

Clocks4Classics

Car Clock Repair Kit

Fitting Instructions for Front Adjusting Clocks



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General Information

These instructions explain how to repair a Smith's or Jaeger electric car clock movement using the Clocks4Classics repair kit.

Two sets of instructions are available to cover the two types of mechanism commonly used in these clocks. These instructions cover "Front Adjusting" clocks i.e. those with a knob on the front of the clock for setting the time. If your clock has the time setting on the rear or underneath the clock, or uses a cable then please see the "Standard" instructions which can be also be downloaded from the Clocks4Classics website.

The instructions are based around the repair of a clock from a Vauxhall Victor which is typical of the type of clock which can be repaired. Slight differences will be evident in clocks from other vehicles, particularly in respect of the removal of the bezel and dial; however, the internal mechanisms are very similar and should be easily recognisable from these instructions.

Kit Contents

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

Important

Do not remove the circuit board from its anti-static packaging until you have read the anti-static precautions below.

Things you will need

For fitting the Circuit Board:

Jeweller's screwdrivers
Small pair of long nosed pliers (electronics type)
Wire strippers
Small pair of wire cutters (electronics type)
Heat gun (for shrinking the heat-shrink sleeving)

For Cleaning & Oiling:

Clock oil
Cocktail sticks
Isopropyl alcohol or clock cleaning fluid.

Vehicle Polarity

The latest Clock4Classics Kits are suitable for both Positive and Negative Earth Vehicles. Single polarity kits have a "P" or "N" marked on the bag containing the circuit board to identify them as suitable for Positive or Negative Earth cars. If you have one of these earlier kits you should download the earlier version of these instructions (V13) from the Clocks4Classics website.

Anti-Static Precautions

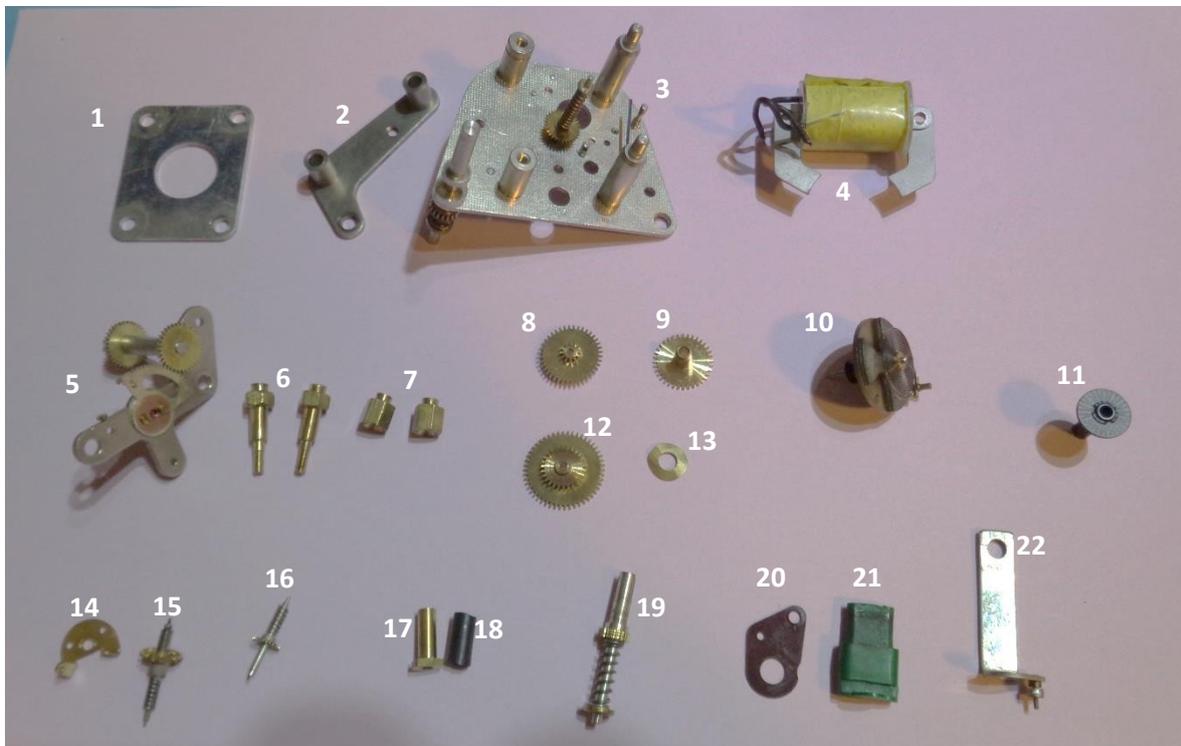
As with any electronic parts, the circuit board can be damaged by static electricity. To avoid damage to the circuit board it is important to take the following precautions when handling the circuit board:

- Keep the circuit board in its anti-static packaging until you are ready to fit it.
- Before you open the anti-static packaging, discharge yourself by touching some grounded metalwork such as a water pipe or radiator pipe.
- Handle the circuit board by the edges and avoid touching the components on the board.
- Avoid contact with materials such as synthetic fibres or wool which generate static electricity.

Main Parts of the Movement

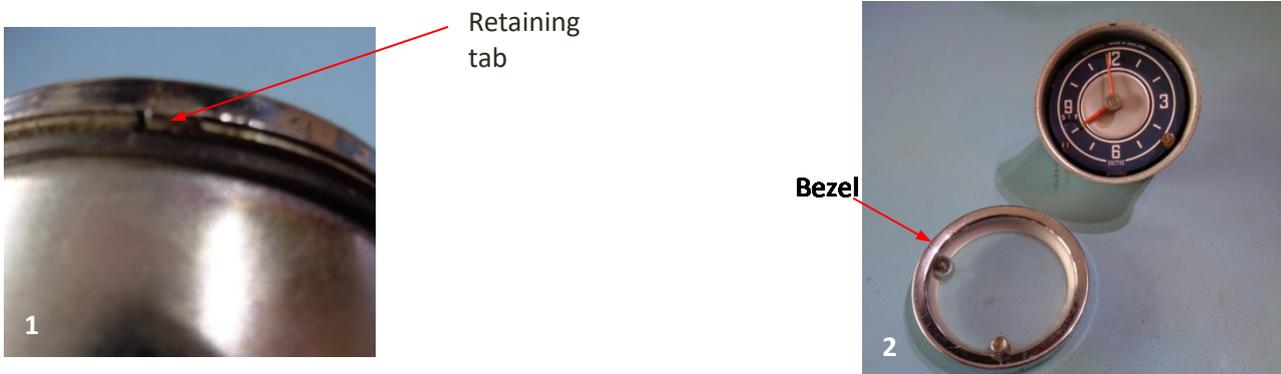
For reference the names of the main parts of the movement are shown below:

| | | |
|--|------------------------------|-----------------------|
| 1 Back Plate | 9 Hour Wheel | 17 Connecting Pillar |
| 2 Setting Support Plate | 10 Balance Wheel Assembly | 18 Insulating Tube |
| 3 Baseplate | 11 Regulating Disc | 19 Regulation Spindle |
| 4 Solenoid | 12 Setting Wheel | 20 Insulating Plate |
| 5 Balance Wheel Support | 13 Dial Washer | 21 Insulating Sleeve |
| 6 Solenoid Retaining Pillars | 14 Double Support Plate | 22 Connecting Bracket |
| 7 Balance Wheel Support Retaining Nuts | 15 Escape Wheel Assembly | |
| 8 Minute Wheel | 16 Transverse Wheel Assembly | |



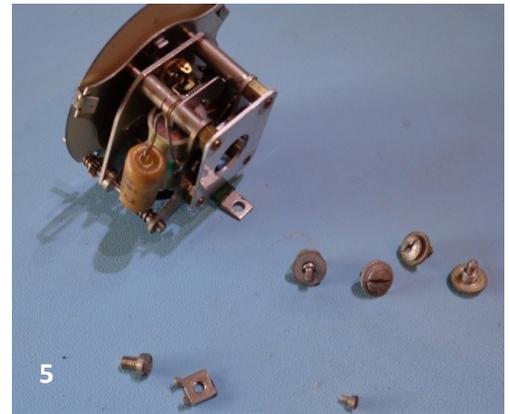
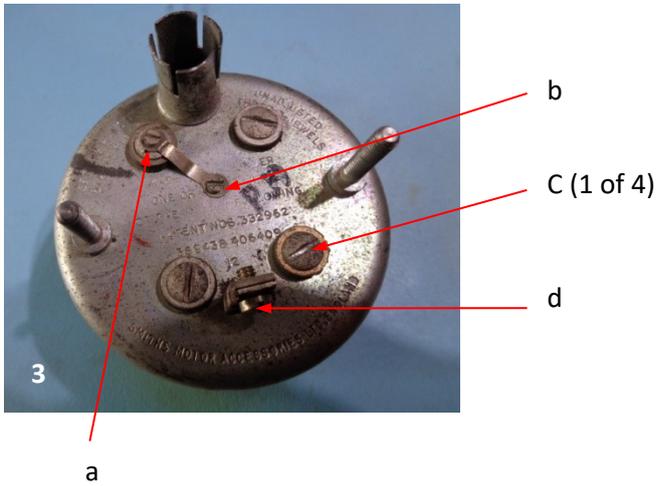
Clock Disassembly

It is recommended that you find a comfortable area to work with good lighting and that you place the disassembled parts small containers so that they are not lost. Be particularly careful with the dial face as this is easily marked.

