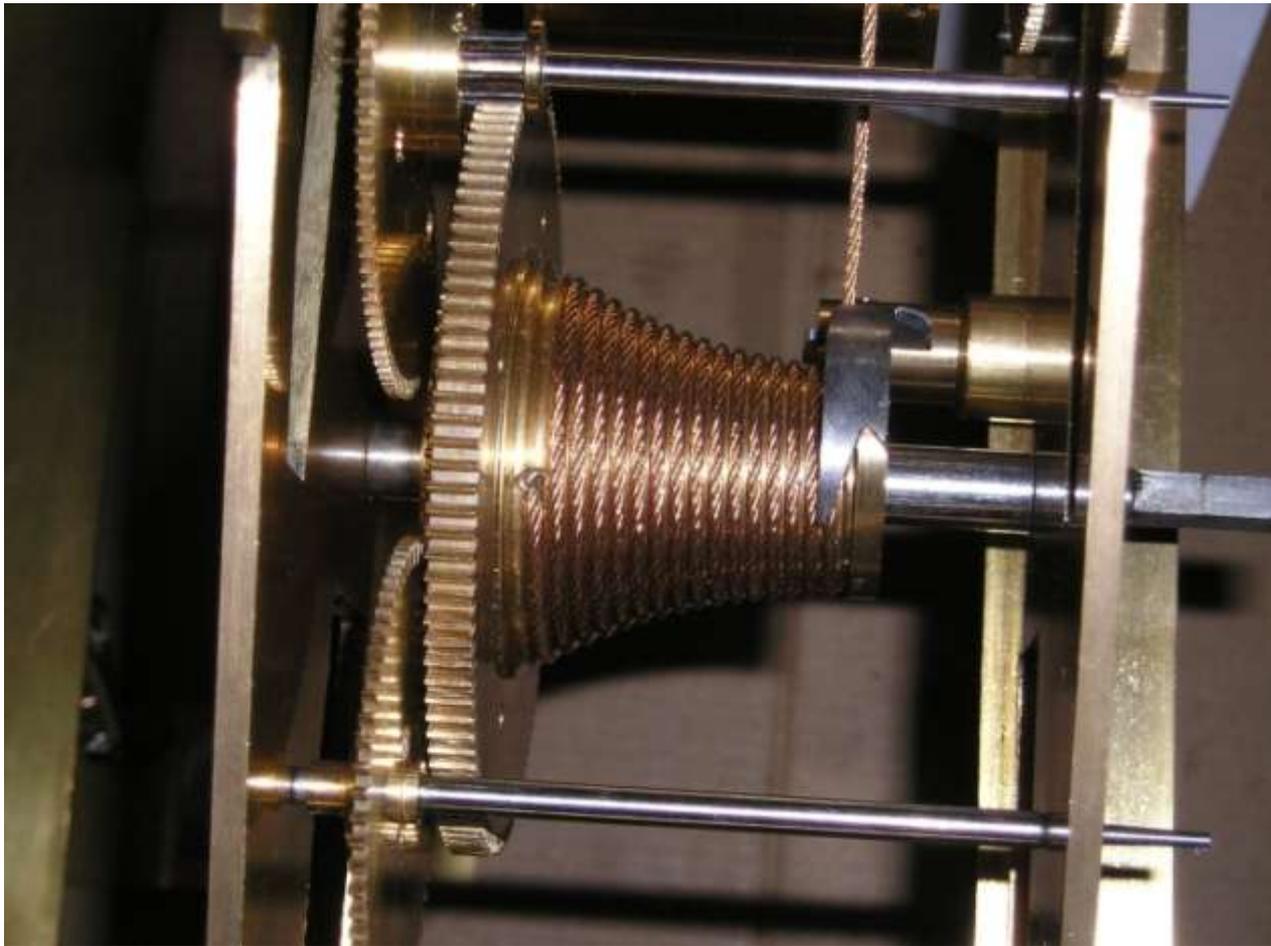
Reassembly



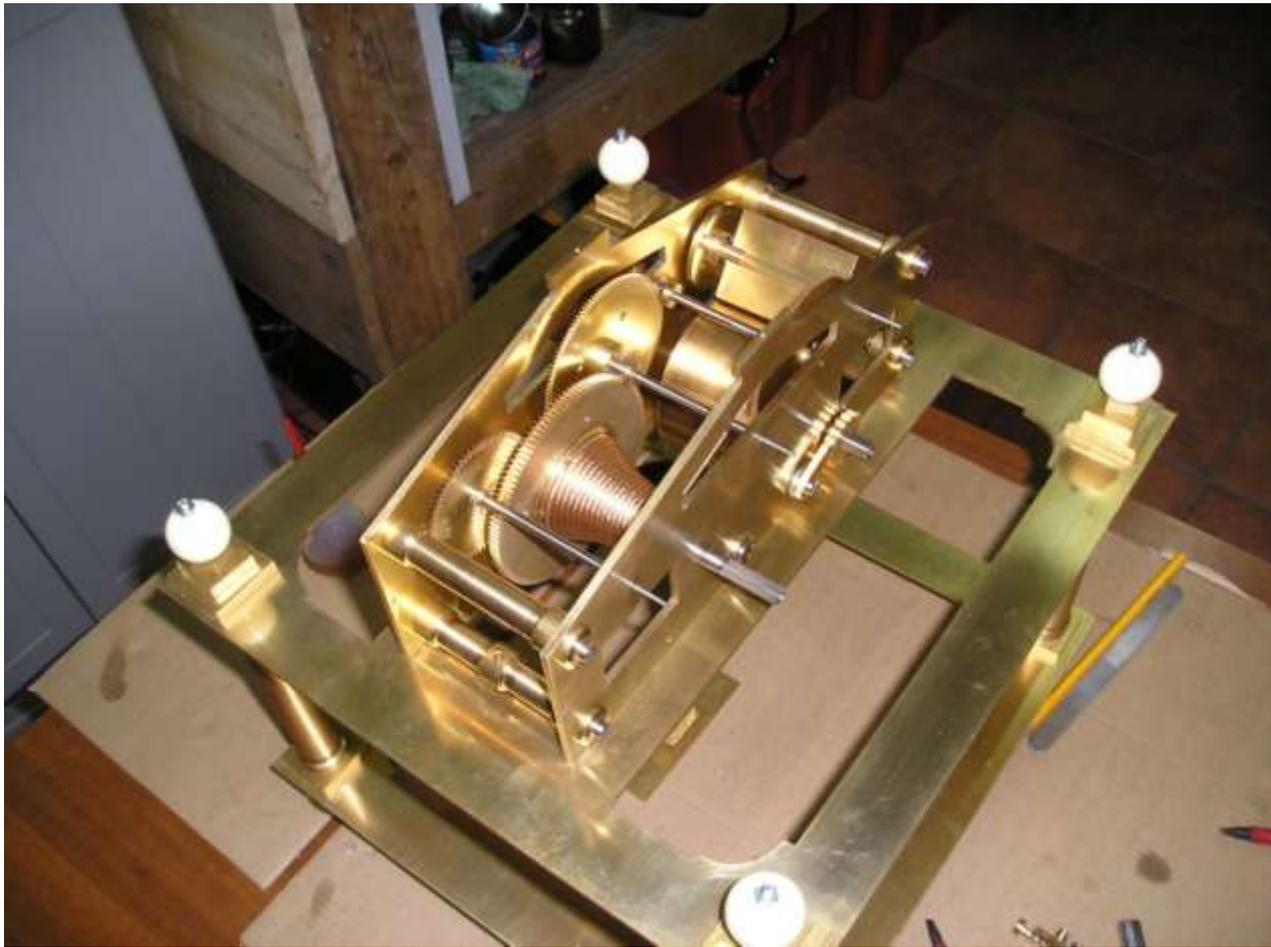
