Synchronome Slave Movement, Maintenance and Set Up.

Dismantling and Cleaning

It is important that the movement is clean and free of any unintended friction from old gummed up oil etc.
To clean the movement fully, it must be removed from the clock housing and dial, and the details of how this is done will vary a bit from one clock to another, but a few general points are worth noting.
The assumption is that a basic wall type dial with a standard slave movement is being maintained. Note that this covers the normal size movement – and can be interpreted to the smaller and larger versions. The various 'silent' versions, and some early variants (such as double locking) are broadly similar, but with a number of detailed differences.

Start by removing the rear cover, front bezel with glass, and putting carefully on one side. Note that Bakelite housings are brittle and need care in handling. Spun metal housings often use spring clips to hold the dial and glass in the spun case from behind. These need care in removal.

Next remove the minute hand. This is held in place by a tapered pin (and sometimes various washers, see Figure 1) and is often a tight push fit through the square arbor. Note the position of washers used where applicable.

Figure 1

It should be pushed out with a set of pin pushing pliers, or pulled out with needle nosed pliers. See Figure 2.

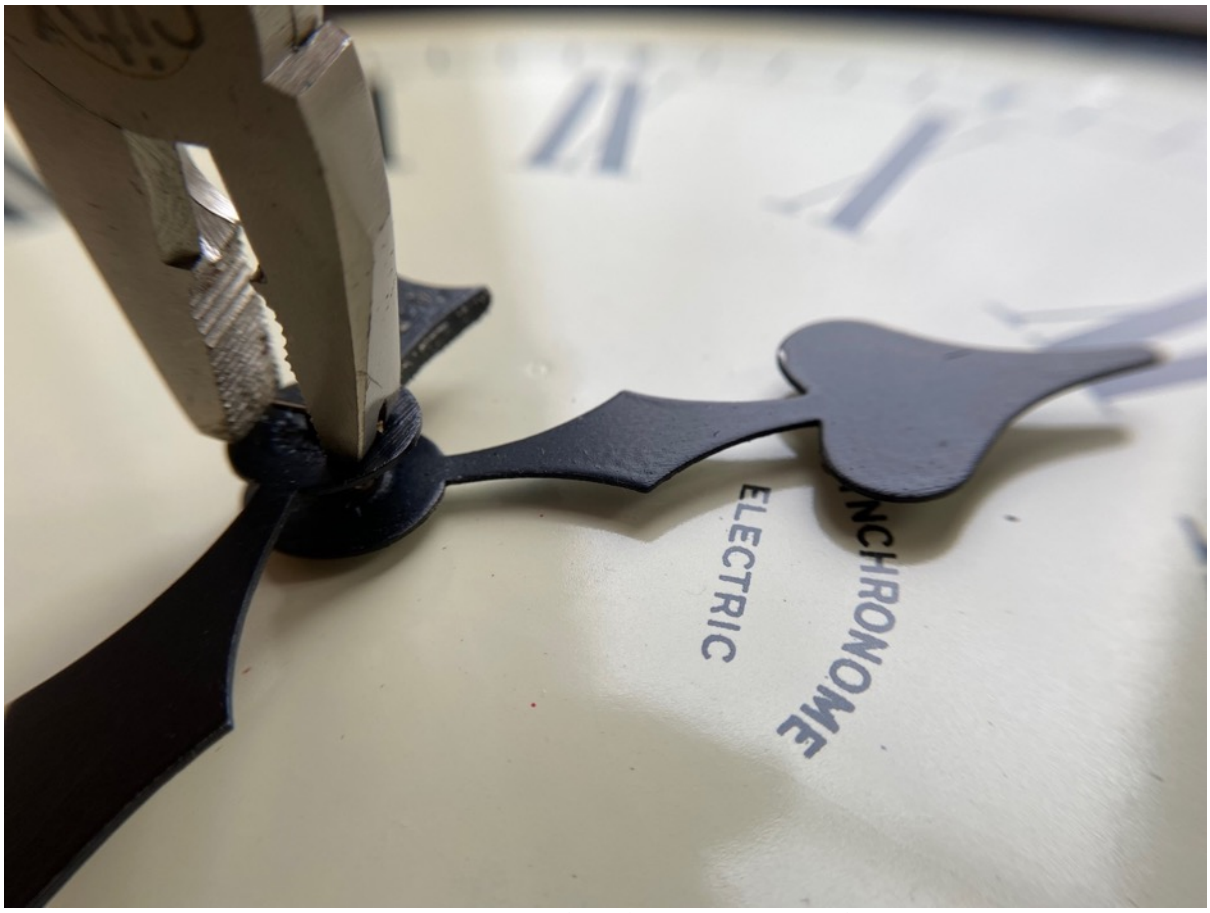

Figure 2 – Using pin pushing pliers to remove tapered pin.

With the pin out, the minute hand can be removed. Note that the hand collet can be very tight on the square arbor. I use a Bergeon type 5797 adjustable hand puller (see Figure 3), but other types are available, or hand pulling levers can be used – taking care to both protect the dial, the hour hand and apply force on the (usually brass) collet, not the soft (possibly aluminium) hand.