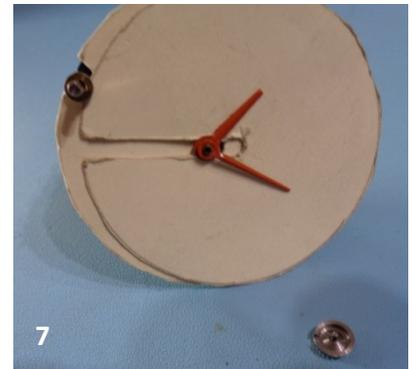
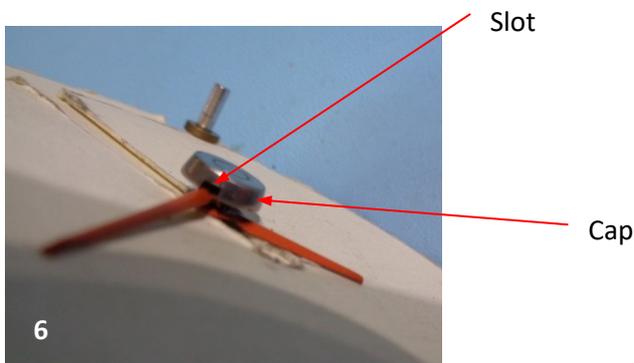


Gently lever back retaining tabs on bezel. It is only necessary to bend the tabs back part way – the bezel can then be `sprung` off the case. Take care not to bend tabs too far or they may break. Remove bezel from clock case.

Note: The bezels on Volvo P1800 clocks are a special case and require a different technique – please refer to the video on this subject on the Clocks4Classics website.

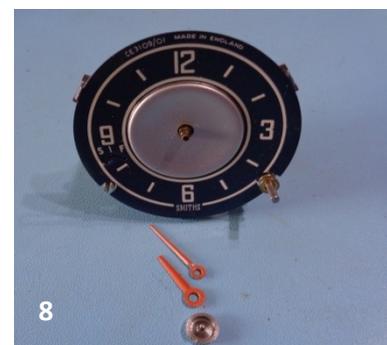
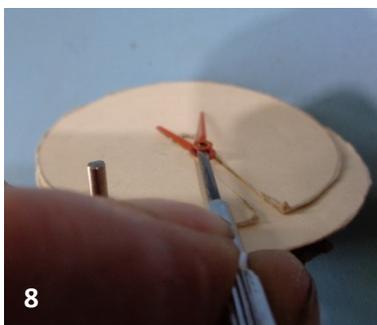


3. Remove small screw (a), loosen small screw (b) and swing fuse link to one side.
4. Remove 4 case securing screws (c), connector screw and plate (d)
5. Remove mechanism from case.

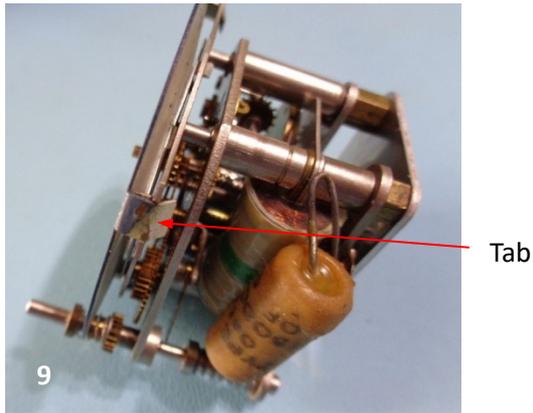


6. Protect clock face with thin cardboard.
7. Place small jeweller's screwdriver in slot shown and carefully lever off the cap.

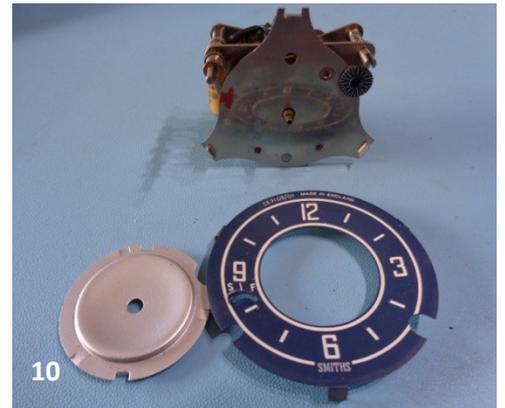
Note: The cap can be quite stiff to remove. Work slowly and do not apply too much force. As the gap between the cap and the hands starts to open up you can move the screwdriver to other points around the edge of the cap so that it the force is applied evenly.



8. Use a Jeweller's screwdriver as shown to carefully lever off the hands.

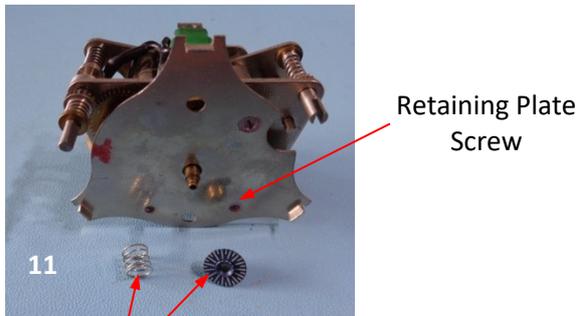


Tab



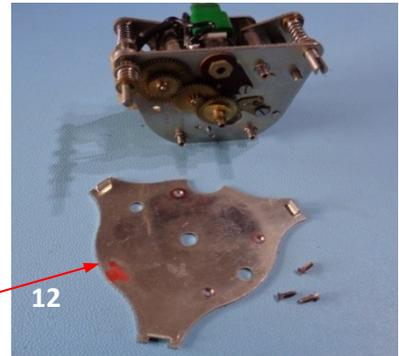
9. Carefully bend back tabs securing the dial.
10. Remove dial parts as shown.

Note: On some clocks the dial is secured by small screws rather than tabs.



Retaining Plate
Screw

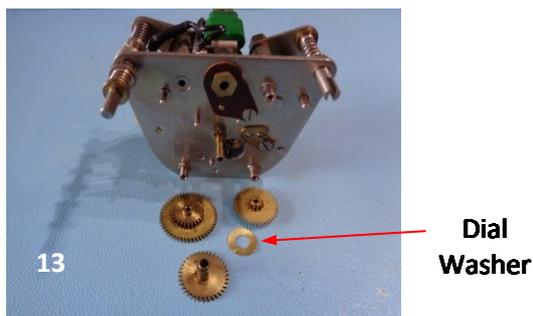
Regulation Disc
and Spring



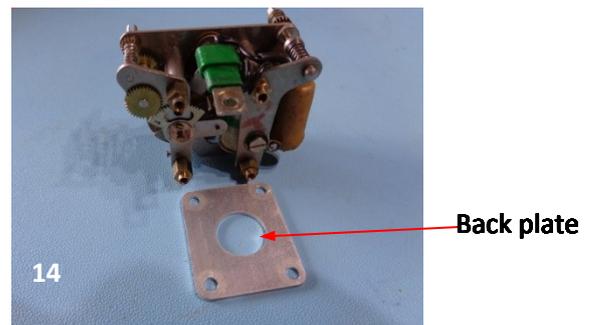
Retaining
Plate

11. Pull off Regulation Disc and spring.
12. Undo Retaining Plate screws and remove Retaining Plate.

NB. If the screws will not move do not use force. Apply cellulose thinners to the screw heads and leave for a few hours to loosen varnish around screw heads. Be patient – this almost always works! Occasionally you may find that the screws have been secured with thread-locking compound (Loctite). In this case they can usually be loosened by applying a hot soldering iron to the head of the screw to soften the thread-lock (use a very hot iron and hold against the screw for 2-3 minutes).



