



January 2015

SMITHS CAR CLOCK REPAIR KIT

Introduction

These instructions explain how to repair a Smith's electric car clock mechanism using the Clocks4Classics repair kit. This kit uses a specially developed printed circuit board to replace the balance wheel contacts which are the usual cause of failure in these clocks. The Clocks4Classics kit is unique in that it uses a solid state sensor and microcontroller chip to replace the contacts thus providing a permanent repair.

The instructions are based around the repair of a Jaguar Mk2 clock, however, many other vehicles use the same Smiths mechanism and the Clocks4 Classics kit can also be used to repair these clocks. In most cases the basic fitting method will be very similar although the removal of the case and dial mechanisms may differ. Please note that for some clocks (e.g. MG Magnette) it is necessary to remove the hands in order to gain access to the mechanism.

Examples of clocks which have been successfully repaired using the Clocks4Classics kit include:

- Jaguar Mk 2
- Jaguar E-Type (Ser 1)
- Daimler V8 Saloon
- XK140
- Jaguar Mk IV
- Alvis TD21
- MG Magnette

Kit Contents

- Printed Circuit board with Microcontroller and Infra red sensor
- Brass spacer
- Balance wheel sticker
- Heat shrink sleeving

Things you will need

For fitting the Circuit board :

- Jewellers screwdrivers
- Small pair of long nosed pliers (electronics type)
- Wire strippers
- Small pair of wire cutters (electronics type)
- Hair dryer or heat gun (for shrinking the heat-shrink sleeving)
- Junior hacksaw and file (for modifying connector bracket)

For cleaning & Oiling :

- Clock oil
- Cocktail sticks
- Isopropyl alcohol (available from computer and camera shops etc).

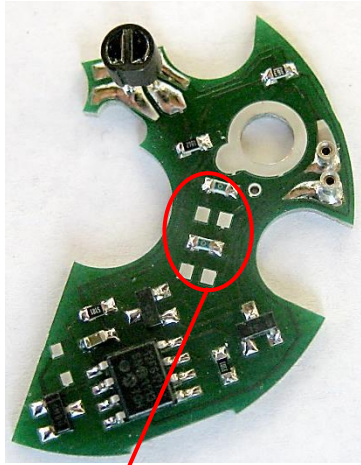
General Notes

- As with any electronic parts, it is important to take anti-static precautions when handling the printed circuit board (PCB). Avoid contact with objects which build up static such as nylon clothing or carpets. Avoid touching the components on the PCB directly. Before working on the PCB discharge yourself by touching a metal water-pipe , radiator pipe or similar.

Cleaning and Oiling

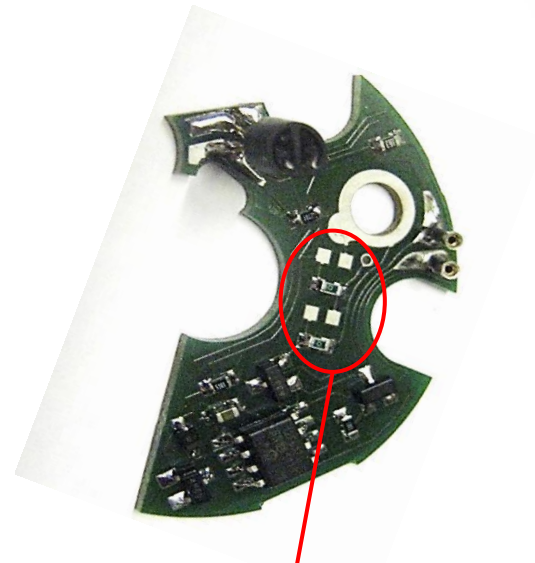
- It is recommended that you use this opportunity to clean the mechanism of your clock. This will help to ensure correct operation and will extend the life of the mechanism. Parts can be cleaned in isopropyl alcohol. Bearings should be cleaned out very carefully using isopropyl and a cocktail stick. Take particular care with the two jewelled bearings.
- Once you have cleaned your clock you can oil the bearings with a very small amount of clock oil. This is best applied using a pin or thin piece of wire. For the jewelled bearings the aim should be to use just enough oil to fill the dip in the bearing. Do not be tempted to use any oil other than other clock oil. Do not oil the gear trains.

PCB Polarity



Positive Earth PCB

(Resistors fitted in 1st and 3rd positions from top)

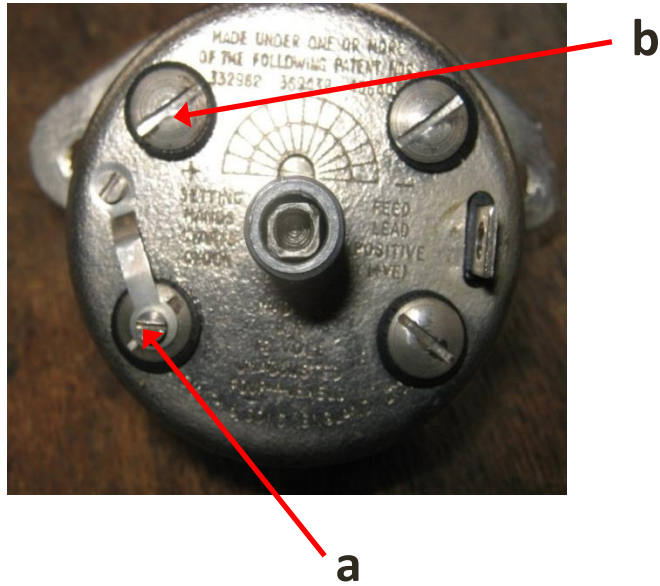


Negative Earth PCB

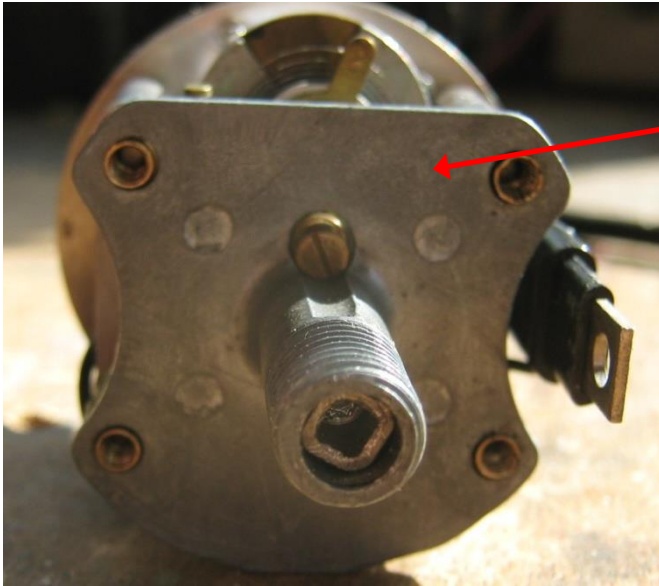
(Resistors fitted in 2nd and 4th positions from top)

Before Fitting your PCB, please check that you have the correct polarity for your vehicle (i.e. positive or negative earth). This is determined by the position of two resistors on the circuit board as shown in the pictures above. Please contact Clocks4Classics If you have the wrong polarity for your vehicle.

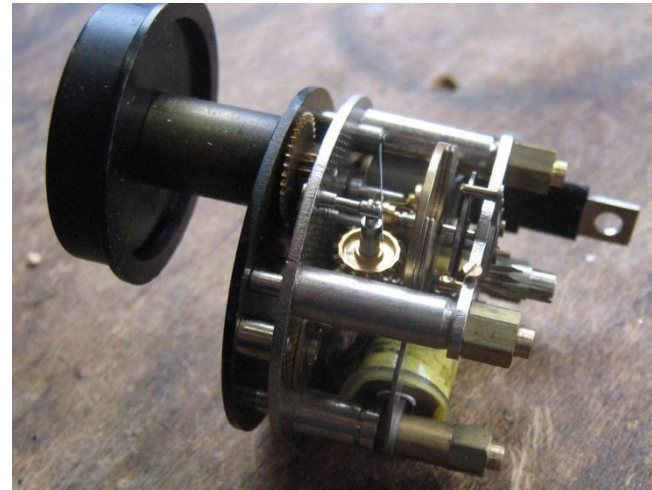
Fitting Instructions



1. Remove small screw (a)
2. Loosen small screw (b) and swing fuse to one side.
3. Remove 4 case securing screws (c) and slide case backwards off mechanism.