Figure 3 – Using a hand puller to remove the minute hand.

Put the hand in a safe place because the hands are soft and easily bent.

Next remove the hour hand. This is held in place by being a friction fit on the hour hand pipe. The hand puller is again useful if available and if using levers, take care not to mark the dial. Again, put the hand in a safe place.

The dial should now be removed (note that occasionally movements are fitted directly to the dial, not a plate under the dial). Dials are usually held in place by several screws around the outside but may on older dials be 'glued' in place by a black pitch like substance called

Chatterton's Compound. This has usually lost its grip and gone hard and brittle. Dials are often thin and easily damaged.

The movement itself is held in place in its 'tin' by two 8BA countersunk screws through the plate under the dial located either side of the hands arbors (locations shown by red pointers).

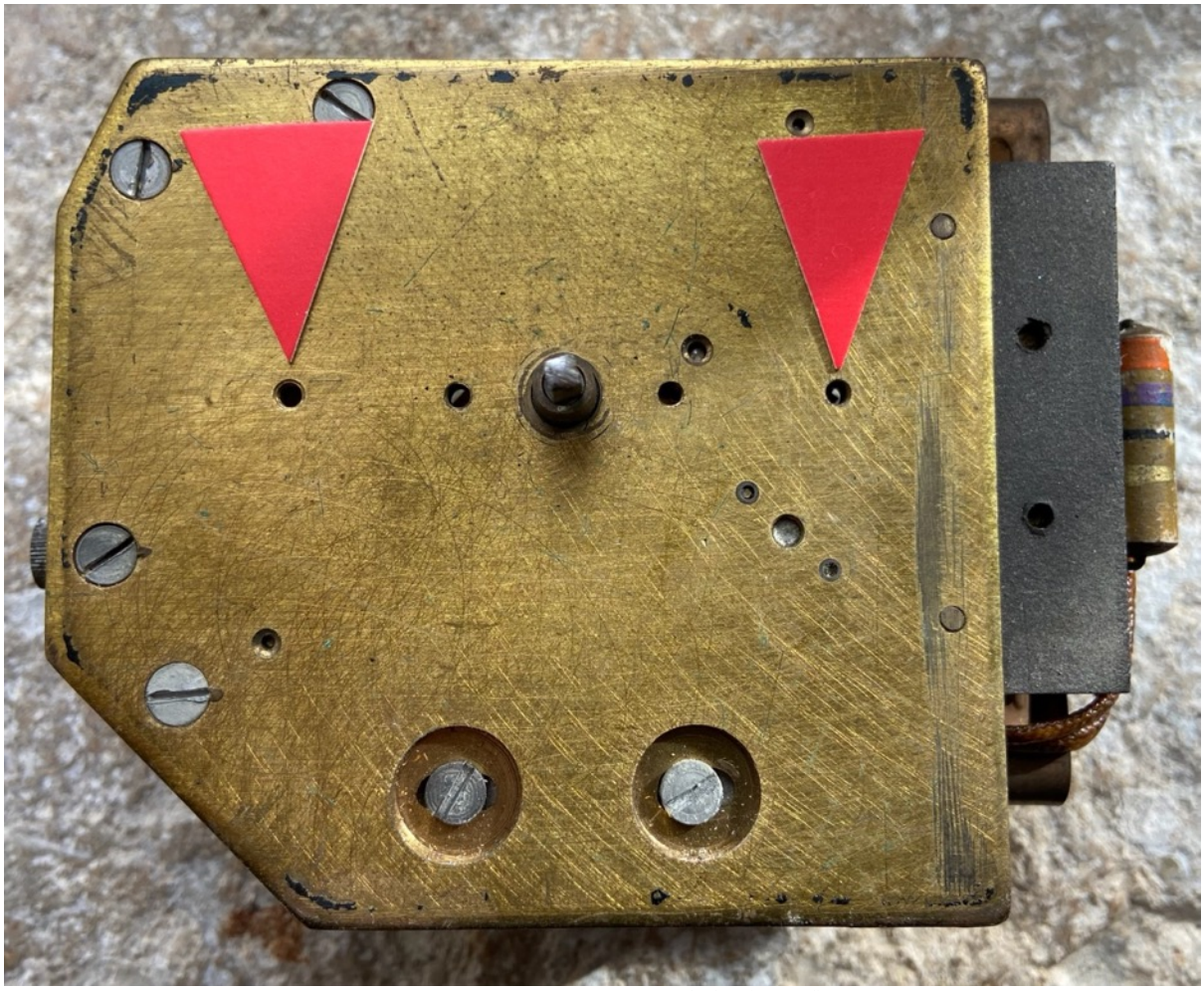

Figure 4 – Movement mounting holes (typical).

Remove these and the movement, tin and possibly a rubber spacer (usually very hardened) can be separated.