½ minute stop pins in place.



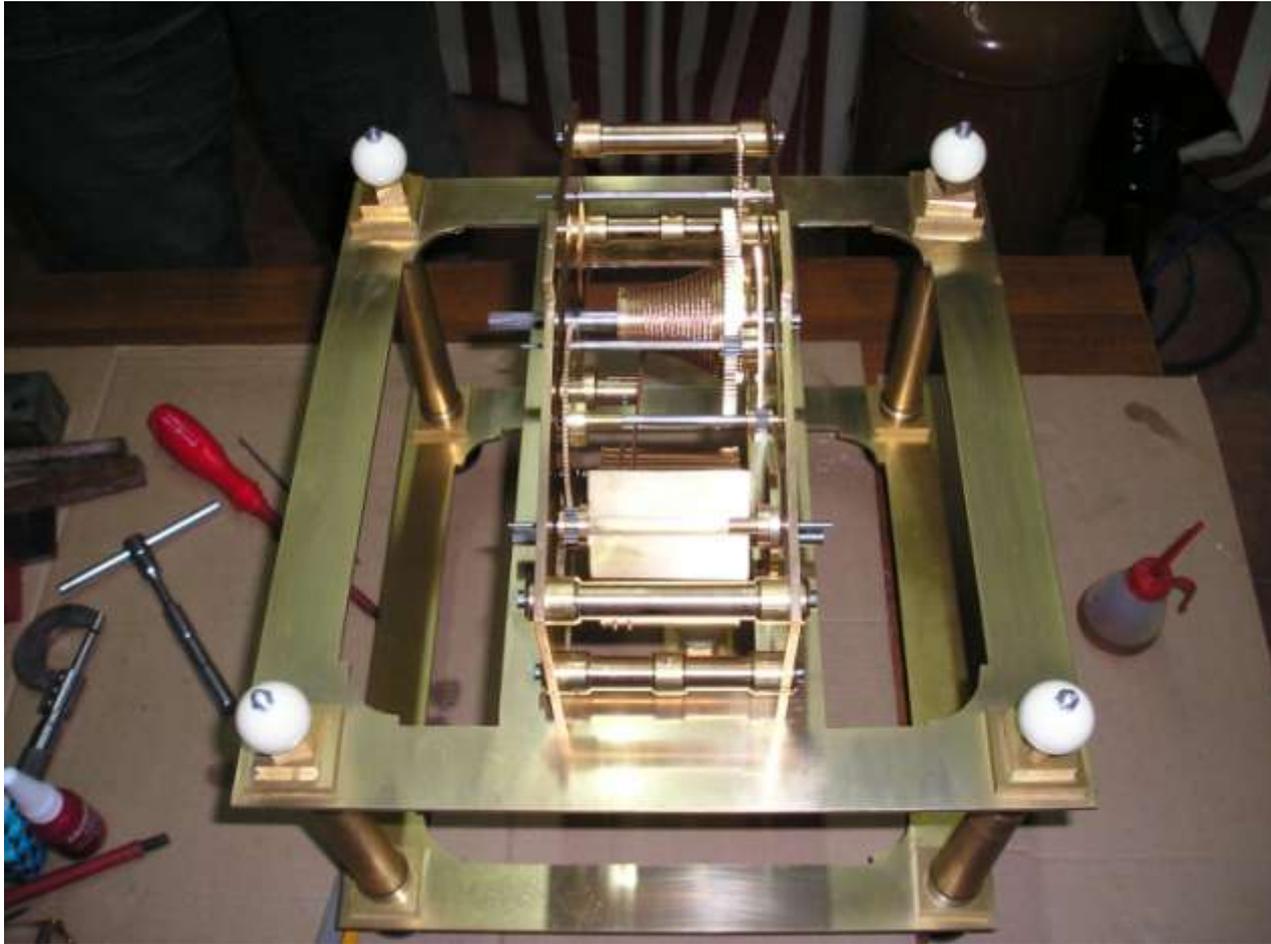
Fusee stop work.