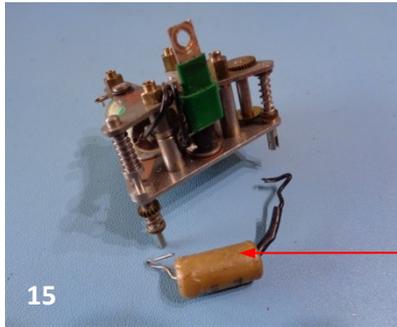
Dial
Washer



Back plate

13. Remove 3 gear wheels being careful not to lose brass dial washer.

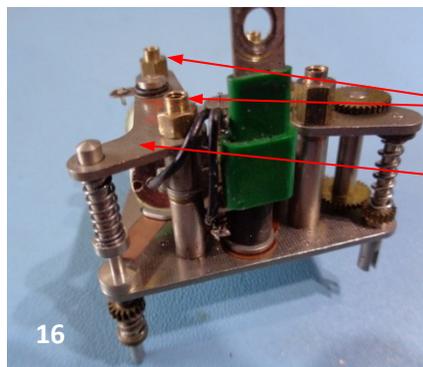
14. Remove Back plate (if the back plate is stiff gently lever it with a small screwdriver)



15. If the movement has a capacitor fitted then cut the wires to the capacitor and remove it. The capacitor will not be required for the rebuild and can be discarded.

Note: Some mechanisms are not fitted with a capacitor.

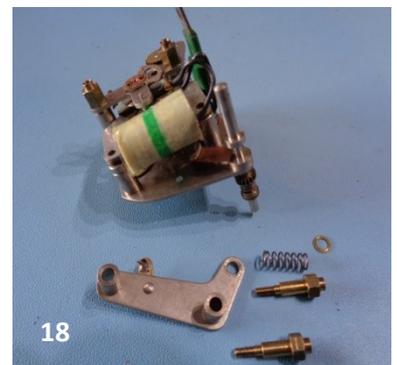
Capacitor



Solenoid
Retaining Pillars

Setting Support
Plate

16

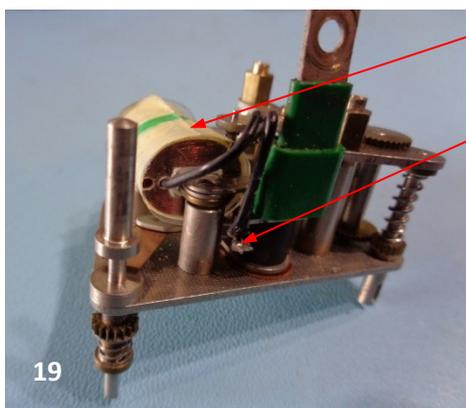


18

16. Remove two solenoid retaining pillars

17. Remove Setting Support Plate.

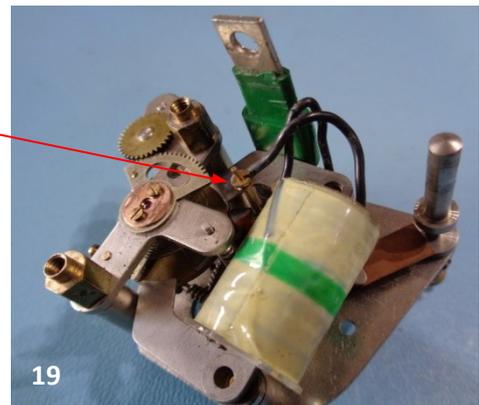
18. Remove spring and washer from Setting Spindle.



Solenoid

Cut wires here

19

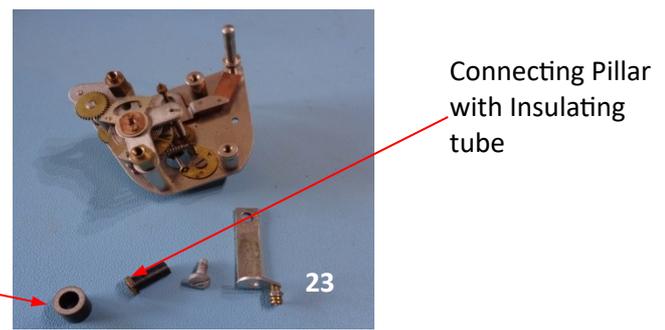
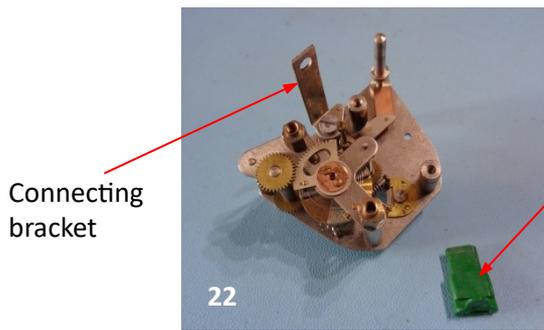


19

19. Cut Solenoid wire leaving as much wire as possible attached to solenoid. **Note.** It is important not to stress the wires as this can break the connection inside the solenoid.

20. Lift Solenoid from mechanism.

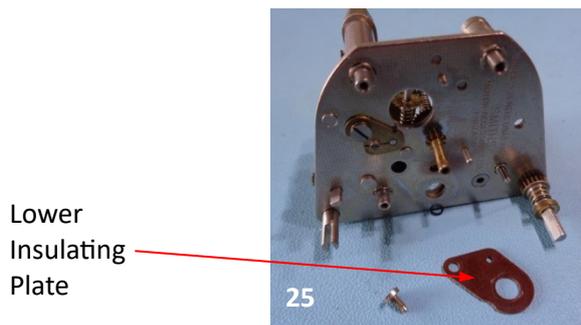
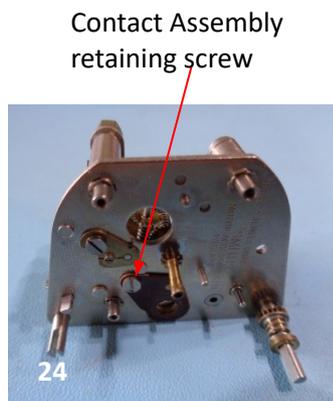
21. Apply super glue to the solenoid wires at the point where they enter the solenoid body and allow the glue to dry before handling the solenoid further. This protects the internal solenoid windings from stress if the wires are moved.



22. Remove insulating sleeve from Connecting Bracket.

23. Undo connector bracket screw and remove connector bracket, bush and brass connector pillar. The brass connector pillar is covered with a plastic insulating tube which must be left in place.

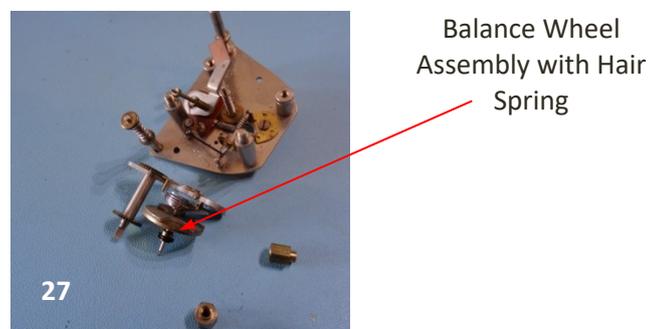
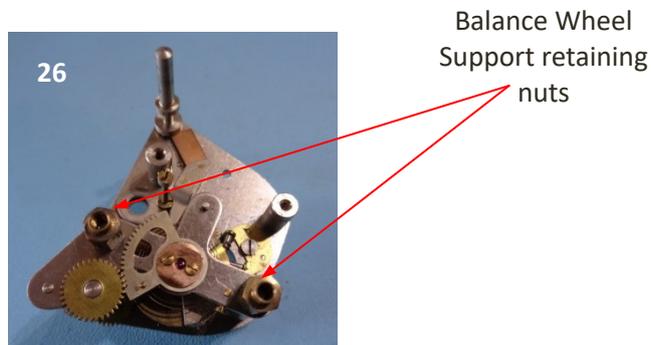
Notes: The bush is not required and can be discarded. It will be replaced by the brass bush from the kit. If the insulating sleeve on the connector pillar is missing or damaged, it can be replaced with the heat-shrink tubing supplied in the kit. Use a heat gun to shrink the sleeving onto the pillar.