The movement can now be dismantled. It is fairly self-explanatory, but the following notes may help;

- Take great care with the wires/coil 'tails' as they are brittle and easily broken.
- It is usually necessary to loosen/remove the coil from the main plate to allow the 120 tooth wheel to be removed, which is necessary to clean the minute hand shaft properly (where it passes through the hour hand pipe).
- The pivots, pivot holes, minute hand arbor and particularly the inside of the hour hand pipe need the old (possibly now gummy) oil cleaned off and the holes pegged out.
- The click/pawl, 120 toothed wheel and backstop need to be clean and the working surfaces are not oiled and should be clean and dry.
- The pivots, holes and the axle (only) of the click/pawl should be very lightly oiled with suitable light clock oil.

- The surface of the armature return spring should be clean.
- The motion work driving the hour hand pipe should be cleaned and its pivots oiled.
- The armature return spring should contact the back of the click near the top.

Once completely clean, reassemble the movement, but do not reassemble into the case yet.

Adjustment

One key adjustment can *only* be done whilst the movement is out of the case – and that is the coil position. That MUST be done before the movement is assembled onto the dial. The coil is usually held by two cheese head screws in slots, allowing a little adjustment of the iron yoke and coil core.

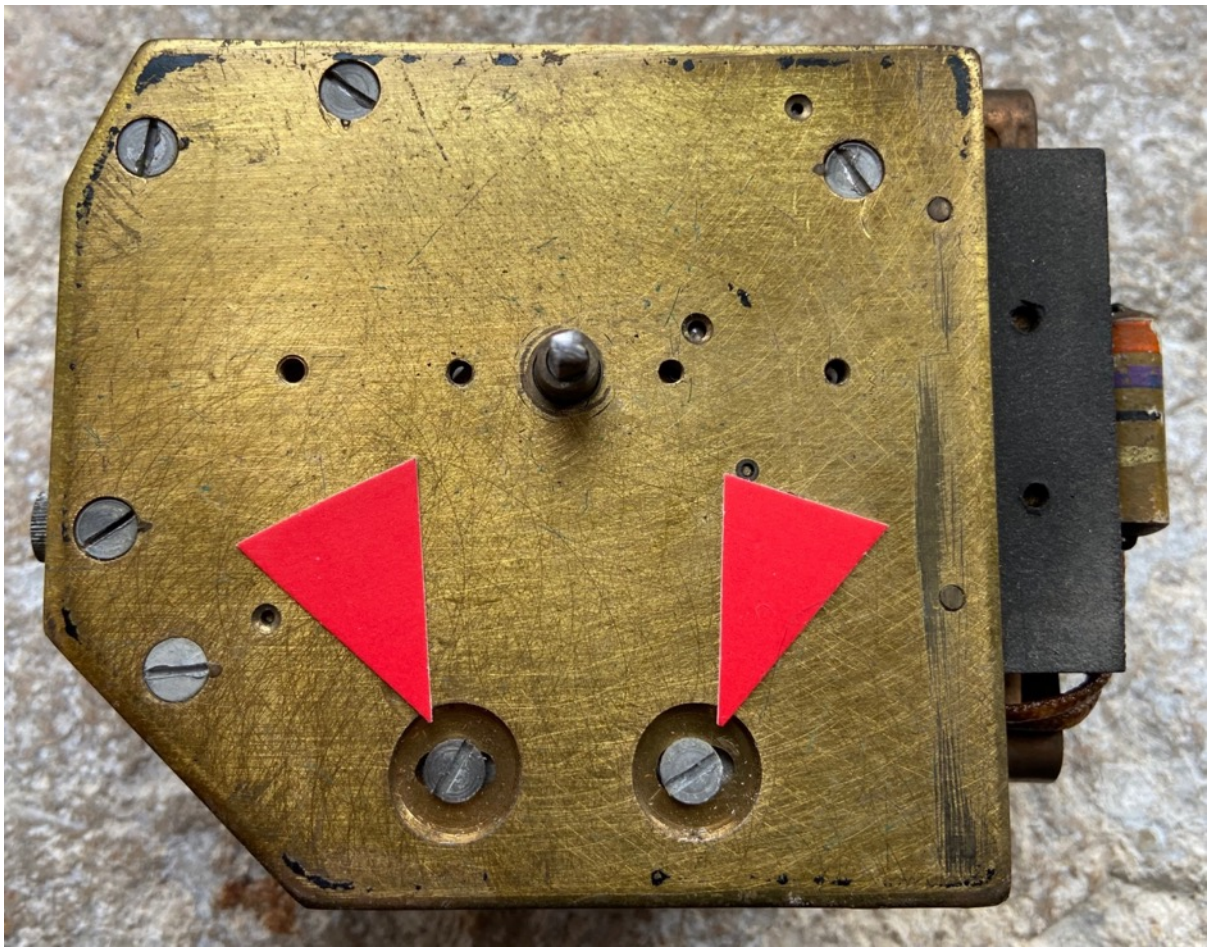

Figure 5 – Coil securing screws in their slotted holes

What is needed is that the magnetic circuit has as small a gap as possible consistent with allowing sufficient movement to drive the clock. It is also necessary that the iron piece does not make 'iron to iron' contact with the coil core – or the small permanent magnetism may cause it to stick in place. This is achieved by a thin paper spacer usually stuck on the iron piece of the moving armature. If this is missing, it should be replaced. Normal paper thickness is fine and masking tape works well.