Fully wound for test of movement components.



Running on test



End of test all OK.





Cutting triangular guides for tilting table

The scroll saw is modified to take a junior hacksaw blade this gives fine control. When cutting to a line.



Truing the cut sides

2 Grades of abrasive were attached to the marble surface plate with double sided tape to true the sides of the triangles accurately.



Marking out from master triangle.

Having cut the first triangle all subsequent ones where marked from this master.

First table triangles cut



Identical triangles.



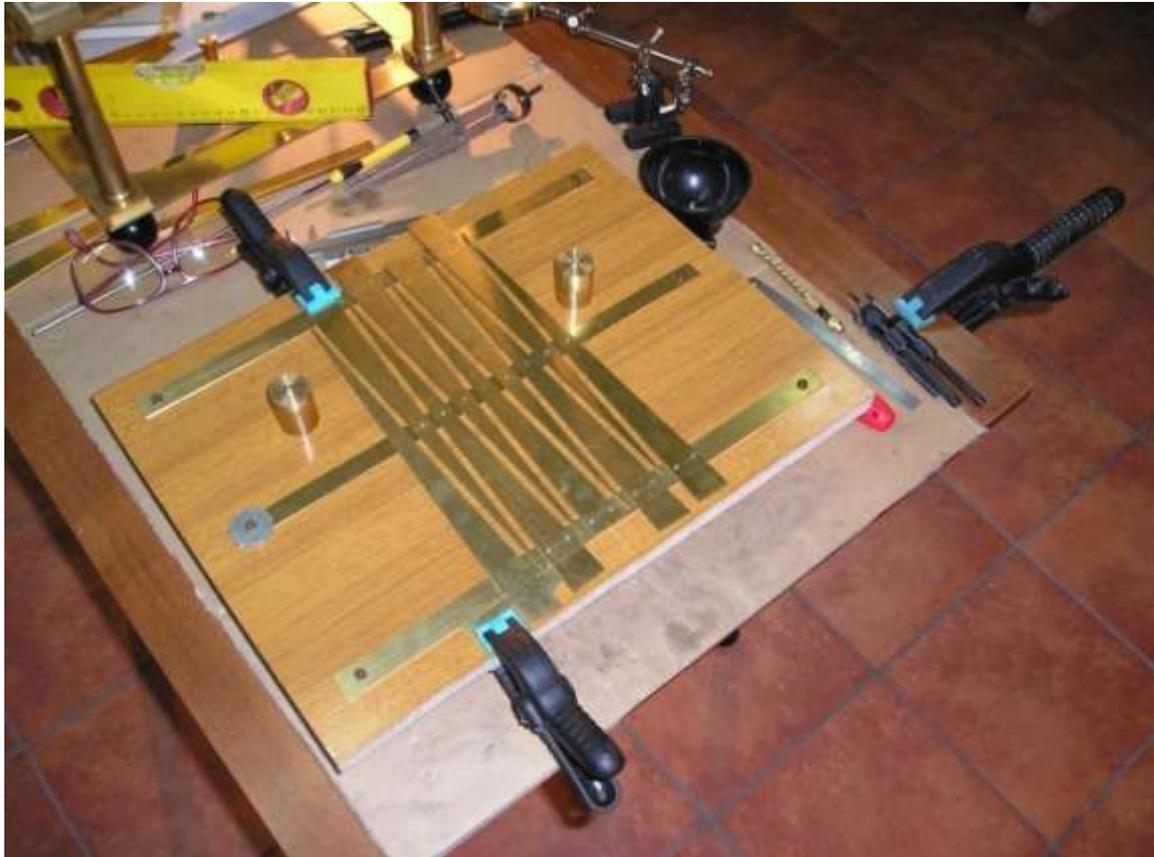
A set of guide triangles.