24. Remove Contact Assembly Retaining screw.

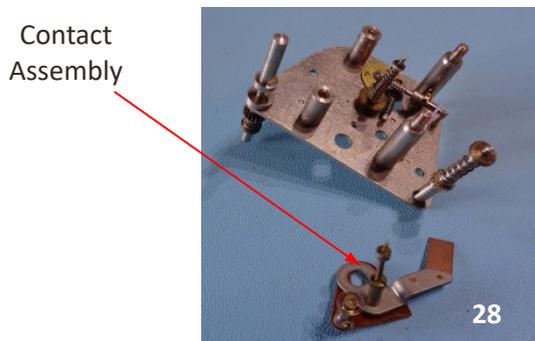
25. Remove Lower Insulating Plate.

Note: When the insulating plate is removed you may find that an insulating O ring is also present. This is not required and can be discarded.

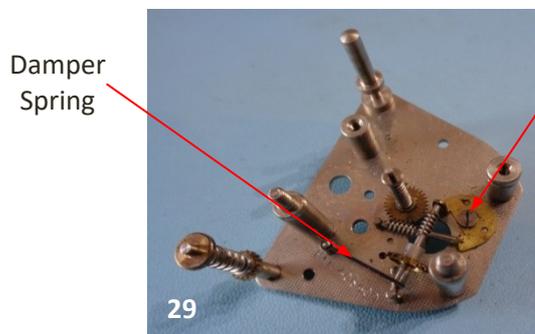


26. Remove Balance Wheel Support retaining nuts.

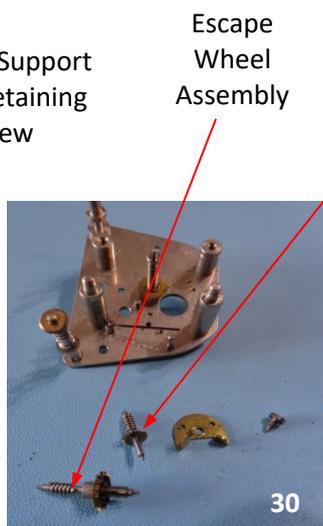
27. Carefully lift off the balance wheel support and balance wheel assembly. Note that the Hair Spring (the coiled spring attached to the balance wheel assembly) is quite delicate - be careful to support it as you lift off the assembly.



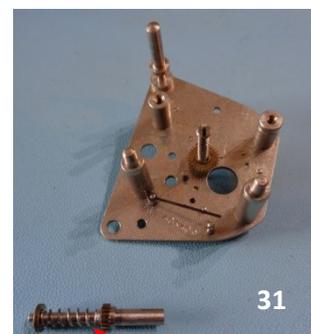
28. Lift off the Contact Assembly. This will be replaced by the circuit board and is no longer required.



29. Remove Double Support Plate retaining screw.



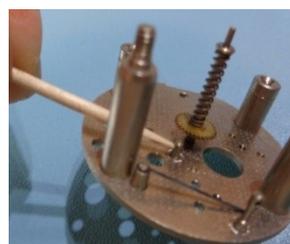
30. Remove the Double Support Plate and Escape and Transverse Wheel assemblies.



31. Remove Regulation Spindle from Baseplate.

Cleaning and Oiling

Once the clock has been disassembled you should carefully clean the parts in isopropyl alcohol or clock cleaning fluid. To clean out the pivot holes and jewelled bearings use a sharpened cocktail stick as shown in the photo.



Cleaning a pivot hole with a cocktail stick

The clock should be oiled using clock oil (do not use general purpose oil such as "3-in-1" as this is too thick).

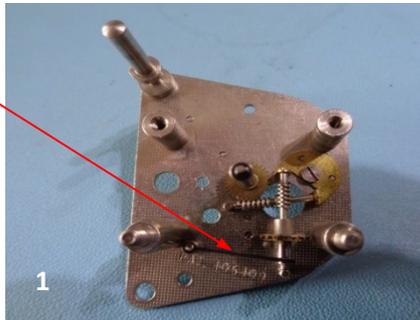
Oil all of the bearing holes, the underside of the damper spring and escape wheel but not the other gear wheels. Also place a drop of oil on the centre spindle where it passes through the base plate and on the thin dial washer which is under the hour wheel on the back of the dial plate.

Be careful not to apply too much oil – the oil should just fill the bearing hole. The best way to apply the oil is to use an oiling pen or a thin piece of wire with a flattened end.

Re-Assembly and Testing

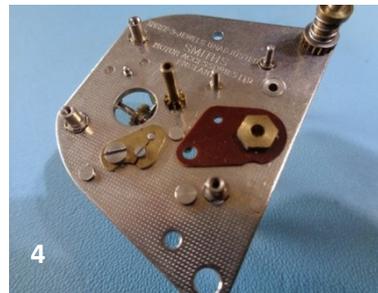
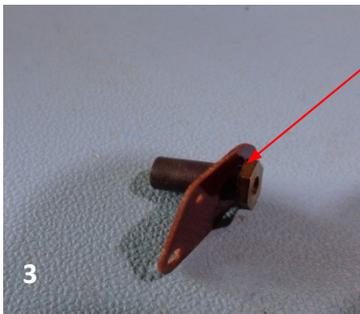
The following pages cover the re-assembly and testing of the clock.

Damper Spring

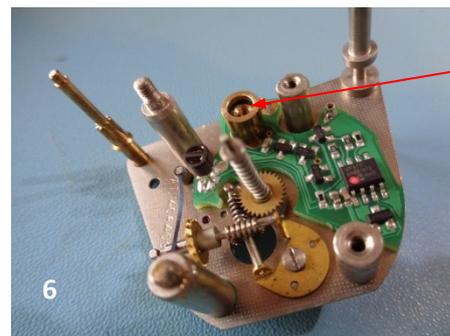
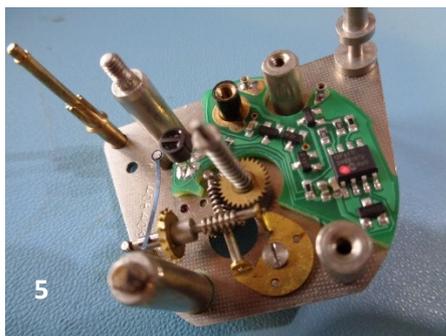


1. Refit the Escape and Transverse Wheel assemblies and the Double Support Plate to the clock baseplate. Make sure that the damper spring is on top of the Escape Wheel shaft. Use tweezers to help position the parts into place.

Connecting Pillar with insulating tube inserted into Insulating Plate



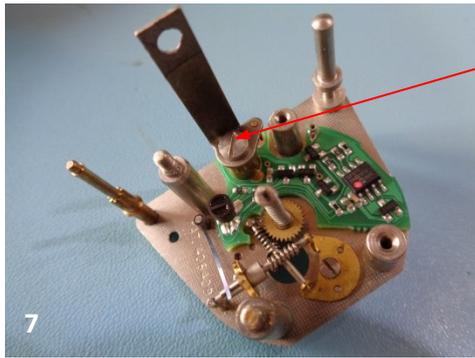
3. Make sure that the insulating tube is pushed all the way down against the bottom of the Connecting Pillar and then insert the Connecting Pillar into the lower insulating plate as shown.
4. Insert the Connecting Pillar into its hole on the underside of the baseplate and position the insulating plate as shown.



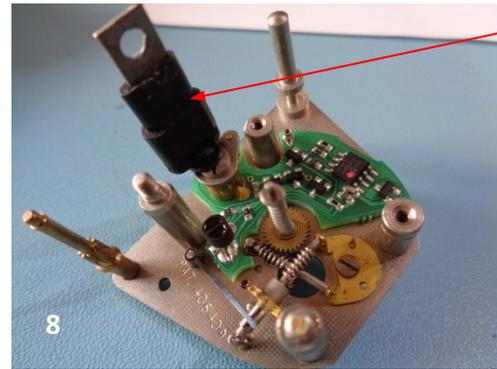
Brass Spacer placed over Connecting Pillar

5. Position PCB on clock base plate as shown with hole over Connecting Pillar.
6. Fit brass bush (supplied) over connecting pillar.