Hold the movement in the normal operating orientation and looking from the back, identify the following items and adjustments;

1. The backstop pawl – which is the non-adjustable piece that prevents the 120 tooth wheel being able to turn backwards – and has its arbor/pivots at the top left as the movement is viewed. There should be 4 tooth ‘peaks’ between the click/pawl and the backstop. Note that this ‘4 tooth rule’ also applies to the small (No 1) movement, and to at least some larger movements.

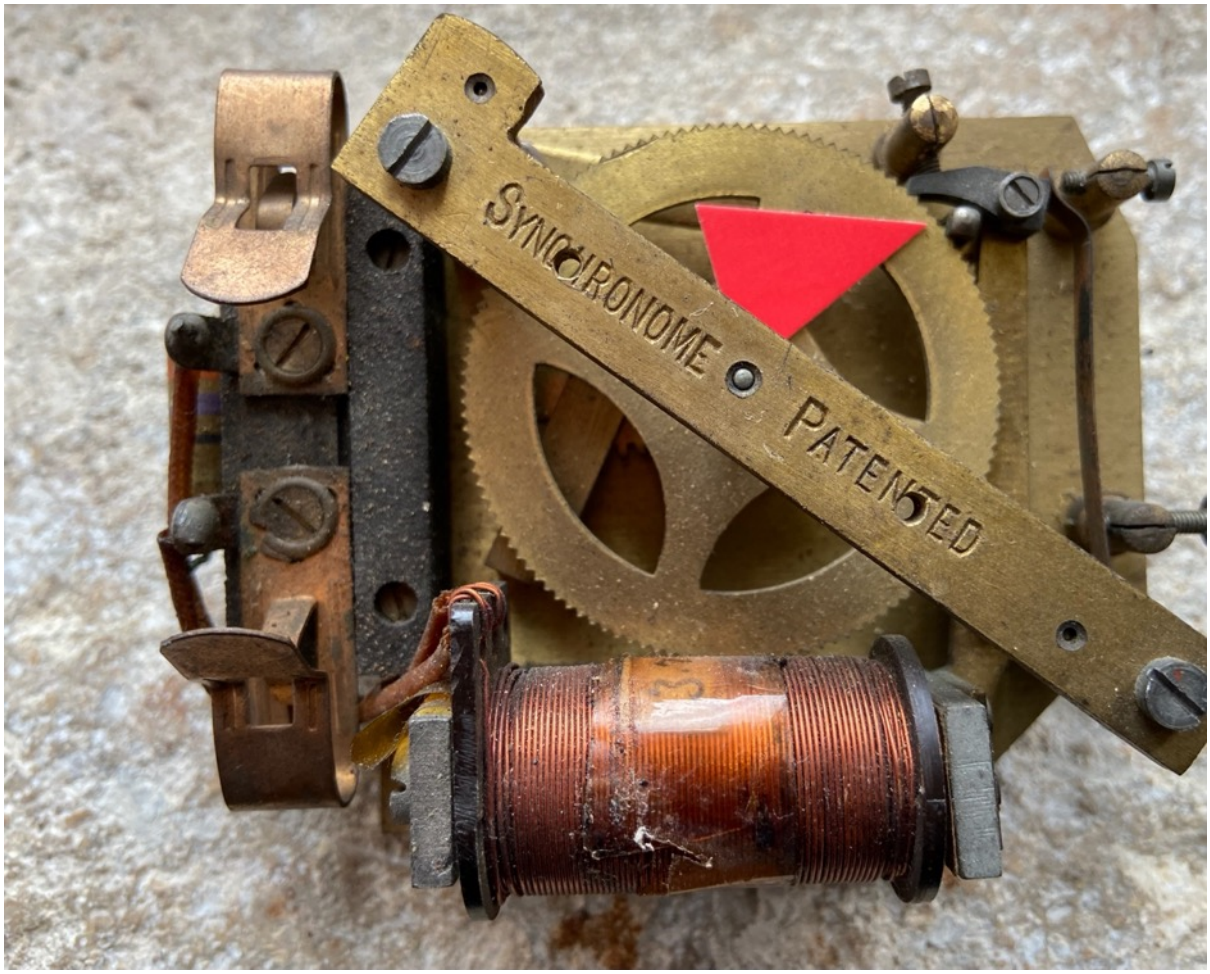

Figure 6 – Backstop pawl.

2. The click released adjustment stop – at the top right of centre and which limits the ‘released’ (i.e. coil not energised) forward movement of the click. Check it is free to adjust and if needed oil the threads sparingly.