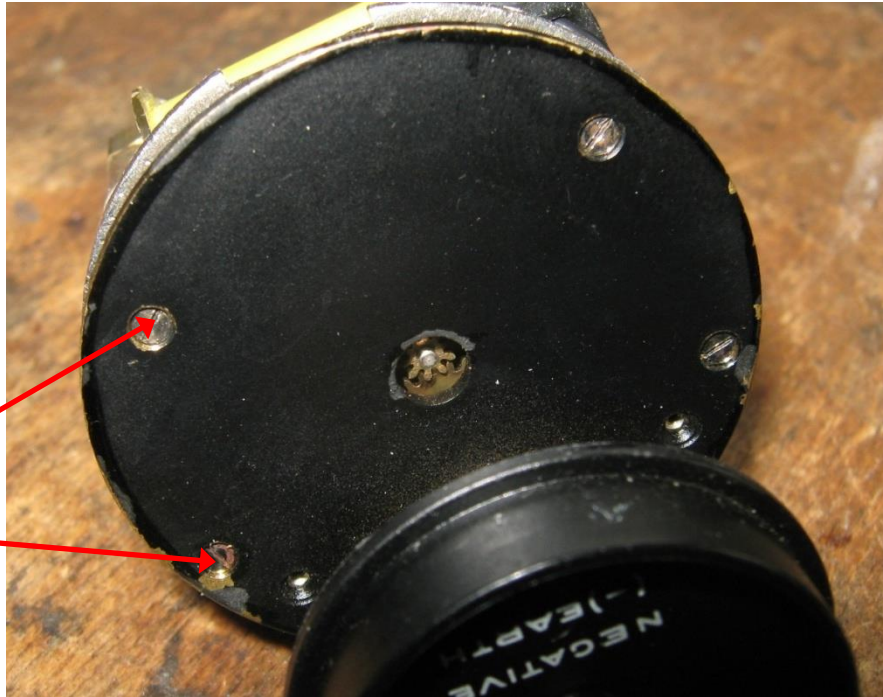


Back-plate



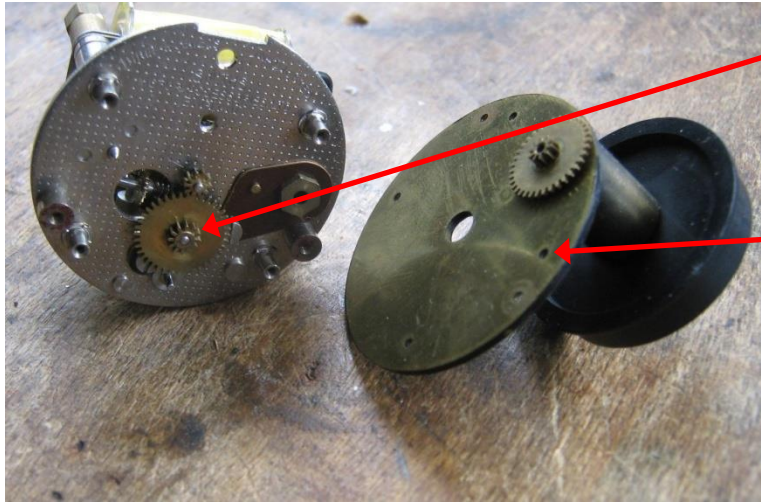
Lift off back-plate to leave mechanism as shown

Dial Mechanism
Securing Screws



Remove 4 (sometimes 6) screws securing front dial mechanism.

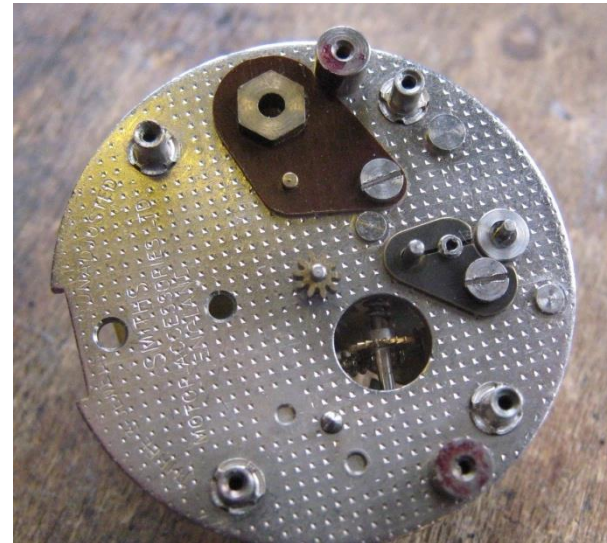
(**NB.** If screws will not move do not use force. Apply cellulose thinners to the screw heads and leave for a few hours to loosen paint around screw heads.)