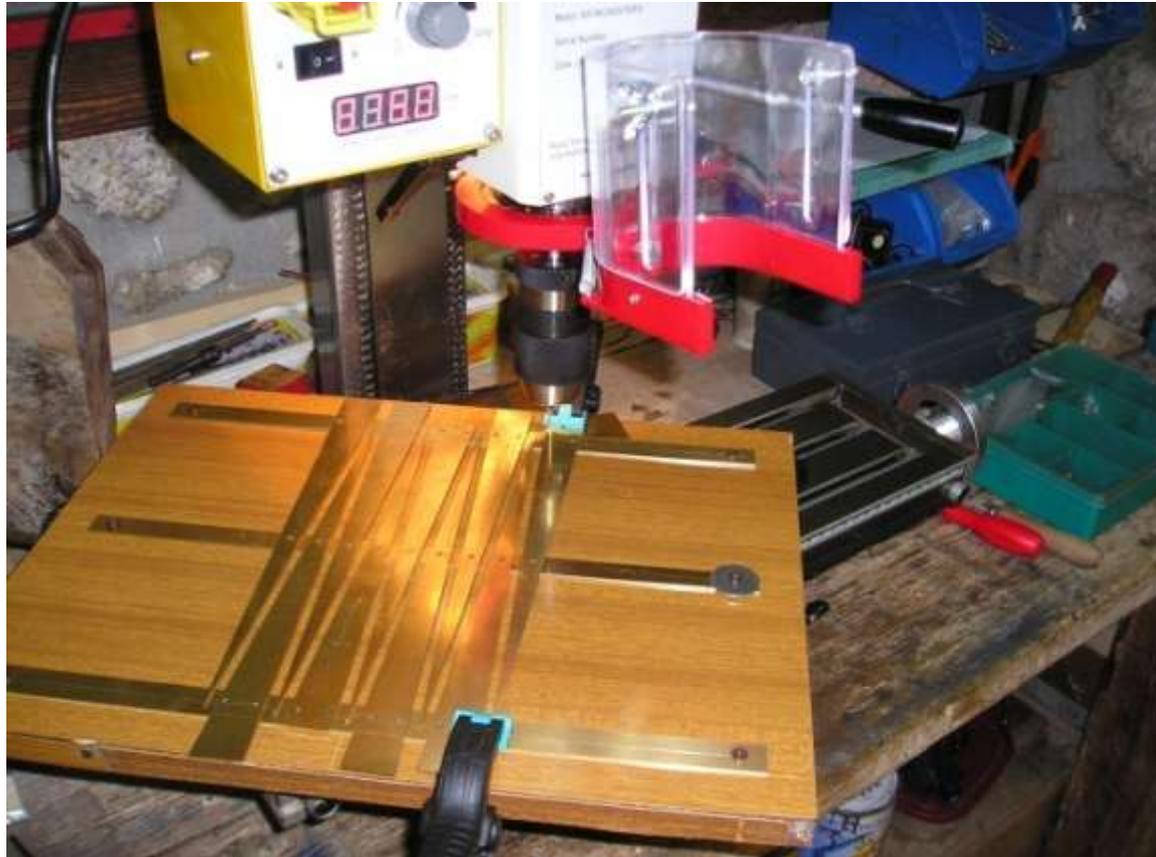
Setting out the tilting table

- The first guide triangle is aligned to the bearers with great care . Subsequent guides are aligned to this master using button spacers.





Building up the table.



Drilling the triangles

Extra throat depth is required to reach the centre bearer so the Champion 16 v mill was used.