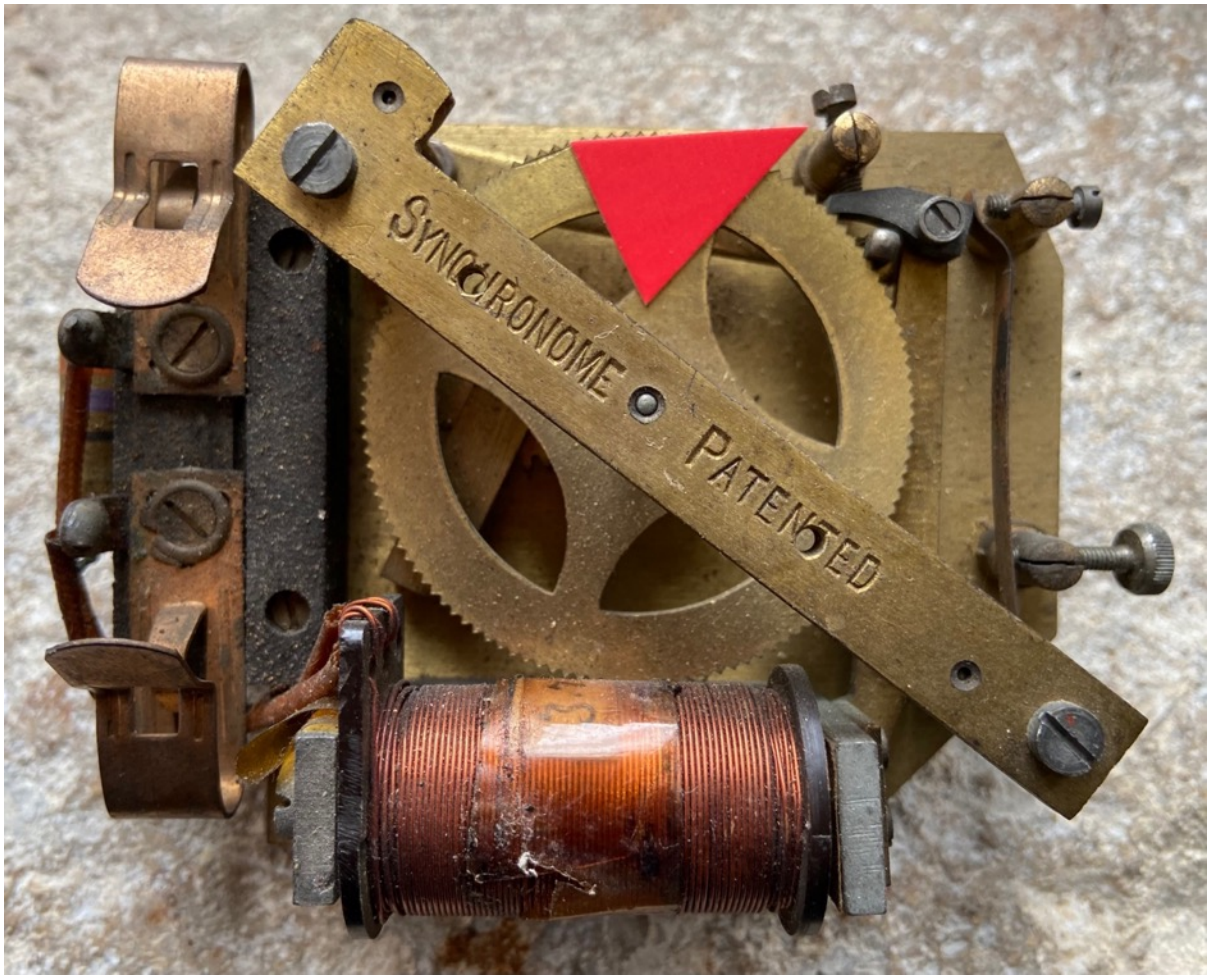

Figure 7 – Click released adjustment stop.

3. The click energised adjustment stop – at the top right side which limits the travel of the click when the coil is energised. Check it is free to adjust and if needed oil the threads sparingly.