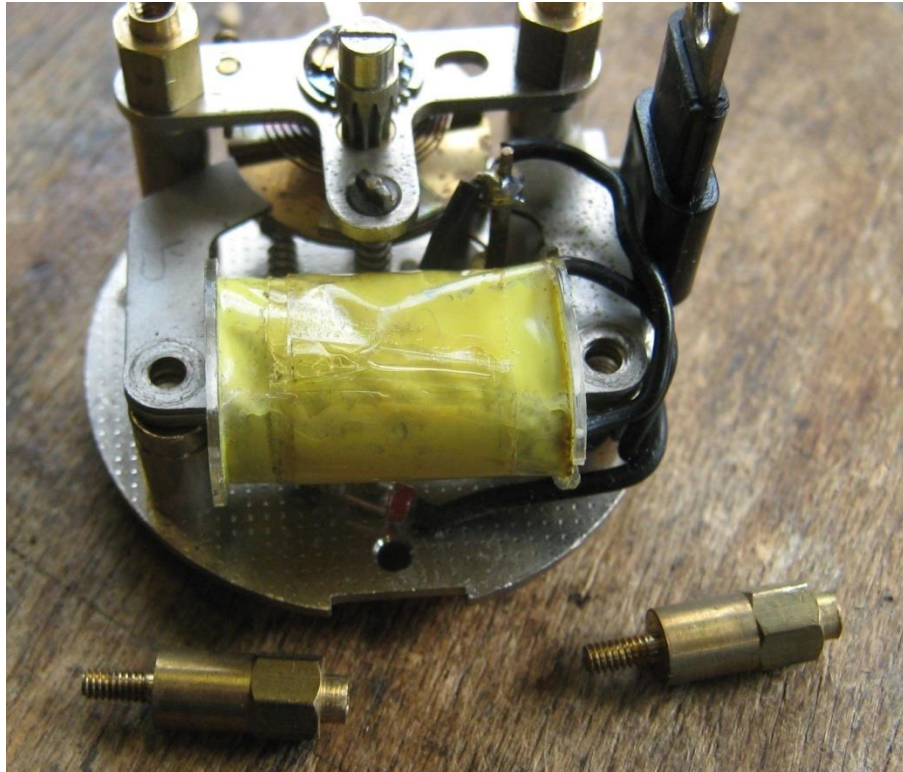


Gear Wheel

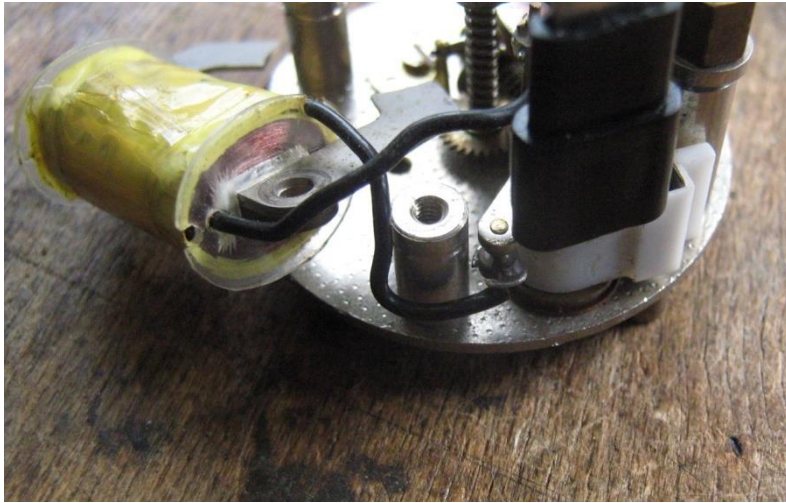
Dial Mechanism

1. Lift off Front Dial mechanism.
2. Lift off Gear Wheel

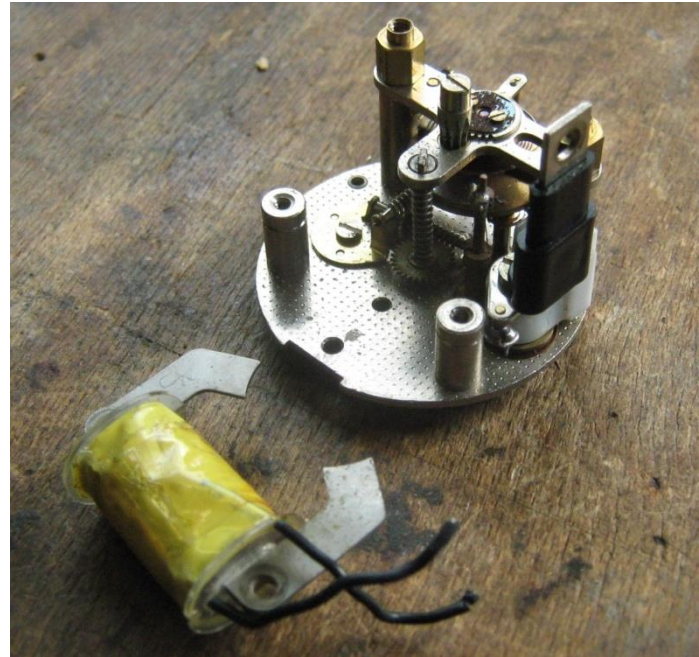


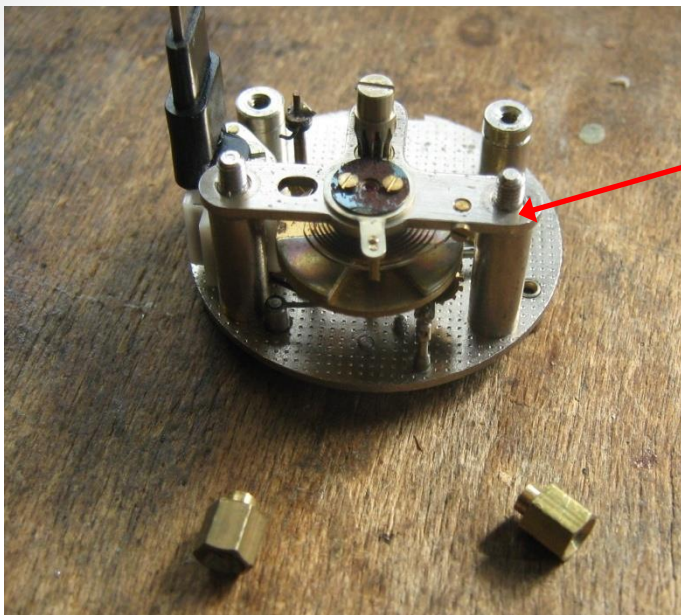


Remove 2 solenoid retaining pillars



1. Lift Solenoid from mechanism.
2. Snip solenoid wires leaving as much wire as possible attached to solenoid.





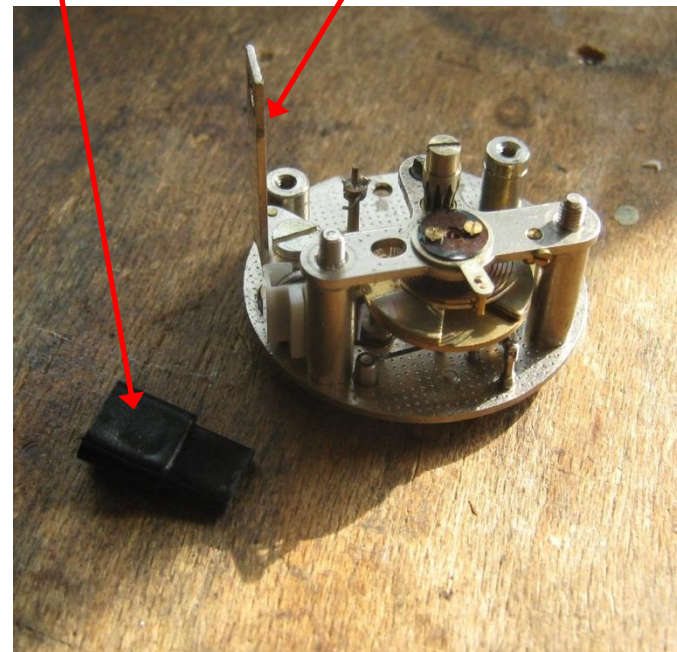
Balance Support

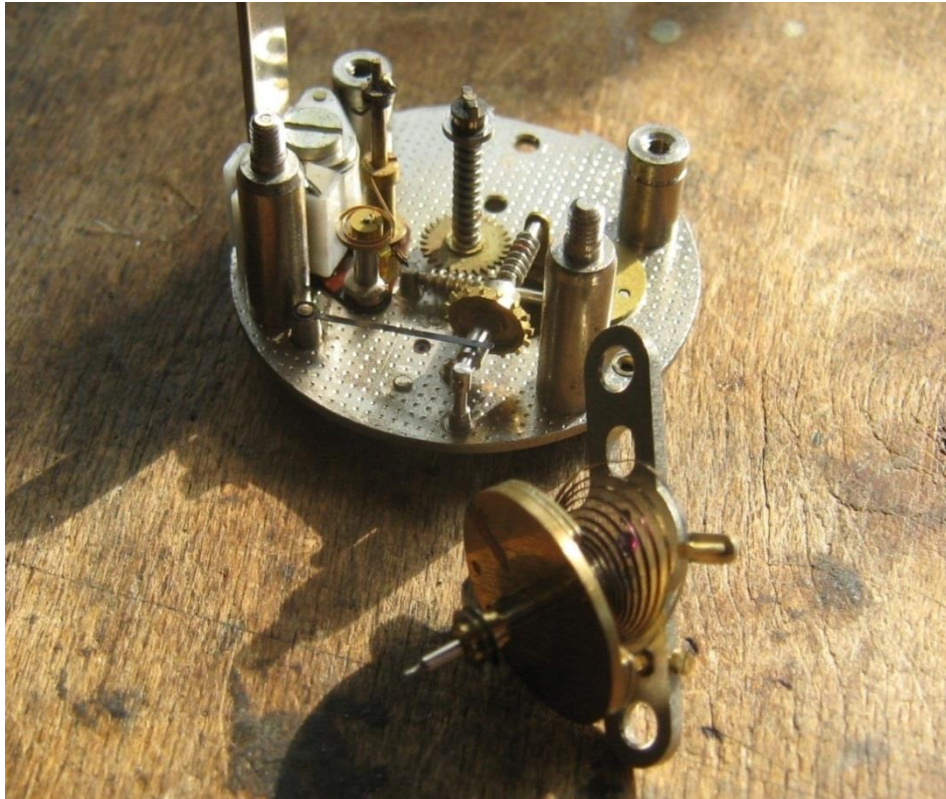
Insulating Sleeve

Connector Bracket

1. Remove two nuts securing balance support.

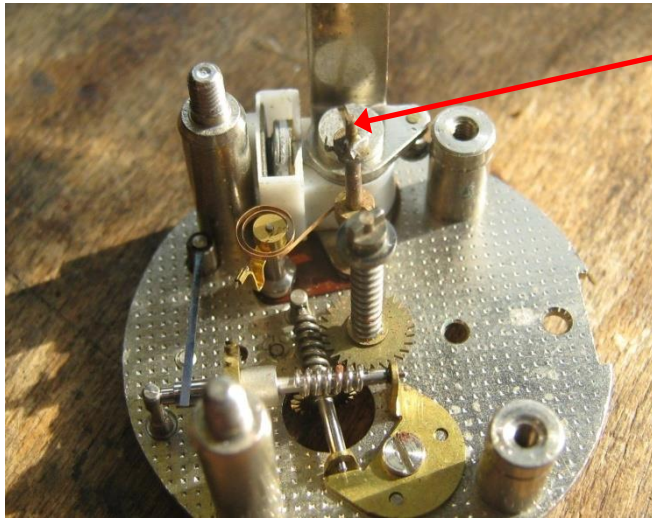
2. Remove Insulating sleeve from connector bracket.





