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British Horological Institute

The Practical Lubrication of Clocks and Watches

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The Practical Lubrication of Watches and Clocks

Contents

1. Sources of information:-

This document has been drawn up with the full support of the Examinations Board of the BHI to provide guidance for both students and professionals. A number of its members, and others, have contributed to the document and their contribution is gratefully acknowledged.

The topic of lubrication is not static and new lubricants and experience will continually add to the body of knowledge. Although it is intended that the information contained represents good practice at this time it has to be recognised that in some aspects other alternatives may well be effective. Whether they are lasting and cost effective is for professional horologists to decide for themselves.

Information on various aspects of lubrication can be found in the Distance Learning Course, as follows. The current document is not intended to duplicate this information but to provide students with comprehensive guidance for oiling and greasing on various types of clocks and watches.

Relevant Sections in the Distance Learning Course are:-

1. How to oil - Oiling equipment, oilers and oil pots (Preliminary Grade L4 P25)
2. Theory of lubrication (Intermediate Grade L 12 P18-21)
3. Reasons for oiling or not oiling (Intermediate Grade L12 P15)
4. Types of oil (Intermediate Grade L12 P17)
5. Oil testing ('Conservation of clocks and Watches', Edited by Peter B Wills)
6. Preparations prior to oiling - cleaning (Intermediate Grade L12 P17)

(Preliminary Grade prepares candidates for assessment at Technician Grade.
Intermediate Grade prepares candidates for assessment at Final Grade Part I.)

2. Introduction:-

Lubrication forms one very important part of the servicing of a clock or watch. It is essential to the good running of the movement. Once repairs have been finished and appropriate cleaning completed then final assembly of the item can take place. It is at this stage that oiling is carried out; some parts will need to be oiled during assembly, such as those items which will not be accessible when assembled. Some aspects will be oiled on the completion of assembly. It is very bad practice to lubricate an item without prior cleaning; dust and dirt will be present which create a very effective grinding paste which will be harmful to the movement. Further, application of oil or grease to a dirty mechanism will usually have only a temporarily beneficial effect on its operation.

The purpose of lubricating a watch or clock is to minimise friction between points of contact. To be effective the working surfaces of the clock movement need to be thoroughly clean before oiling to prevent spreading and early deterioration of the lubricant. The type of oil is important, as is the quantity of oil applied; too much oil will overflow and cause it to be drawn away from the bearing surface. Oil in the wrong place, such as wheel teeth, will retain dust and accelerate wear.

It is advisable to buy good quality oils. The cost of oil is such a small part of servicing costs that using cheap oils is a false economy. It is important to bear in mind the shelf life of the oil when making a purchase.

The information contained in this document will help students to understand and become efficient at lubricating any type of clock, watch or chronometer. The lubrication of watches and platform escapements will receive attention first followed by clocks. The methods of applying oil, the equipment necessary and which components to oil are common to both clocks and watches. The main differences arise due to the variation in size of the mechanisms; this influences the types of oil which are used and the quantity which is applied.

3. The Lubrication of Watches:-

Introduction:-

It must be appreciated that the modern watch, with its fast 28800 vibs/hour fine train, together with a strong mainspring, relies far more on cleanliness and lubricants than earlier watches. The slow train watches, 18000 vibs/hour, would keep functioning, albeit after a fashion, when completely dry. The oil manufacturer invests a lot of time and money in the development of lubricants and watchmakers should treat them with great care. Where the oiling of watches is concerned, nothing short of perfection should be accepted.