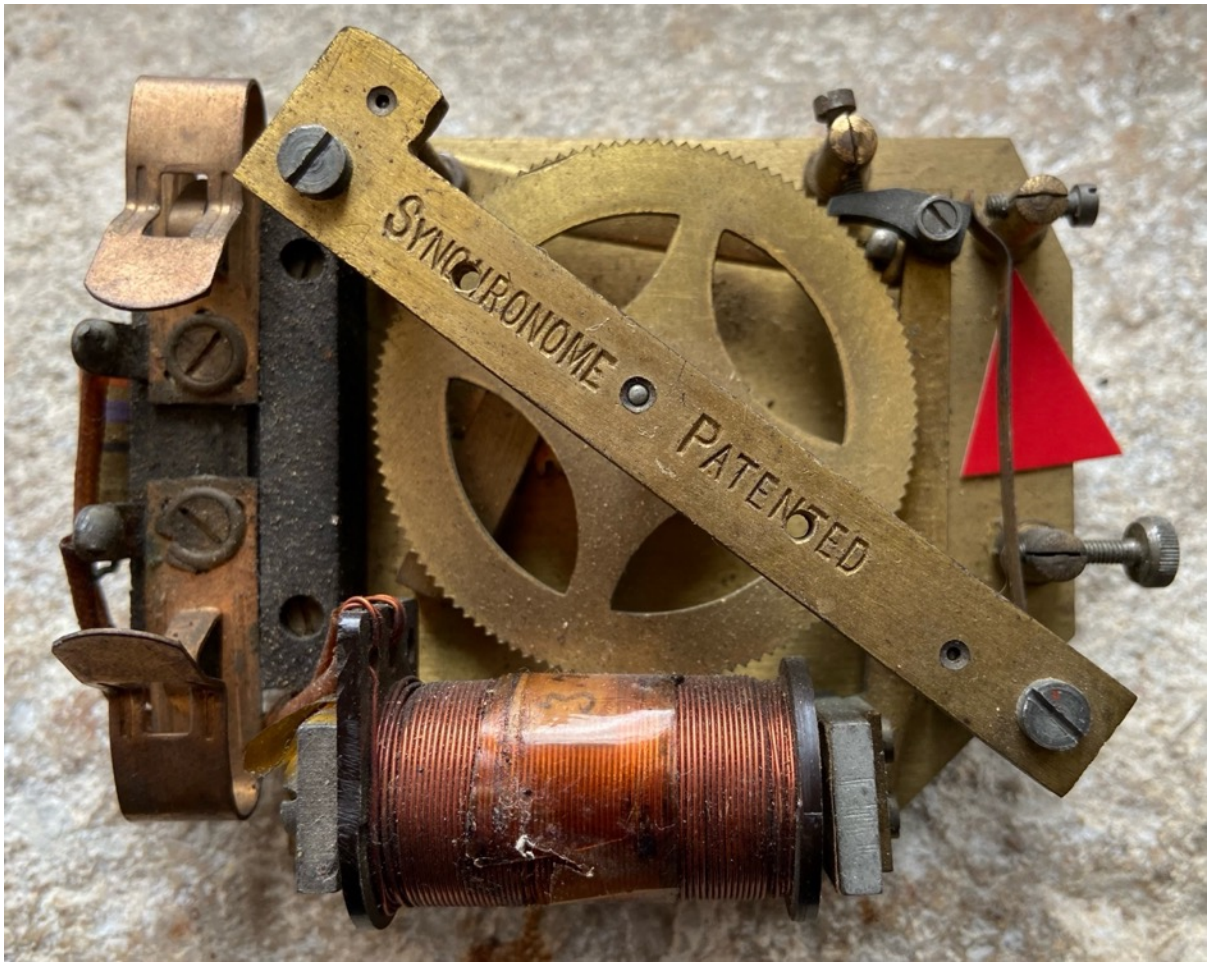

Figure 8 – Click energised adjustment stop.

4. The two screws holding the coil/yoke assembly, which should be just finger tight at this stage.
5. The tension adjuster for the armature return spring on the mid right hand side which should at this stage *lightly* tension the spring against the click. Again check it is free to adjust and if needed oil the threads sparingly. Note that some very early clocks do not have this adjustment. In these – the whole pillar on which the spring is mounted may have to be rotated – which can only be done with the movement out off the dial, because the screw holding it passes from the dial side.