Note: On some clocks the insulating tube around the connecting pillar is made of thick material and may be difficult to pass through the brass bush. In this case replace the insulating tube with heat shrink sleeving supplied with the kit. Shrink the sleeving onto the pillar using a heat gun.

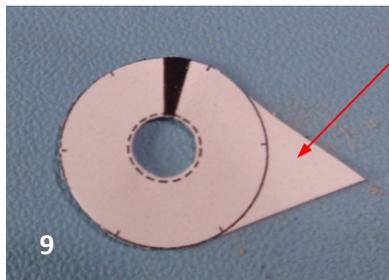


Connecting
Bracket
Retaining
Screw



Insulating
Sleeve

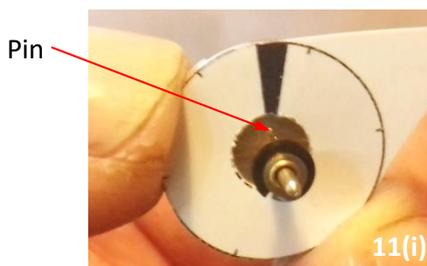
7. Place the connector bracket on top of the brass spacer and secure the bracket to the connector pillar with the retaining screw. Make sure that the curved edge of the PCB lines up closely with the clock baseplate as shown.
8. Fit Insulating Sleeve over connector bracket as shown



Tab

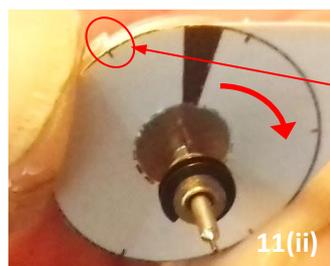
9. Use a scissors to cut out one of the balance wheel stickers from the sheet (the sheet includes a spare). Leave a 'tab' on the edge of the sticker to help with removing the backing when fitting. This tab can also be used to help hold the sticker when positioning it on the balance wheel. The tab can be trimmed off once the sticker is fitted.

10. Carefully clean underside of balance wheel with Isopropyl alcohol and a Q-tip.
11. Before removing the backing from the sticker, practice positioning it as follows (see photos):
 - i. Hold the sticker above the underside of the balance wheel and position the sticker so that the thin end of the black stripe is directly in line with the pin.
 - ii. Rotate the sticker clockwise by a small amount so that the alignment marks on the outer edge of the sticker line up with the steel segments on the top of the balance wheel. This is the correct position for the sticker.



Pin

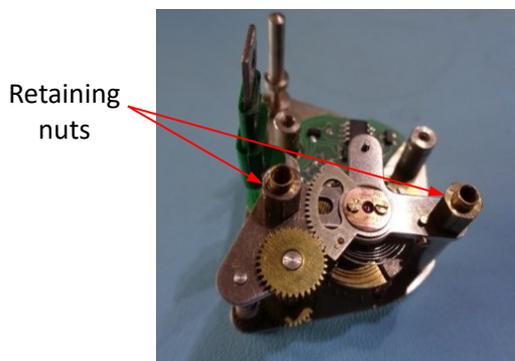
11(i)



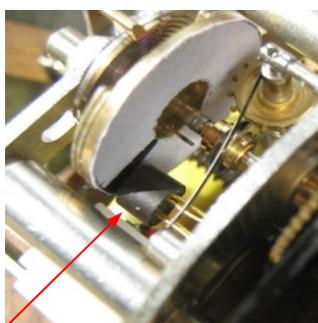
Sticker rotated clockwise
so that alignment marks
align with segments on
back of balance wheel.

11(ii)

12. Once you are confident that you have found the correct position for the sticker, peel off the backing and apply the sticker to the underside of the balance wheel. Smooth it down and trim off any parts which overhang the edge of the balance wheel with a sharp craft knife.



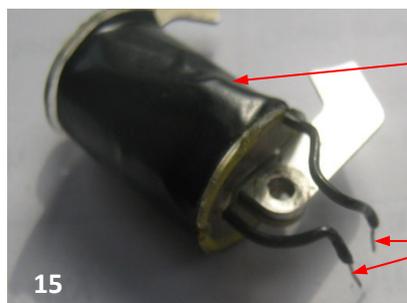
13. Place the balance wheel assembly loosely in place and use tweezers to position the spindles into their bearing holes. Once all the spindles are in their holes push the assembly gently into place and check that the balance wheel rotates freely. **Note:** Sometimes the regulation gears can prevent the balance wheel assembly from being pushed fully into place. In this case turn the regulator spindle a little to bring the gears into mesh.



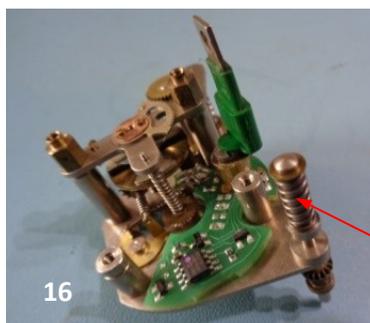
14. Secure the balance support with the two retaining nuts and check again that the balance wheel turns freely. When the balance wheel is at rest, the black marker stripe should sit just a little clockwise of the sensor (when viewed from the underside of the balance wheel). If the marker stripe does 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 Appendix A).

Sensor

15. Strip approx. 3mm from the ends of each solenoid wire. If the tape around the solenoid body looks worn, wrap this with a couple of turns of new insulation tape. Be careful not to flex or pull on the wires as this can break the connection inside the solenoid. To avoid straining the wires, use a small pair of pliers to hold the wire end near to the solenoid body whilst using the wire strippers.

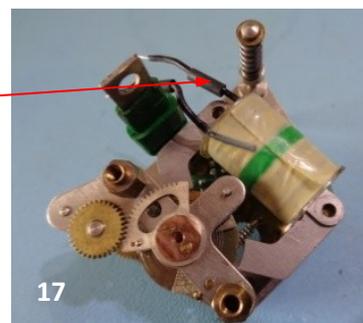


New Insulation Tape
Ends of Solenoid wires stripped



Setting Spindle with spring and Washer

Heat-shrink Sleeving over solenoid wire



16. Fit Setting Spindle, spring and washer.

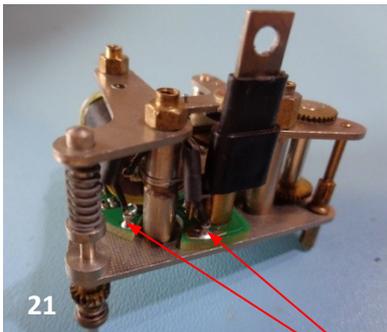
17. Fit the solenoid and place a small piece of heat-shrink sleeving over each wire.



18. Refit the Setting Support Plate and loosely tighten the retaining nuts.
19. Check that solenoid pole pieces are evenly spaced around balance wheel and that balance wheel moves freely.
20. Tighten retaining nuts.

Setting Support Plate

Caution: Make sure that the connector bracket cannot twist and touch against the baseplate pillars or solenoid pole piece as this would cause a short circuit. The insulating sleeve should prevent this but if the gap between the connector bracket and these parts is very small then it is advisable to add some insulation or trim the connector bracket.



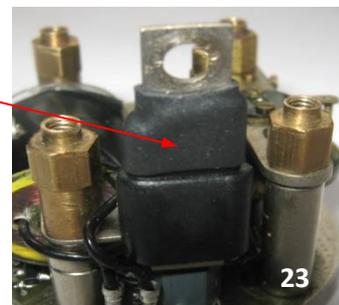
21. Use tweezers to push the solenoid wires into the two connection sockets on the PCB.
22. Once the wires are in place slide the heat-shrink sleeving over the sockets.

NB: The socket posts are designed to have low insertion force; although the wires slide in easily they will still make a good connection. Do not solder the wires into the socket posts as this will melt the solder on the PCB and may cause damage. Do not shrink the heat-shrink tubing until movement has been tested.

Wires fitted into connection sockets



Heat-shrink sleeving shrunk over damaged insulating sleeve



23. 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.