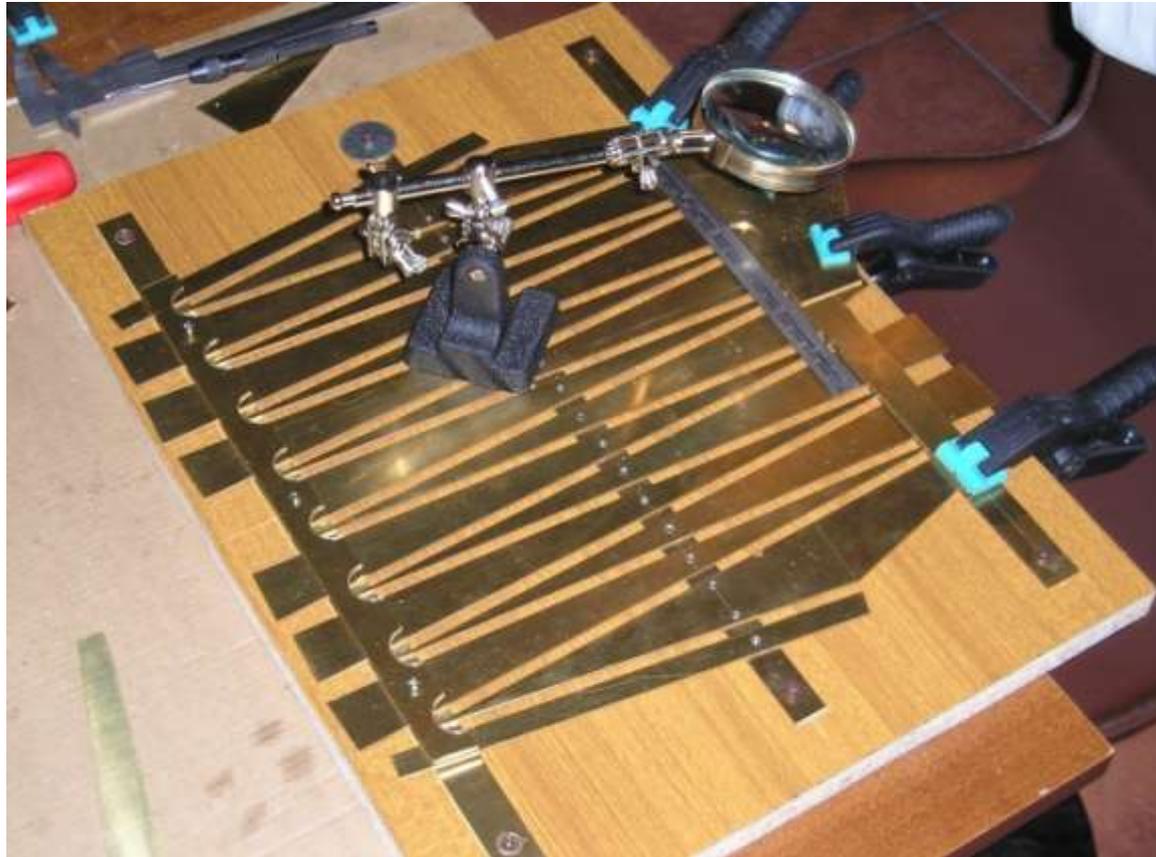
Making spacers.

The lathe is set up with a facing tool, parting tool and drill. So the spacers are made by simply drilling then moving the cross slide forward to face then back to part off.



14 identical spacers.

The spacers hold the ball guide strips at the correct height.



Cutting the ball guides

The guides reverse the ball at the end of each triangle without disturbing its momentum.



Testing with the ball

Small corrections are made to ensure a smooth run. The end triangles have a larger angle to increase the speed of the ball at the start and end of the run.



Fitting the tilting table



Pivot assembly

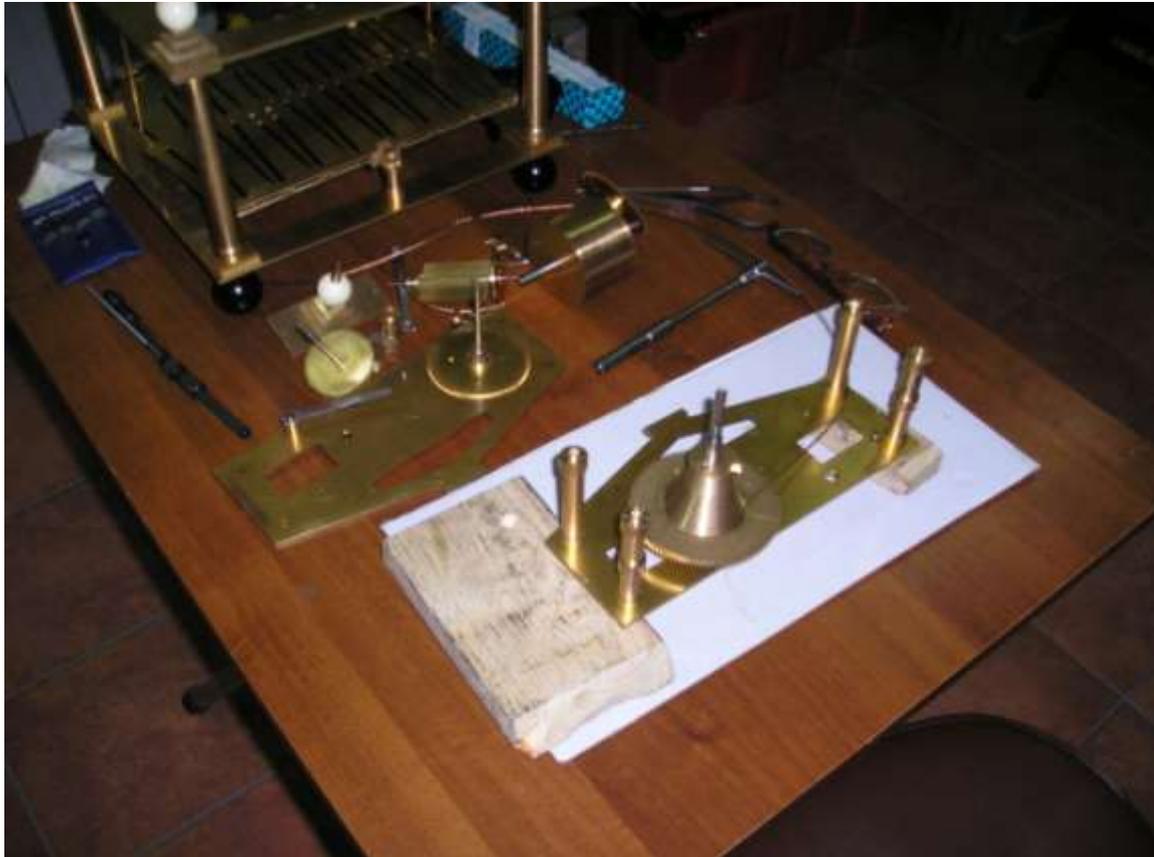


The crank throw can be adjusted to speed or slow the clock by altering the tilt of the table.