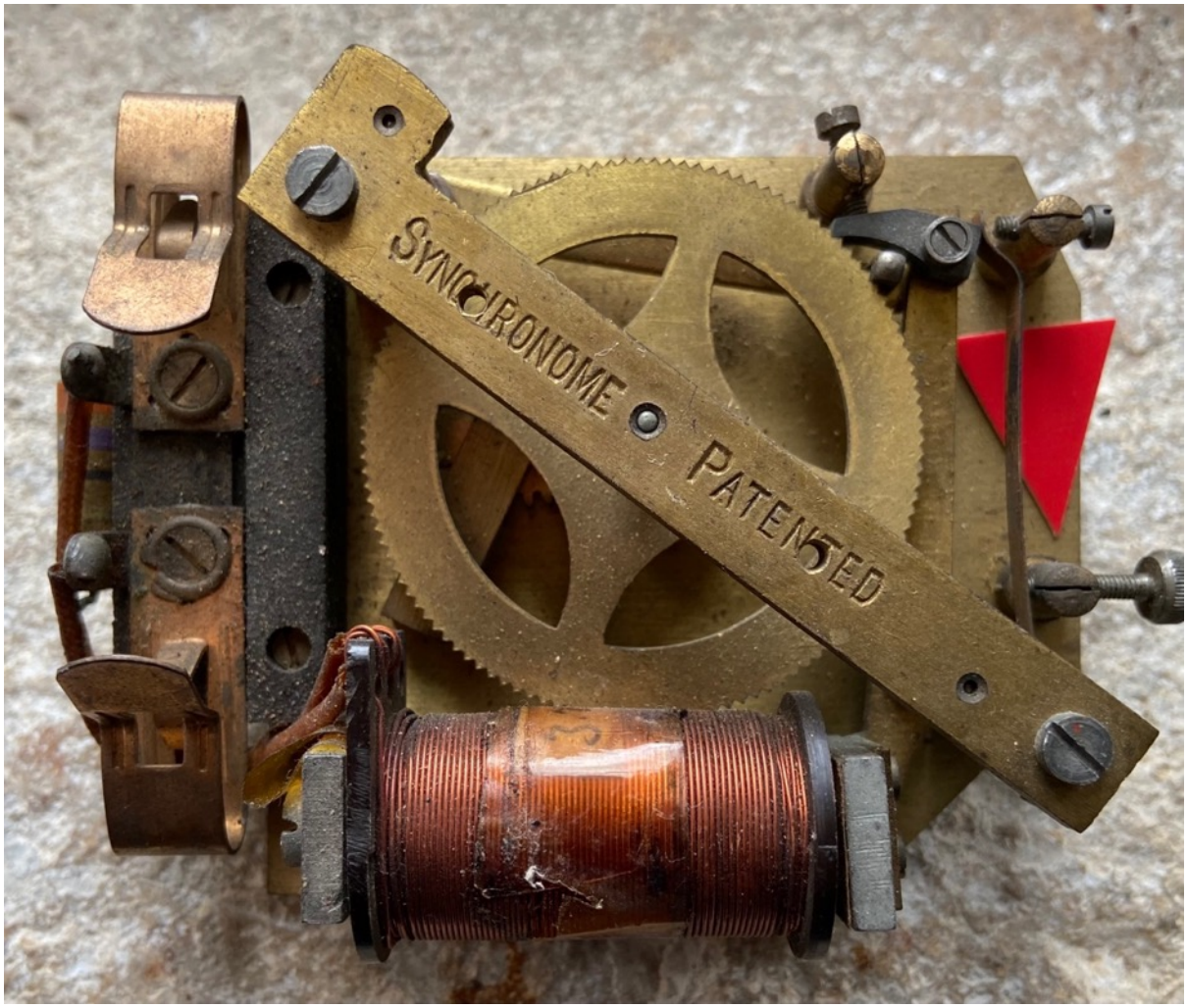

Figure 9 – Armature spring adjuster.

Adjust as follows;

1. Check that the movement works freely and correctly using a finger to operate the armature and that there is no significant friction. It is worth doing this for a full rotation of the 120 tooth wheel, because a slightly out of true arbour may cause friction only in some positions. Each operation of the armature should gather one tooth and advance the minute arbor 1/120 th of a revolution on release. Note the backstop pawl should drop into place behind the tooth preventing the 120 tooth wheel reversing as each tooth is passed. This is 4 teeth from the tooth acted on by the click/pawl. Check that 4 tooth peaks are between the backstop and the driving click/pawl. If it doesn't advance, check there is sufficient tension in the armature return spring and increase slightly if needed. If there are not 4 tooth peaks, adjust the click released adjustment stop such that are 4. This is important because the mechanics may allow operation with only 3 teeth in between – and this will give an excessive gap in the magnetic circuit leading to an inability to set the other items correctly. Check that the armature spring contacts the rear of the click/pawl near the top.
2. Now adjust the click released adjustment stop (Figure 7) such that the click/pawl advances the 120 tooth wheel just enough to give a very small clearance between the backstop pawl and the tooth against which it acts. This should be very small to allow for tolerances, thermal expansion etc. It is important that this stage to check and

ensure that this clearance applies for a *whole rotation* of the 120 tooth wheel because it is not unknown for these to be very slightly 'out of true'. Too much clearance will give a little recoil at the minute hand – which is acceptable, but too little will prevent operation.

3. Next adjust the click energised adjustment stop (Figure 8). Using finger pressure, simulate the operation of the coil and move the armature such that the click/pawl gathers one tooth. Adjust the click energised adjustment stop to allow the pawl to drop behind the tooth to be gathered again with a little clearance. Once again – check for a whole rotation. Note: the coil and yoke should have enough clearance at this stage not to impede the movement of the armature – which is why it was left loose.
4. Now the coil/yoke assembly position is adjusted and fixed. Note that the pole piece on the armature should have a thin paper covering to prevent iron to iron contact. Masking tape will suffice. Using finger pressure – simulate the armature energisation – then with the armature held in that position, slide the coil/yoke assembly towards the armature such that it just clears – and tighten the adjusting screws (Figure 5). Note that there is some 'alignment' adjustment available and ideally the 'gap' in the magnetic circuit should be as small and even as possible – and that a 'gap' must be present both between the central coil core and the armature *and* the yoke and the armature (against the baseplate). If there is no gap, the tooth may not be gathered due to limited armature movement – but if there is too much gap, then the magnetic circuit will be weak and operation may be unreliable.
5. Now to set the tension for the armature return spring (Figure 9). This is set to operate at 330 mA normal operational current but should be set as follows. Set the power supply to deliver 330mA through the circuit (typically takes about 1 – 1.5 volts) and check for correct operation. If operation is unreliable, adjust the spring tension accordingly. Then reduce the current to 220mA. The movement should 'just' operate at this current. Reduce the tension to achieve this state (note final adjustment may be required when assembled with the hands in place).

Reassembly

Reassembly is done by reversing the dismantling process, but note the following;

- Thoroughly check operation – especially the coil position before reassembly because this adjustment cannot be accessed once assembled.
- The 8BA screws holding the movement must not be too long because they may foul (and in the limit badly damage) the 120 tooth wheel, so if using replacements ensure that this cannot happen
- When fitting the minute hand, some hands are balanced with a counterweight on the hand, but some rely on a balance weight/non pierced section of the 120 tooth wheel to balance the hand – in which case this must be fitted in the correct orientation. Note that where movements or hands have been exchanged/replaced, rebalancing may be needed.