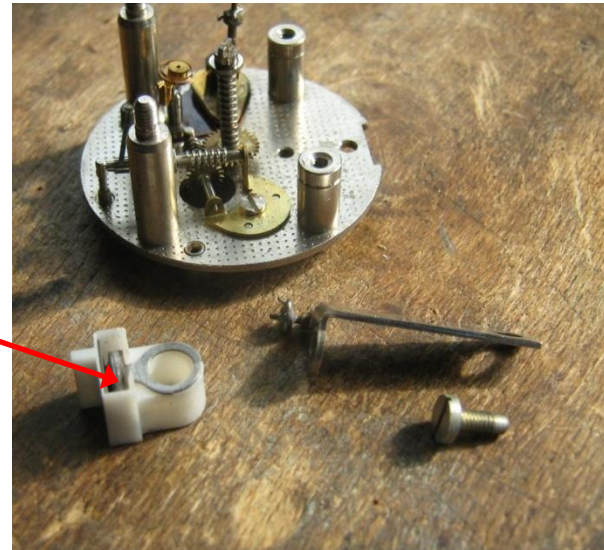
Carefully lift off the balance support and balance wheel assembly taking care not to damage the hair spring.

[**NB.** On some clocks (e.g. Jaguar Mk IV, XK140), there is an adjustment gear on the top of the balance support which prevents removal of the balance wheel assembly. In these cases this gear must be removed – please see slide labelled “Removal of Adjustment Gear” at the end of these instructions.]

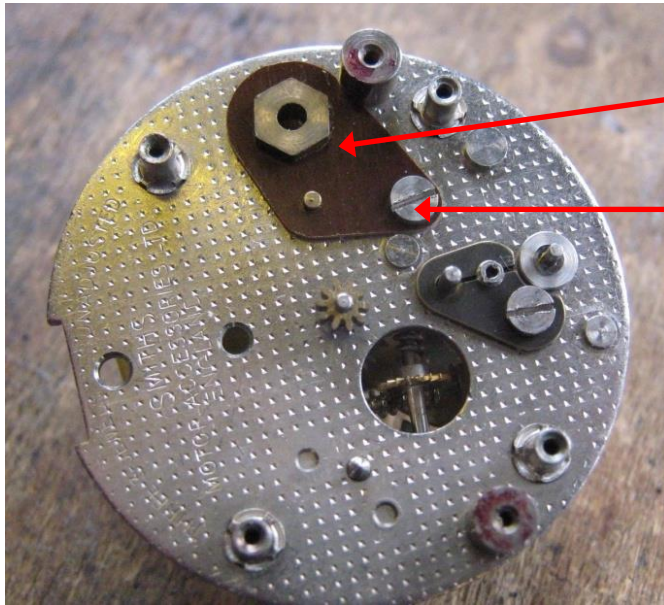


Connector bracket retaining screw.

Connector Bracket Support



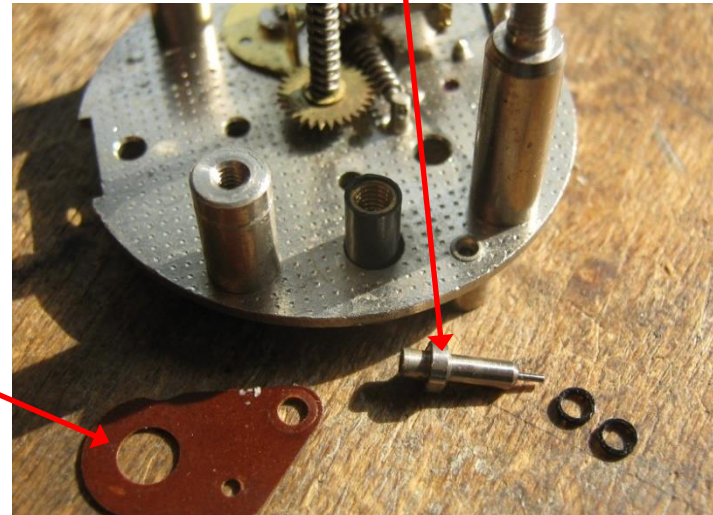
Undo connector bracket retainer screw and remove connector bracket and plastic connector bracket support. Note that the plastic connector bracket support is no-longer required and should not be refitted.



Lower insulating plate

Contact pillar retaining screw

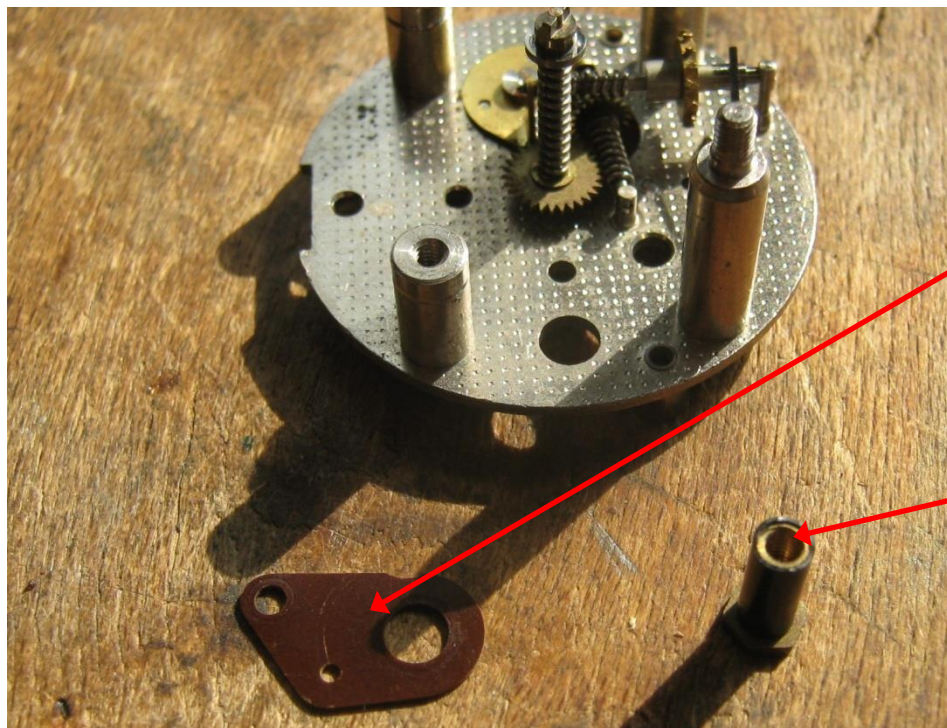
Contact pillar



Upper insulating plate

Undo contact pillar retaining screw and remove contact pillar upper insulating plate, contacts (not shown) and insulating 'O' rings.

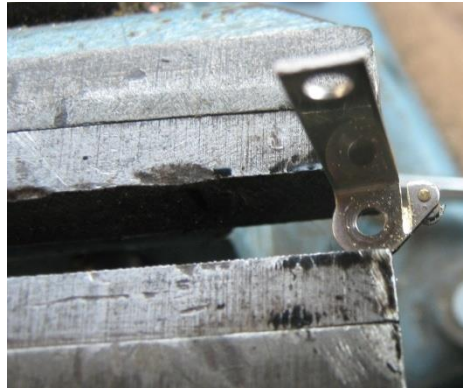
NB: Contacts, contact pillar and insulating 'O' rings are no longer required and should not be refitted.