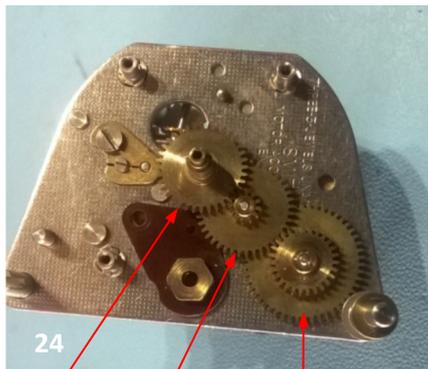
Testing the movement

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

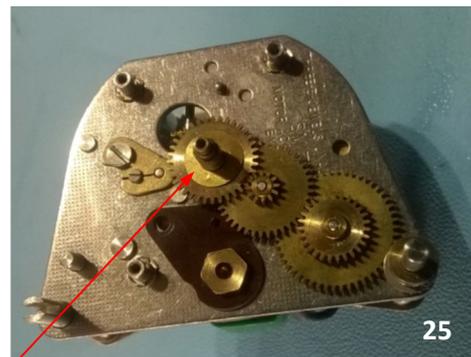
Power Supply Requirements

For testing the clock you must use a **fused** 12V battery or a **regulated** 12V power supply. Car battery chargers are not designed for use without a battery in the circuit and are unsuitable for powering the clock as they produce a very “noisy” output under these circumstances. Similarly, wall mounted power supplies (such as those used for used for powering consumer electronic equipment etc.) are often unregulated and will not produce a suitable output. Using a battery charger when the clock is installed in the car does not generally cause a problem as the battery smooths out the voltage fluctuations. **Caution:** When testing the clock be very careful not to short the PCB terminals against the body of the clock or to each other as this will damage the PCB.

- Connect the clock to the 12V supply – one terminal to the clock supply connector and the other 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 fault finding section at the end of these instructions.



Hour Wheel
Minute Wheel
Setting Wheel



Dial Washer

24. Replace three gear wheels starting with the Setting Wheel, then Minute Wheel and finally Hour Wheel.

25. Fit Dial Washer as shown.

Note: Before fitting, place a small drop of clock oil on the shaft of each gear wheel and also on each side of the dial washer.

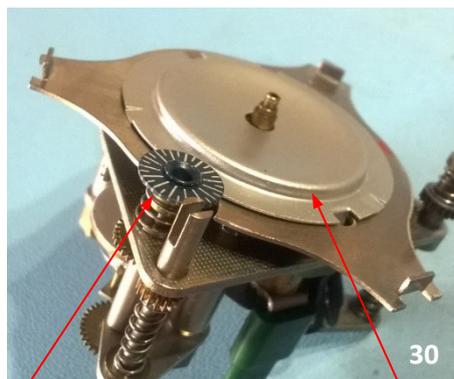


26. Refit the retaining plate (3 screws).

27. **Note:** The back of the retaining plate must be clean so that it doesn't cause friction against the dial washer. If necessary, polish with metal polish before fitting.

28. Re-connect the movement and check again that it is running properly. If it does not run properly but did run previously this is probably because of extra friction caused by fitting the retainer plate – make sure that the back of the plate is clean. In some cases it may be necessary to adjust the damper spring (see fault finding section).

29. If the movement runs correctly use a hot air gun to shrink down the heat-shrink sleeving around the solenoid wires.



Regulation
Disc

Dial Centre
piece

30. Fit regulation disc and spring.

31. Fit Dial centre piece (not present on all clocks)

32. Fit dial plate and secure in place by bending back tabs on retainer plate.



33. Fit hour and minute hands making sure that they align at the 12 O'clock position.

34. Turn the Setting spindle and make sure that the hands do not touch the dial or each other.

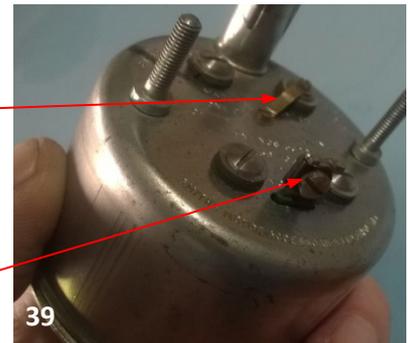
35. Fit the Cap over the centre of the hands

Note: To aid fitting the hands it is useful to make a “hands pusher” tool. This consists of a small piece of dowel with a hole drilled through the middle to clear the spindle. The tool should be made of a material that will not mark the dial e.g. wood or nylon.



Fuse Link

Connection Screw and Plate



36. Refit Backplate

37. Fit movement into case and secure with case screws making sure that the screw with the tapped hole is in the correct position for the fused link.

38. Fit fused link

39. Fit connection screw and plate

Regulating the Clock

Before fitting the clock to the car you should adjust the timekeeping using the regulator screw on the front of the clock.

- 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.

Installing the Clock in The Vehicle

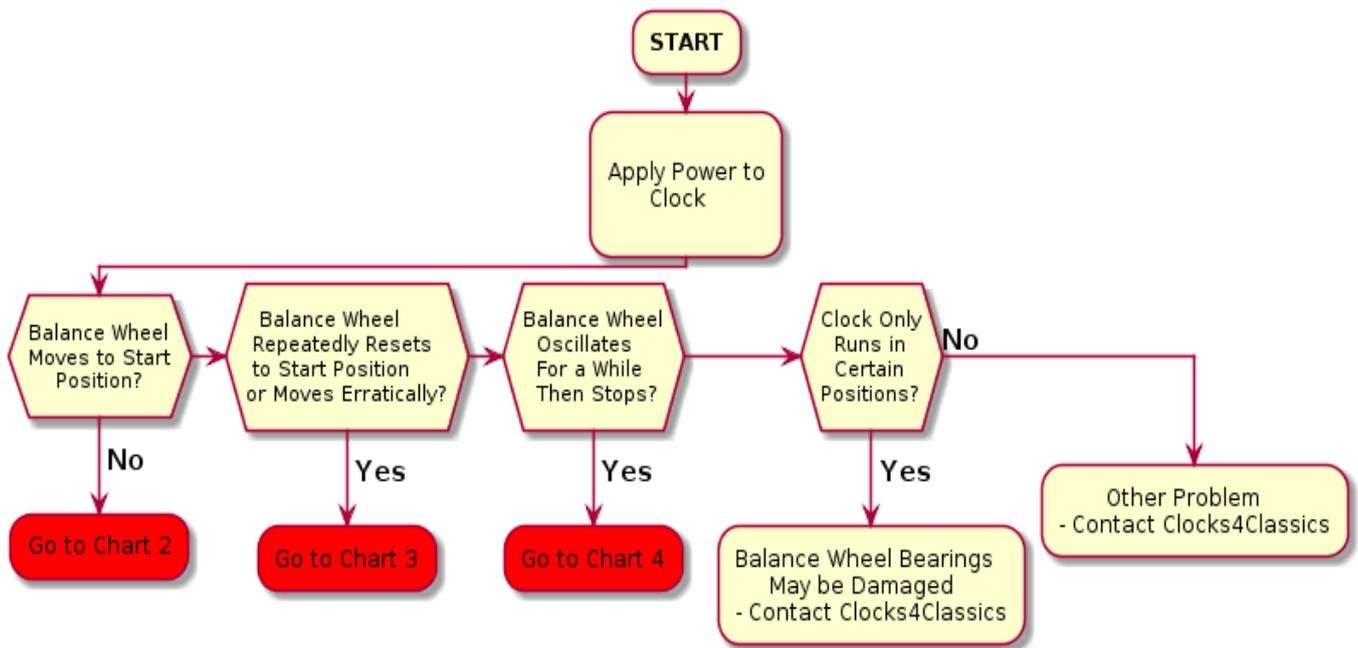
The clock should be fitted to the vehicle using the original mounting points. To protect the wiring it is recommended that the supply to the clock is fitted with a 1 Amp in line fuse.