3.1 Oiling Equipment and its Maintenance:-

3.1.1 Oil Pots:-

1. The best oil pots are of the all-in-one incalite type which is easy to clean and take to the work instead of stretching over the bench to large heavy individual oil stands. The latter usually have hinged lids and many places for dirt and dust to accumulate. Oil pots should be kept scrupulously clean, with the lid in place when not actually being used. Dirt, fluff, hairs, skin cells or other contamination must be prevented. It is good practice to clean oil pots and replenish with fresh oil every week. All-in-one pots do have the potential disadvantage of cross-contamination of oils and special care in use is needed.
2. Care also needs to be taken to avoid scraping the incalite oil pot with the oiler and thereby transferring small fragments of incalite into the watch movement. Agate cups, due to the very hard material, remove this risk.
3. The use of a number of single type pots has the advantage that only one pot is exposed to the air at a time thus reducing the risk of contamination.
4. Regular replenishment of a small quantity of oil in an oil pot is better than infrequent replenishment of a large pot.
5. Oil should not be used after five years have elapsed from the packing date; it should be protected from light and stored at room temperature, 15 to 20 C, or as recommended by the manufacturer.
6. Contamination of oil in the bottle must be prevented when filling oil pots. A fine glass probe with a small sphere on the end serves very well for assisting

oil from the narrow neck of a bottle. It can easily be sterilised before use to remove any particles of fibre or fluff by passing it through a flame.

All-in one type of oil pot

3.1.2 Types of Oilers:-

Watchmakers vary in their preference of type of oilers; in expert hands each can be effective. The advantages and disadvantages of each are set out below.

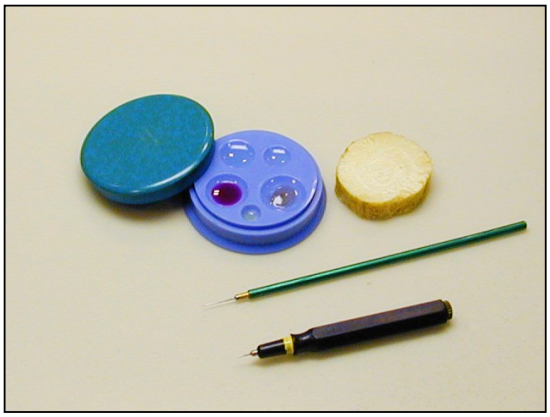
Simple oilers:-

Advantages:-

1. Easy to judge the amount on the oiler nib and reduce if it is too much by depositing of the excess oil onto a clean finger nail.
2. Cheap to maintain i.e. should the nib become damaged or broken it is quickly repaired with a staking set and a fine stone.

Disadvantages

1. Need to develop ability to obtain correct drop size.



Oilcup, pith and oilers

Automatic Oilers:-

Advantages

1. Speed of application.
2. Ability to deposit selected amount of oil.
3. Protects oil from environment and air.
4. No risk of contamination with other oils.
5. Efficient in a busy workshop when servicing similar calibres.

Disadvantages

1. Considerable practice is required to ensure the correct amount of oil is deposited every time. This may make it difficult to ensure the precise oiling of different sizes of jewel hole.
2. Several sizes of nibs are needed for the different lubricating procedures; a number of automatic oilers are therefore required.
3. Need to keep nib clean.
4. Nibs susceptible to breakage.
5. There is a small additional workshop maintenance cost.
6. Automatic oilers need to be kept out of daylight.

3.1.3 Pith and Rodico:-

Pith

Only best quality pith with high absorption properties should be used.

Rodico

After oiling, if there is any extraneous oil present around oil sinks or on watch plates it is advisable on good quality work to re-clean the components. Many watchmakers, however, find Rodico useful in such circumstances. There is a need for caution in its use; it is more successful when used in a “dabbing” motion rather than “wiping” which can leave marks on the plate. It should not be used as a rescue from slipshod work. Rodico can also be very useful during assembly, for example, when placing end stones in position.

3.1.4 Cleaning of oilers:-

Clean pith should be used to clean the oiler nib each time it is used **and** each time a change in the grade of lubricant is required. i.e. when oiling the train wheel pivots - centre wheels have a different grade from the rest of the pivots.

Particular care must be exercised to ensure that there are no particles of pith present on the oiler during use. Instead of pith, or after cleaning with pith, many watchmakers use Rodico. However it must be recognised that Rodico is effectively a sponge which will accumulate and transfer oil to the watch. Even clean Rodico leaves a slight residue which can contaminate oils. Care must therefore be exercised in its application and many watchmakers avoid its use.

Automatic oilers will require thorough cleaning from time to time, especially when changing from one type of oil to another.