Lower Insulating
plate

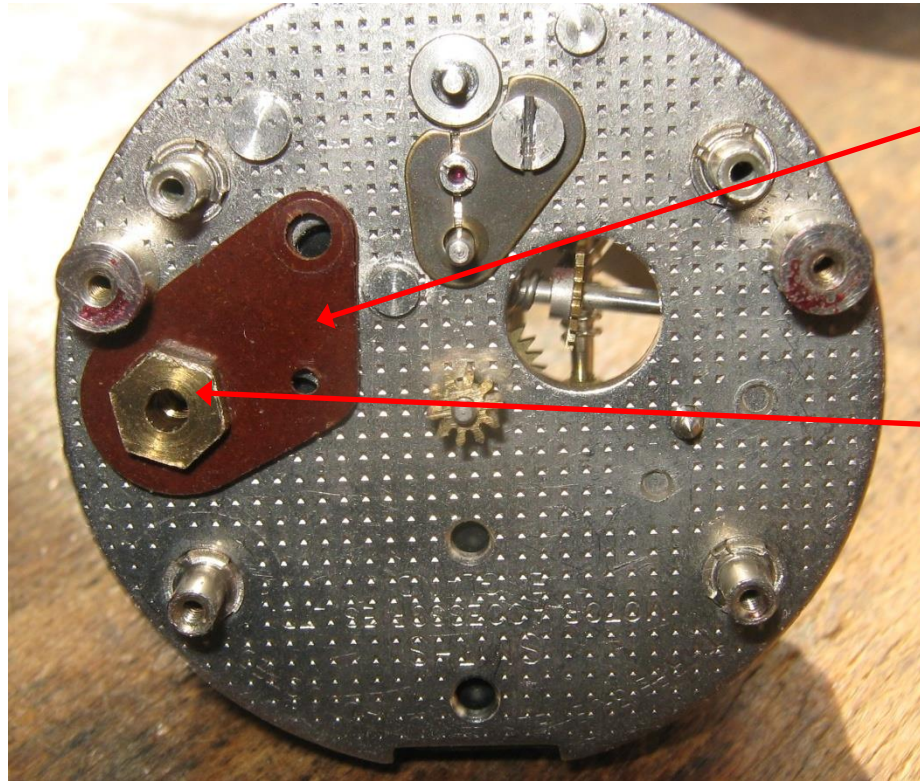
Connector pillar +
insulating tube

Remove connector pillar (with insulating tube) and
lower insulating plate.



Modify connector bracket by removing side `ear` as shown



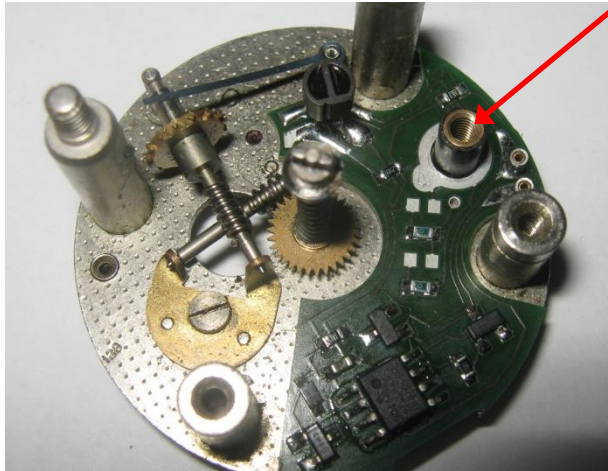


Insulating
plates (x2)

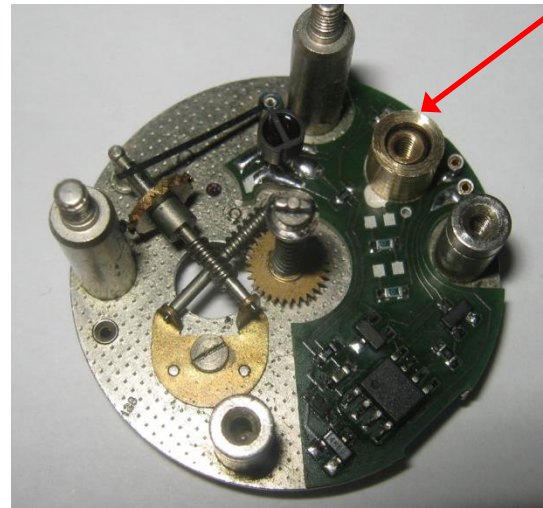
Connector Pillar

Fit BOTH insulating plates (upper and lower) to connector pillar and insert into clock baseplate from front . Ensure that insulating tube is in place around connector pillar.

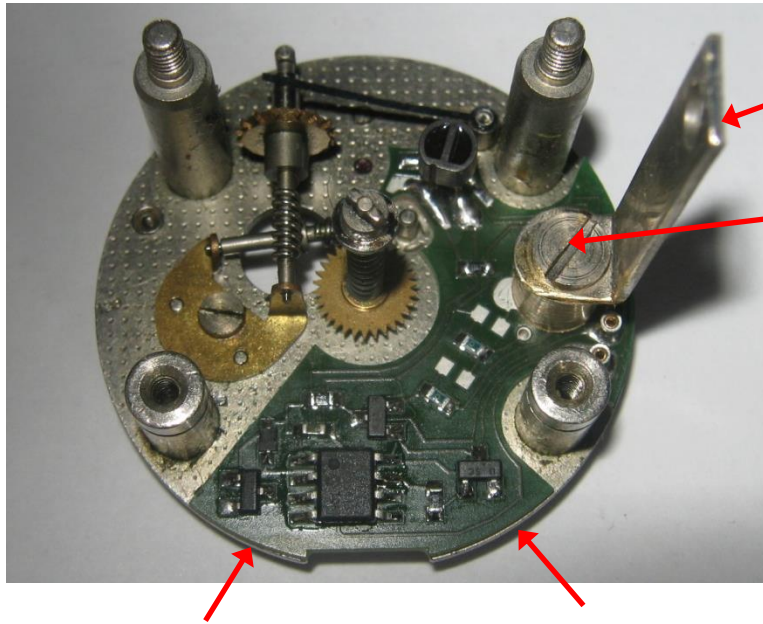
Connector Pillar
(with insulating
tube)



Brass Spacer
placed over
Connector Pillar



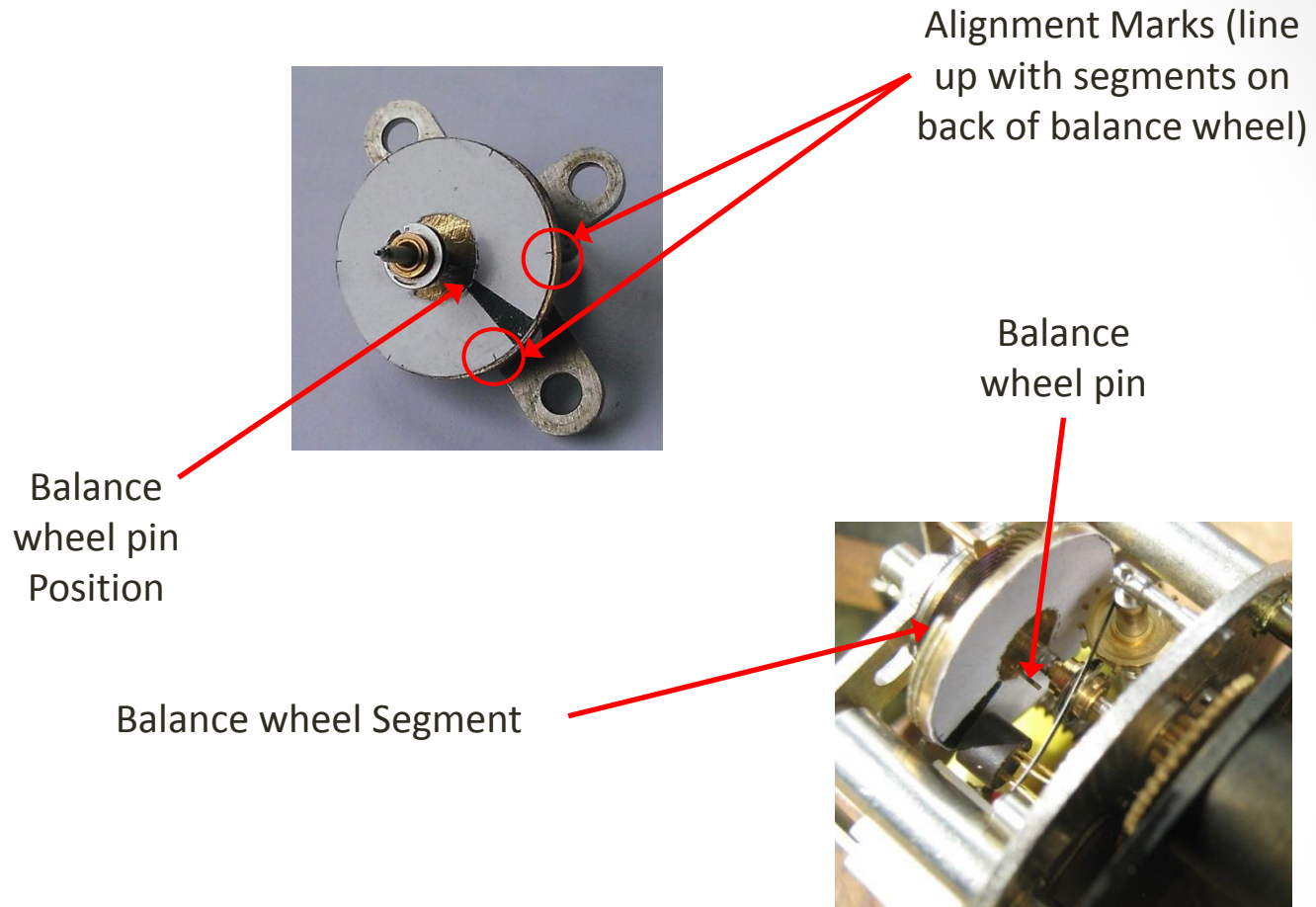
1. Position PCB on clock base plate as shown with hole over connector pillar.
2. Fit brass spacer (supplied) over connector pillar.