First test run

Yes it runs, What a Relief!!: note the trip levers at the end of the ball run, to unlock the stop pins, and tilt the table in the opposite direction.



Cleaning and correction.

Attention to pivot freedom etc.



Second test run.

Cold conditions in the workshop affected the reliability, so the clock was moved indoors.



Proving trial.

The clock now has temporary hands and is being run to check reliability and time keeping, gradually increasing the running period.



Remedial work

Movement to be stripped for inspection.



Remove centre wheel spacer.



Installing new modified centre pinion to eliminate the need for the spacer.



Handle fitted to lathe for manual operation.



Unwinding the spring

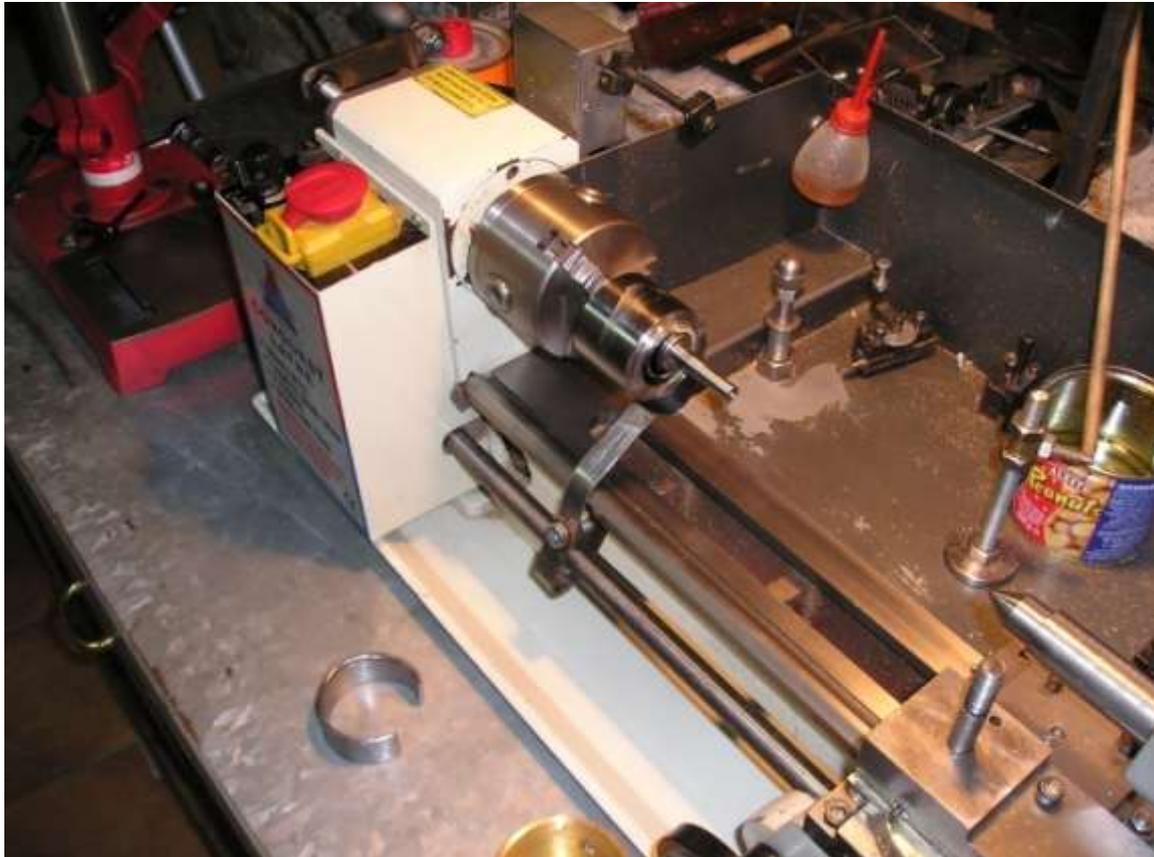
When the clock was fully wound power was lost, due to inadequate lubrication, it was decided to change from the recommended oil to grease .



Spring cleaned and ready for greasing.