Fault Finding

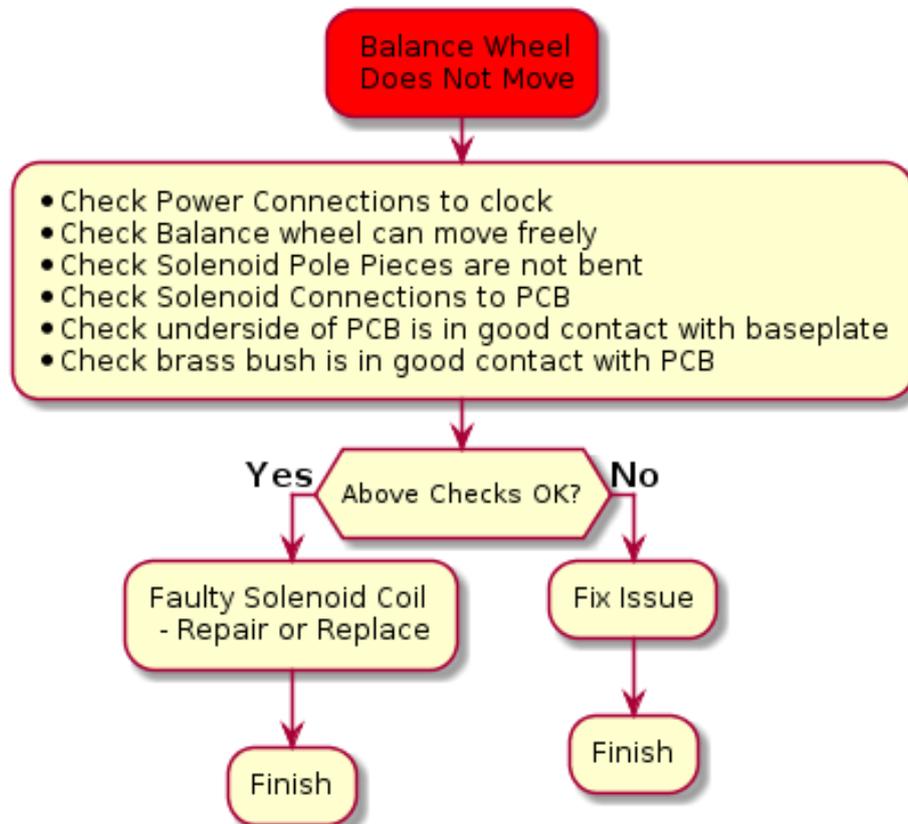
If you have problems getting your clock to run please refer to the fault finding charts below this should enable you to quickly find the cause of the problem.

The great majority of problems are caused by lack of cleaning which results in excess friction in the movement - please note that although the balance wheel may appear to move freely it only takes a very small amount of extra friction to cause a problem and re-cleaning and oiling will often enable the clock to run correctly.