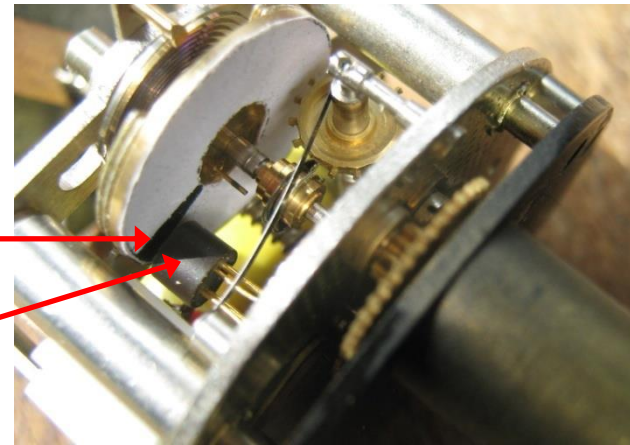
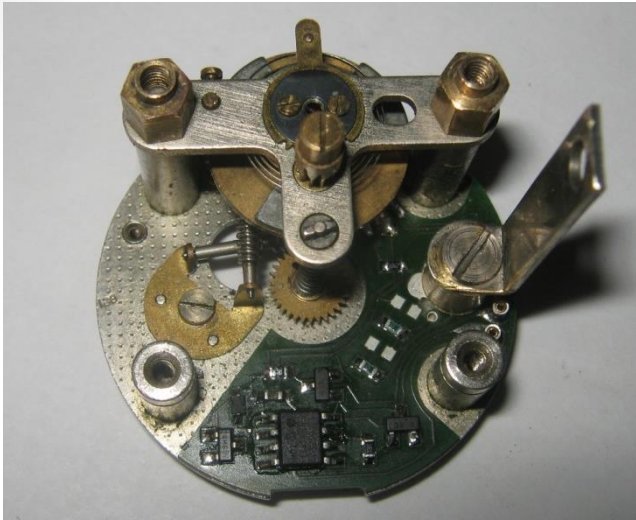
Connector
Bracket

Retaining
Screw

Place the connector bracket on top of the brass spacer and secure the bracket to the connector pillar with the retaining screw. Make sure that the curved edge of the PCB lines up closely with the clock baseplate (arrowed).



Carefully clean underside of balance wheel with Isopropyl alcohol and a Q-tip. Position sticker on underside of balance wheel and smooth down carefully. The sticker should be positioned so that the balance wheel pin is close to the black stripe and the alignment marks (circled) line up with edge of balance wheel segments on opposite side of balance wheel. If any parts of the sticker overhang the edge of the balance wheel carefully trim these with a sharp craft knife.



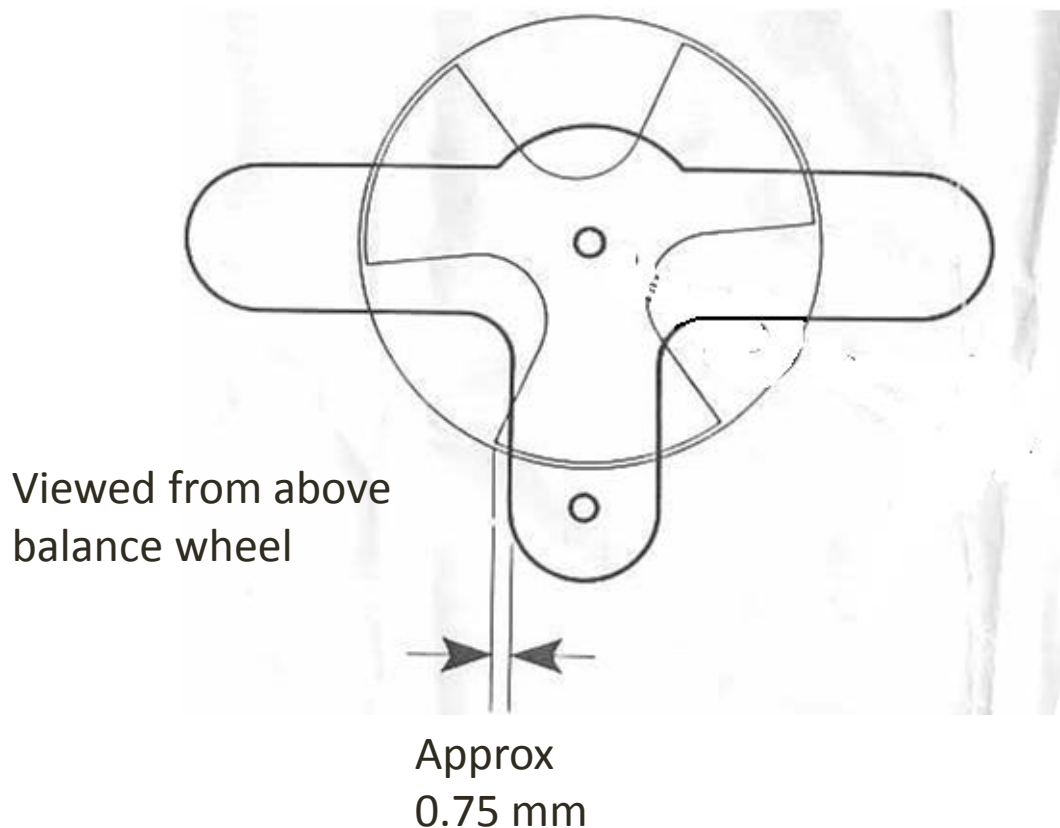
Black marker
stripe

Sensor

Carefully re-fit the balance wheel taking care not to damage the jewelled bearings.

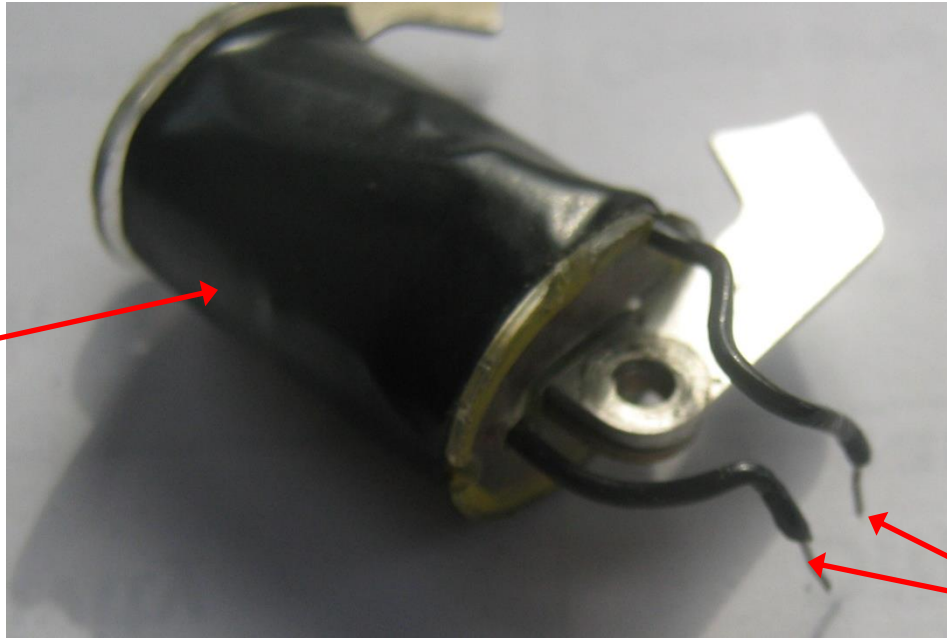
When the balance wheel is at rest, the black marker stripe should sit just a little clockwise of the sensor (when viewed from the sensor side of the balance wheel). If the marker stripe does not appear to be in the correct place, check that the label is correctly applied and then check the at-rest position of the balance wheel (see next slide).