Rewinding the spring

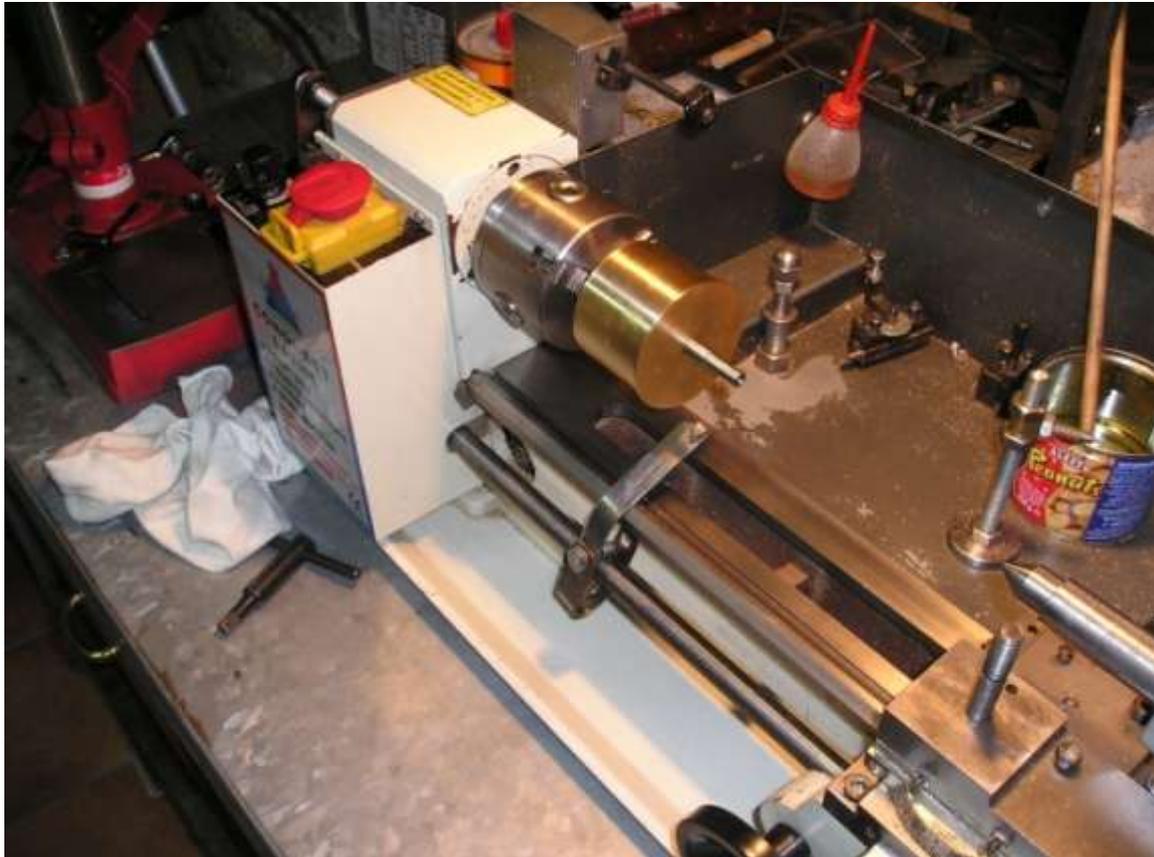


Wound spring ready to transfer .(note C clamp on table)



C clamp placed over spring to retain the coils.

The C clamp allows the end of the spring to be free to locate on the barrel hook.



Spring hook released and barrel fitted over the assembly.