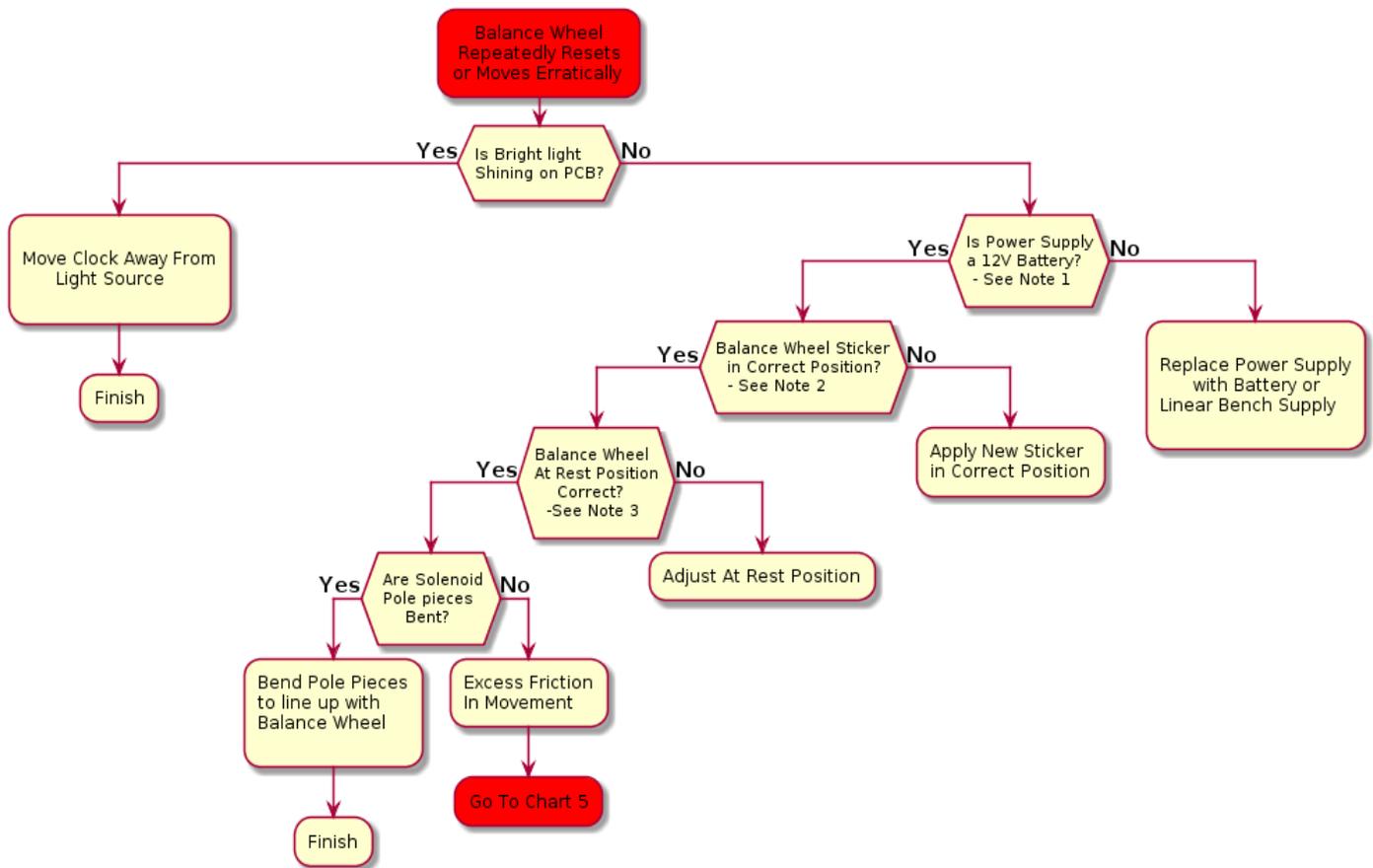
Fault Finding Chart 1



Fault Finding Chart 2



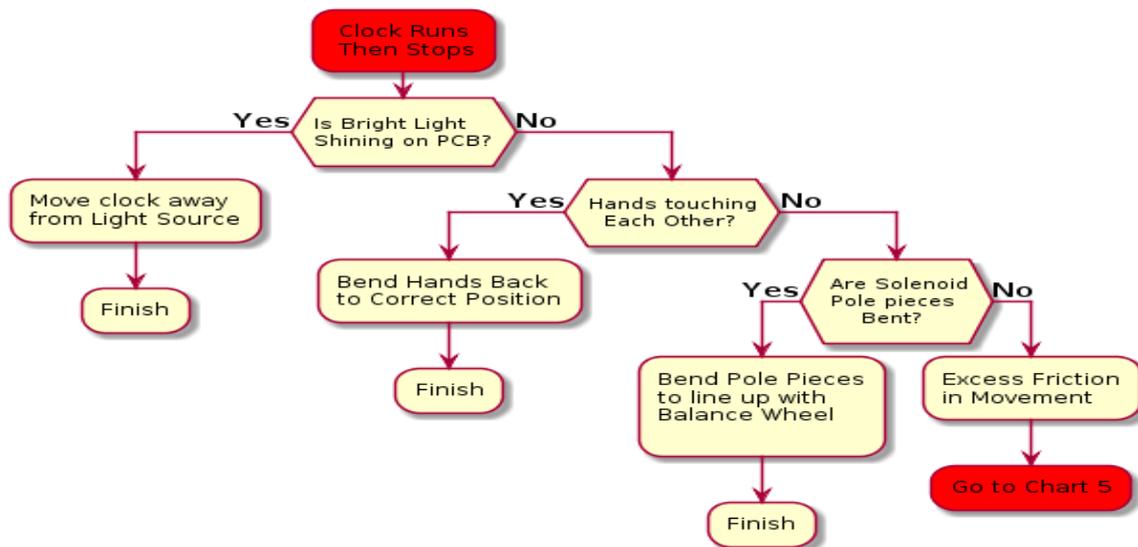
Fault Finding Chart 3



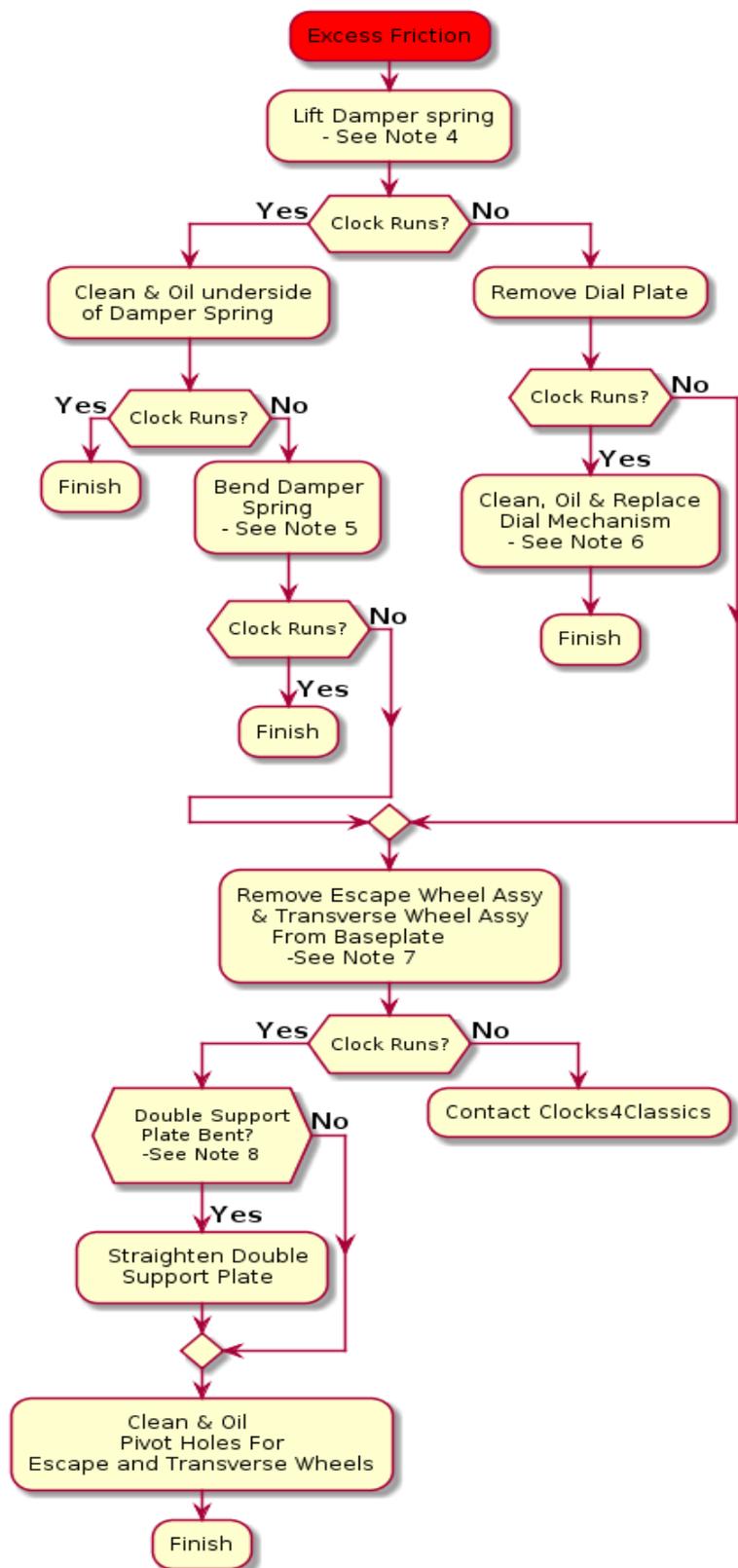
Notes:

1. To test the clock you must use a 12V battery or a good linear bench power – see Power Supply Requirements on Page 14.
2. The sticker must be aligned correctly – see sticker positioning instructions on Page 11 .
3. At Rest position is factory set – only change this if you are sure it is incorrect – See Appendix A on Page 20.

Fault Finding Chart 4



Fault Finding Chart 5



Notes:

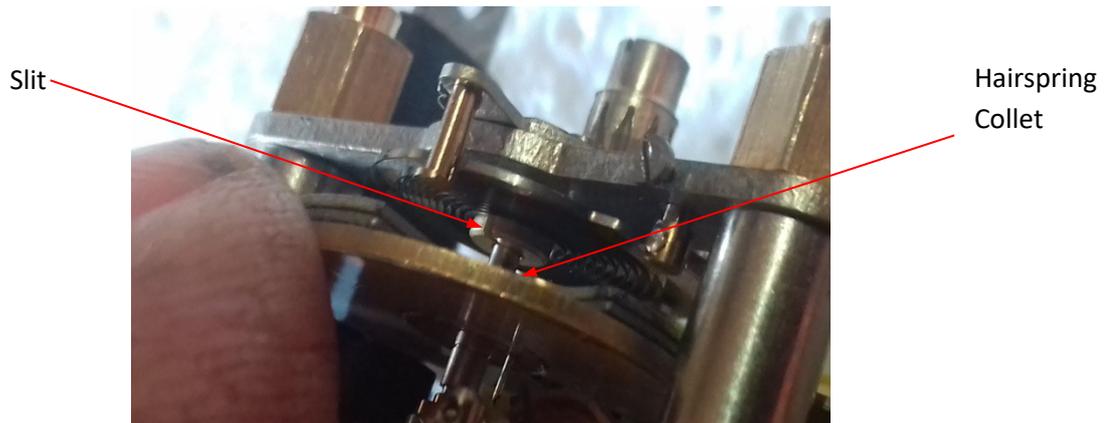
4. Gently lift the spring away from its shaft with a small screwdriver and see if clock will run. A picture of the damper spring is shown on Page 9.
5. If the Damper spring is too stiff gently bend it upwards but be careful not to break it.
6. To clean the dial mechanism, remove the hands and clean & polish the two shafts which drive the hands. Also clean & polish the back of the dial plate where it rubs against the thin dial washer. Apply a drop of clock to all parts.
7. A picture of Escape and Transverse Wheel Assemblies and Double Support Plate is shown on Page 9
8. If the vertical parts of the plate are bent they will rub on their respective shafts and cause friction. A picture of the double support plate is shown on Page 9

APPENDIX A:

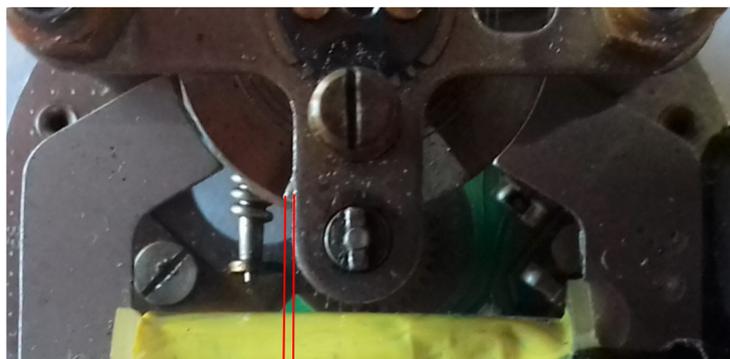
Balance Wheel at Rest Position

The “at rest” position of the balance wheel is factory set and should NOT need to be adjusted, however, if it is clearly wrong it can be adjusted as follows (note that photos are from a similar but earlier movement).

1. Turn Balance wheel until the slit in the hairspring collet is visible as shown below:



2. Place a thin Jeweller’s screw driver in the collet slit and use this to hold the collet in its current position (i.e. prevent it from rotating)
3. With the collet held by the screwdriver, use your thumb to rotate the balance wheel on its shaft to achieve the correct “at rest” position. The correct position is achieved when the balance wheel segments are as shown in the photo below (viewed from the top side of the movement).



Approx. 0.75 mm

4. Note that the collet is sometimes quite stiff and it can be difficult to get the balance wheel to rotate in the first instance. In this case it may be easier to hold the balance wheel still and use the screw driver to rotate the collet. Once the collet has begun to move it is generally easier to hold the collet still and rotate the balance wheel as this gives finer control. It is easy to accidentally “overshoot” the adjustment and it may take several attempts to achieve the correct position.