Balance Wheel At-Rest Position



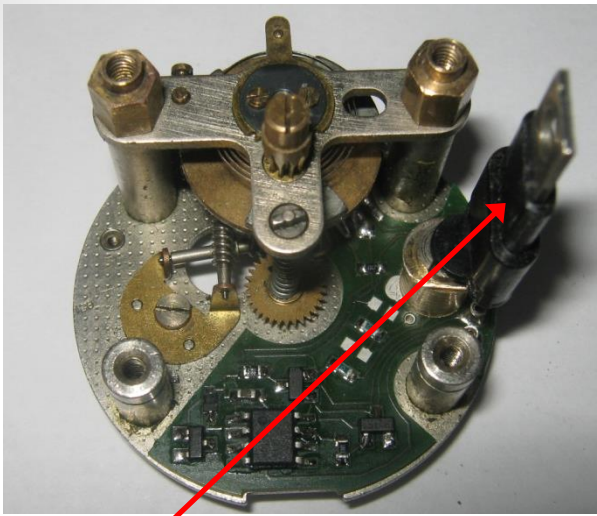
The above diagram shows the at-rest position of balance wheel. Note that this is factory set and should NOT need to be adjusted. The exact measurement of 0.75 mm is not critical but the balance wheel should be slightly offset from the symmetrical (as shown). If the position is clearly wrong, it can be adjusted by gently turning the balance wheel whilst holding the hairspring collet still by using a jeweller's screwdriver in the slit of the collet.

New Insulation
Tape

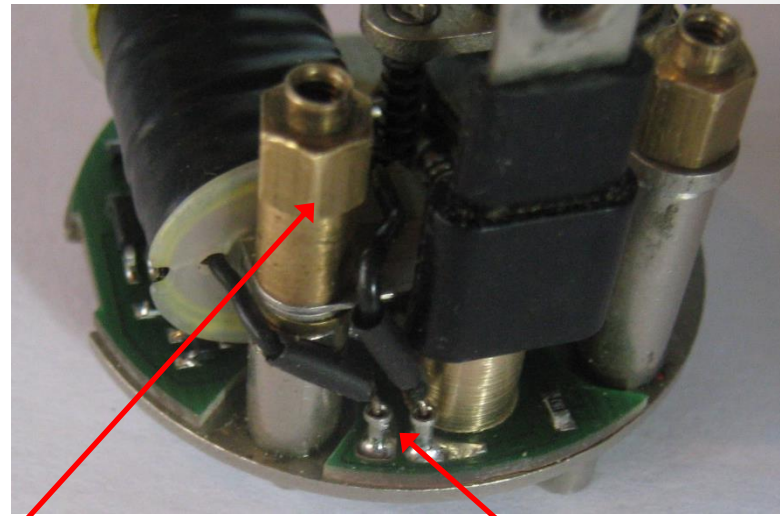


Ends of Solenoid
wires tripped

Strip approx. 3mm from the ends of each solenoid wire. If the yellow tape around the solenoid body looks worn, wrap this with a couple of turns of new insulation tape



Insulating Sleeve



Solenoid retaining pillar

Solenoid wires pushed into socket posts

1. Fit insulating sleeve over connector bracket.
2. Re-fit the solenoid and screw solenoid retaining pillars into place. Place two pieces of heat-shrink over solenoid wires and carefully push the two solenoid wires into the socket posts as shown.

NB. Do not shrink heat-shrink tubing until mechanism has been tested (see later slide)



Heat-shrink
sleeving shrunk
over damaged
insulating sleeve

If the top of the plastic insulating sleeve is damaged, cover the damaged part with the heat-shrink sleeving supplied and use a hair dryer or heat gun to shrink the sleeving over the plastic insulating sleeve

Testing the movement

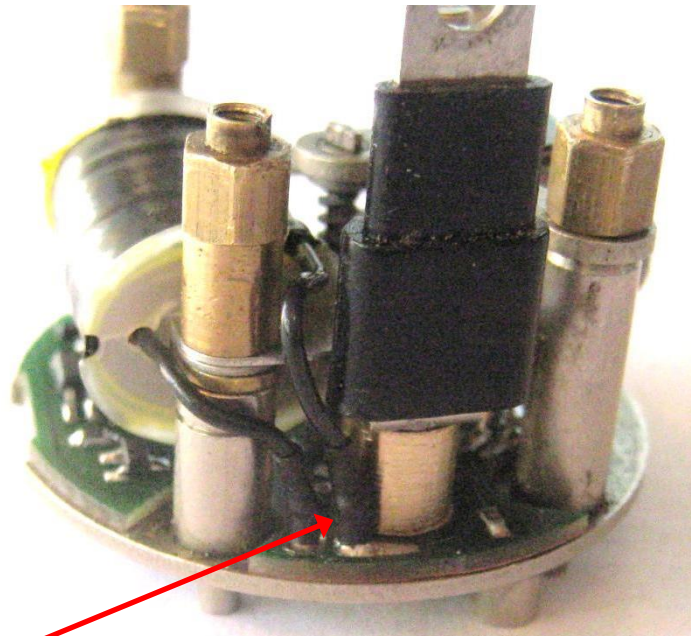
At this point it is a good idea to test the operation of the movement.

Connect the clock to a **fused** 12V battery supply (For negative earth cars connect the '+' terminal to the connector bracket and the '-' terminal to the body of the clock. For positive earth cars connect the '-' terminal to the connector bracket and the '+' terminal to the body of the clock)

The balance wheel should first move to a starting position and remain there for approximately 3 seconds.

Following this it should start to oscillate back and forth. The amplitude of oscillation will build up over a minute or so until the wheel is oscillating steadily.

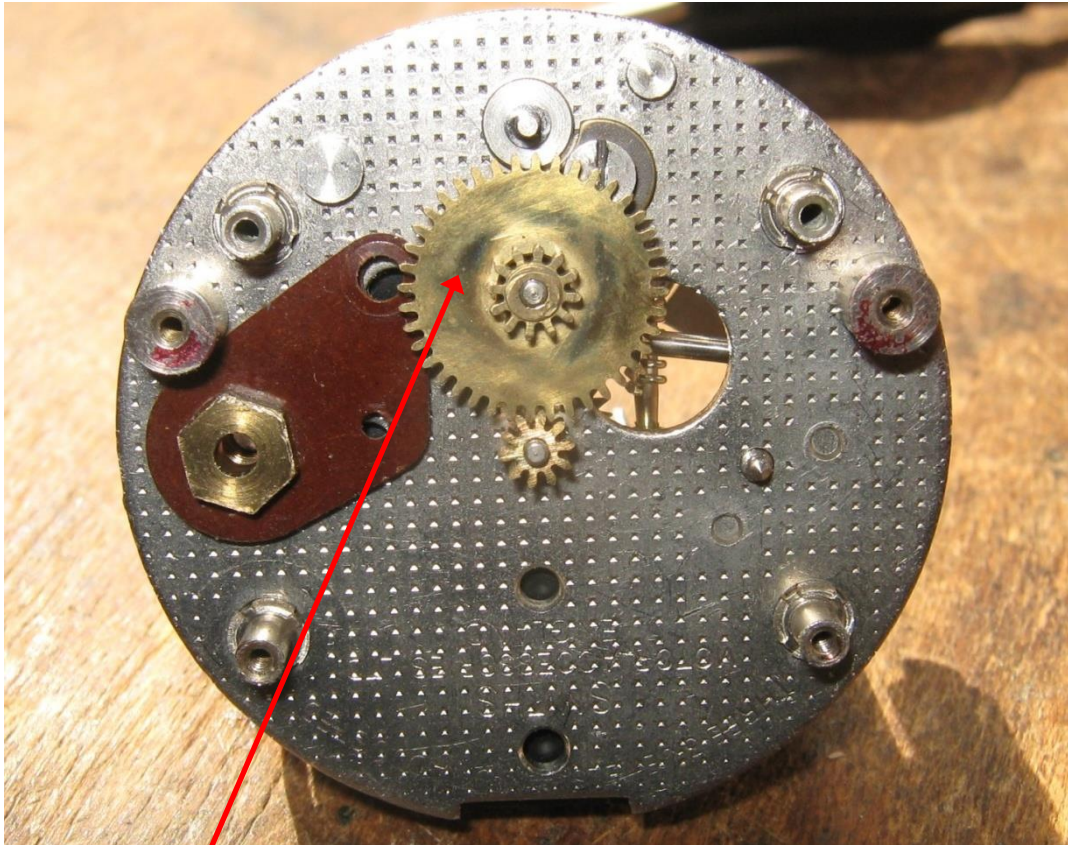
If the balance wheel does not oscillate please see the trouble shooting section at the end of these instructions.