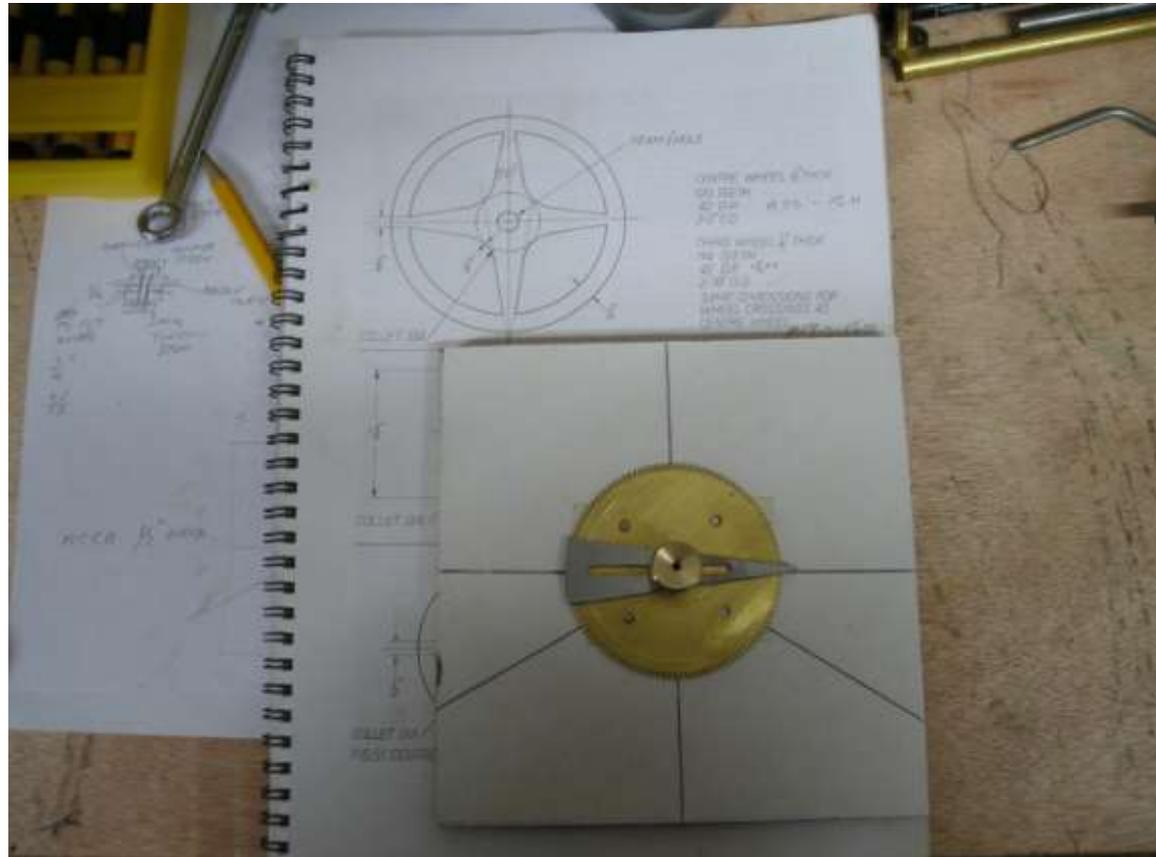


Barrel turned around, spring rewound and clamp removed.

Removing the spring is the reverse procedure



Greased spring in barrel.



Fixture for marking crossings on the wheels.

This fixture works very well allowing different widths of crossing to be marked also 4 or 3 spokes. The centre stud is centre drilled to take one leg of my odd leg dividers so the circular lines can be drawn easily.

The wheel is held in place by double sided tape



Crossing out the wheels.



Adding the ball feet location pins.



Marking the dial rings.

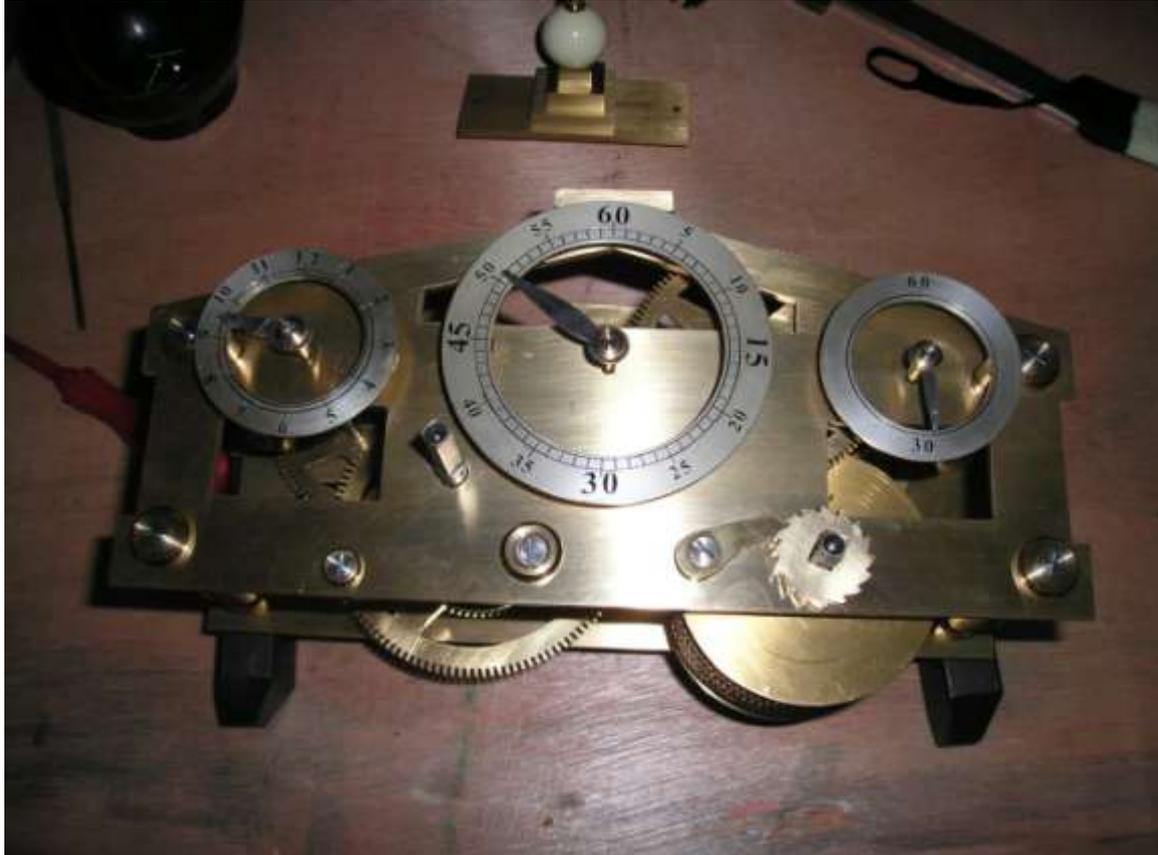
The dividing head was set up to give 6° intervals ($1 \frac{1}{2}$ turns) to mark the 1 minute divisions.



Dial rings ready for silvering.



Completed dials ready for mounting



Dials mounted on movement.



Marisa's CONGREVE up and running.

Mounted on the plinth with the key.

Running in the work shop prior to its final polish.



Continuing with No 2.

The movement is assembled and work on the tilting table started.



Workshop set up for second tilting table.

This time the mill and two pedestal drills Are set up with tapping size..clearance size...and countersink, helping the flow of work, there are 49 10BAScrews In the guide triangles alone.



Guide triangles in place.

The work continues.



Number 2 running



Two running clocks



No1 about to depart.