It is also worth noting before final assembly that the hands need to be free from touching each other or the dial/dial glass etc. Check at every stage. Slight adjustment of the minute hand (which has a square collet fitting onto a square arbor) to exactly align to the chapter ring divisions *may* be possible by moving the hand relative to the collet. Great care should be taken as the hands are usually aluminium and easily damaged.

Perform a final check with the clock in the vertical plane and it may be necessary to slightly adjust the spring tension to allow for the weight/balance of the hand.

Other types of movement

There are various other types of movement, particularly early variants.

Early movements including most standard size double locking movements (Figure 10) have no tension adjuster for the armature spring. Tension can be adjusted by rotating the pillar on which the spring is mounted – which requires the movement to be out of the assembly to allow access to the front screw. Minor adjustment can be made by very gently bending the spring.

Figure 10 - Double locking movement – detail showing additional locking.

The small (No 1 size) movements are set up just as the 'normal' size movement.

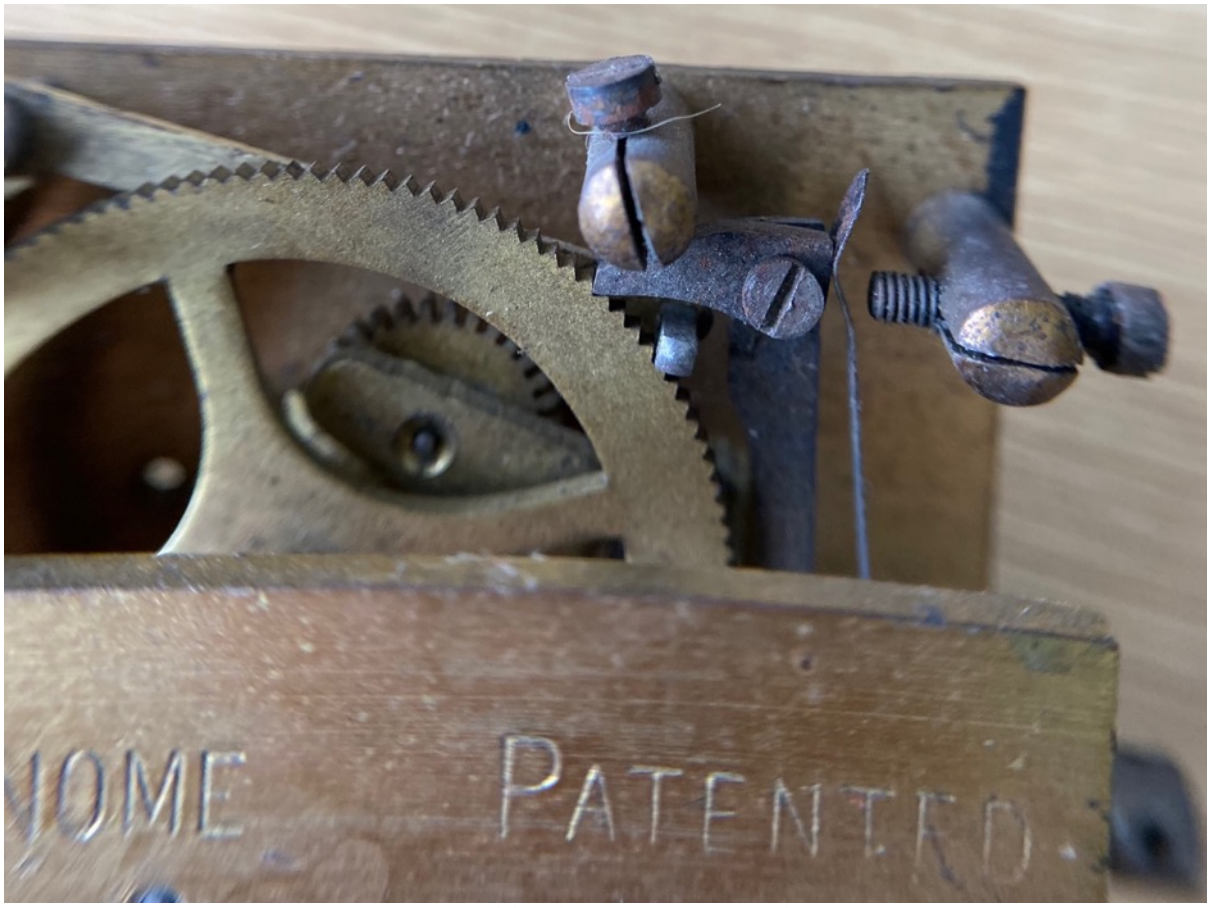

Figure 11 - Small (No 1) movement showing adjustments.

There are a number of types of ‘quiet’ movement. The same basic ideas apply for adjustment, but there are variations in design. Some units, but not all have an adjuster for the armature spring tension.

These notes are based on both my own ‘trials and errors’, and the material in Chapter 13 of “Synchronome : Masters of Electrical Timekeeping” by RHA (Bob) Miles. (AHS publication).

Silent movement – teeth between click and backstop