Heat-shrink tubing shrunk
over socket posts

Push heat-shrink tubing down over socket posts and then use a hairdryer or heat gun to shrink the tubing over the posts. Be careful not to use too much heat as this may melt the insulation on the wires.

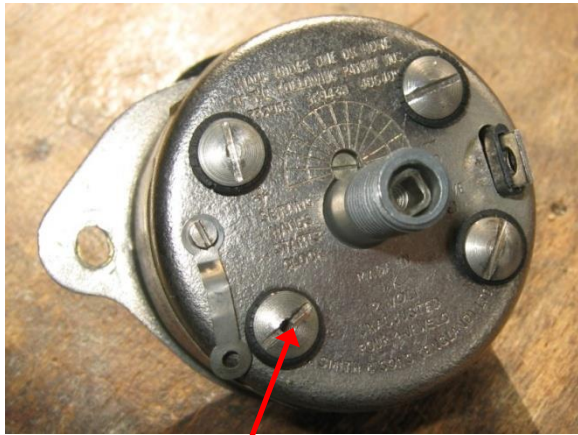
Tip: A pair of tweezers can be useful to tease the heat-shrink tubing over the socket posts.



Re-fit gear wheel



1. Fit front dial mechanism being careful that hands align correctly (check alignment at 12 o'clock position).
2. Re fit back plate to rear of clock



Screw with threaded hole



Fuse Link

Refit case and 4 retaining screws. Ensure screw with threaded hole is in position shown.

Refit fuse link and tighten both screws

Adjusting the Clock

Regulator
Screw



- Before fitting the clock to the car you should adjust the timekeeping using the regulator screw on the back of the case.
- First set up the clock on the bench in its normal orientation and connect it to a fused 12V supply (e.g. an old car or motorcycle battery).
- Allow the clock to run for an hour or so before attempting any adjustments.
- Turning the screw anticlockwise makes the clock run faster, turning it clockwise makes it run slower.
- Be aware that the adjustment is quite sensitive – small movements of the screw can make a big difference.
- Bear in mind that this is still a mechanical movement and will be affected by temperature etc.
- **NB.** There is often quite a lot of backlash in the dial mechanism so it can take some time for the mechanism to 'catch up' before the hands begin to move. The best way to overcome this is simply to set the hands a couple of minutes fast when first setting the clock.

Troubleshooting

1. Balance wheel does not move when 12V supply is connected.

- Check that the polarity of the 12V supply is correct and that the fuse is has not blown.
- Check that the connections to the solenoid coil are fully pushed home.
- Check that the balance wheel can move freely.
- Check that the pole pieces (the flat strips of metal which stick out of the solenoid coil) are not bent.

If all of the above points are OK then it is likely that the solenoid coil has failed. This is unusual but can happen if the wires to the solenoid have been stressed. If you have a multi-meter you can check the resistance of the solenoid which should be around 900 Ohms. Damaged solenoid coils can usually be repaired – please ask for details.

2. Balance wheel moves when 12V supply is first applied but does not oscillate

- Check that there is no dirt or grease on the infra-red sensor (this can be cleaned with isopropyl alcohol).
- Check that the mechanism is not exposed to bright sunlight as this can affect the sensor when testing the mechanism outside its case - move the mechanism to a more shaded area for testing.
- Check that the balance wheel sticker is in the correct position (see earlier slide)
- Check that the balance wheel can move freely.
- Check that the clock hands are not touching each other (they may have become bent).
- Check that the underside of the damper spring (the thin straight leaf spring) is clean. Sometimes this can be slightly rusty in which case it should be cleaned with fine wet and dry paper (**take care** when doing this as the spring is easily be broken).

If all of the items above are OK then the problem is likely to be excess friction in the mechanism . – check items under point 3 below.

Troubleshooting

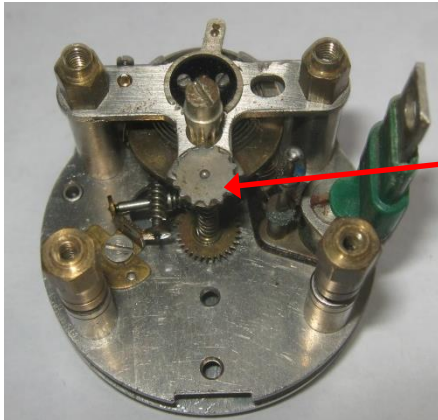
3. Balance wheel starts to oscillate but stops after a short time.

- Check that the mechanism is not in bright sunlight as this can affect the sensor when testing the mechanism outside its case - move the mechanism to a more shaded area for testing.
- Check that the underside of the damper spring (the thin straight leaf spring) is clean and free from rust. Rust can be removed with fine wet and dry paper (**take care** as the spring is easily broken).
- Try removing the dial mechanism and see if the clock then runs. If it does then there is excess friction in the dial mechanism - check that the dial mechanism is clean.
- If the clock still will not run check that the balance wheel runs freely and if necessary re-clean and oil the jewelled bearings.

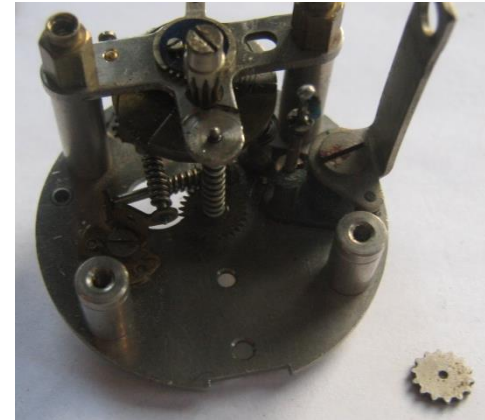
4. Clock runs too fast or too slow (and cannot be adjusted to run correctly)

- If the clock is much too fast, check that the hair-spring coils are not stuck together – if they are clean the hair-spring.
- Check for excess friction in the mechanism (see items under point 3 above).
- If neither of the above solve the problem, it may be that the hair-spring length has been incorrectly adjusted in the past. You can adjust the spring by loosening the retaining screw which holds the brass securing pin to the balance wheel support at one end of the spring. Remove the brass pin, adjust the spring length slightly (shorter if the clock is fast, longer if slow) and replace the pin and securing screw.

Removal of Adjustment Gear



Adjustment
Gear



Some clocks (e.g. Jaguar Mk IV, XK140) have an adjustment gear on top of the balance support which prevents removal of the balance wheel mechanism.

The ideal way to remove this gear is to use a Jeweller's gear puller, but if this is not available, the gear can be removed by using two Jeweller's screwdrivers to gently lever between the gear and the balance support. Lever very gently using both screwdrivers simultaneously with the screwdrivers positioned opposite each other. Periodically rotate the gear wheel so that the force evens out around the gear. It will take some time, but with patience, you can gradually tease the gear off the shaft.

To replace the gear press it back on making sure that the bottom of the shaft is well supported; this can be done using a small vice or G-Clamp; again, be very gentle and use some packing to protect the shaft. Replacing the gear will be made easier if you gently warm it first so that the hole expands slightly. Before removing the gear take note of which way up it fits – the upper side is slightly curved.