3.2 Types of Lubricant – general principles:-

The choice of lubricant to apply to any part of a watch will depend upon its duty. For example, it is important that the oil applied to the escapement of a watch is of low viscosity and resistant to oxidation and degradation. Synthetic oils are therefore generally used; there is much agreement on the particular type to use for different applications. The use of unsuitable lubricants will harm the action and timekeeping of the watch.

The viscosity of the oil required for the train of a watch will depend upon the size of the pivots and the load on the pivot. Manufacturer's current recommendations are the best guide in such circumstances; in the absence of such information then a comparable service guide can be used for guidance. The use of inappropriate oils may affect the period of operation of a watch, increase wear and reduce the interval between servicing.

Since there are a number of different types of automatic watches the lubricants used are usually specific to the type of movement and service manuals are, again, the ideal source of advice. Use of unsuitable oils will harm the action of the winding mechanism and affect the going period of the watch.

The choice of oils or greases for winding work is not critical to the operation of the watch but the lubricant must spread to the various parts of the winding mechanism but not contaminate other parts of the watch. An unsuitable oil or grease will not harm the movement but may influence the period between servicing.

For mainsprings a number of options are possible and each manufacturer usually has their own preferences. Use of inappropriate lubricants may influence the period of operation of a watch.

Surface treatment to prevent spread of oils is commonly used in watches, particularly escapements. It is less commonly used in clocks but can have similar advantages. Please refer to "Surface Treatment and its Application" (Page 7). Each manufacturer has their own preferences and some place reliance upon the additives in the oil and cleanliness to avoid the oil spreading.

There are a number of different types of oil available and, generally, manufacturers of the various lubricants provide advice on their suitable use. If such instructions are not available then as a guide the following oils or equivalents can be adopted; further detail is present in the table to be found in Section 3.3.

Moebius Synt-a-lube 9010	Pivot holes for fast moving wheels, low pressure in jewelled bearings. e.g. second and escape arbor pivots and balance.
Moebius 941	Impulse face of pallets and escape arbor pivots for **low frequency** calibres: 18000, 19800, 21600 vibs/h
Moebius 9415 grease	Impulse faces of pallet and escape arbor pivots for **high frequency** (high speed *clinergic* escapements) calibres: 28800 vibs/h

Moebius 9020 — Pivot holes for trains, escape wheel and balance pivot holes in larger calibres

Moebius Synt-HP 1000 — Pivot holes for slow moving wheels with high pressure on jewelled bearings.
e.g. Barrel-arbor, centre and third arbors

Moebius KT 22 (Bergeon ref. 2588) or PML (Bergeon ref. 2845)
Mechanical friction systems
e.g. Cannon pinion, winding and setting mechanism, calendar mechanism and mainspring

Moly OLYT 778 — Barrel wall of automatic watches; it is important to remember to ensure the lubricant is suitable for the particular material used for the barrel.

Fomblin UT 18 — Grease for case gaskets: to ease assembly, assist the function of moving parts (crown in tubes) and contribute to the water proofing property of the case.
Ex. Case back, tube, crown, pushers and rotating bezels.

Also assists the smooth functioning of the 'snap' on bracelet clasps!

3.3 Detailed Guidance for Selecting lubricants:-

The table shows examples of the oils which are appropriate for the size and frequency of the escapement.

Type	Balance staff	Pallet jewels	Escape arbor pivots	Train pivots	Centre arbor pivots	Barrel arbor pivots	Main Spring ++	Winding or setting	Automatic mechanism
Up to 8 ¼ ligne	9010	941 up to 21,600 train	9010	9020	HP500	HP1300	* 8030.	8030	HP500
8 ½ to 12 ½ ligne	9010 or 9020	941 up to 21,600, 9415 high frequency	9010 or 9020	9010 or 9020	HP500 or HP1000	HP1000 or HP1300	* 8200 Jisma 124 KT22. Moly Olyt 778 on autos	8030	HP500 HP 1000
13 ligne and greater	9020 +	941 up to 21,600 train **	9020 +	9020	HP500	HP1300	* 8200	8030	HP500

Notes for the table giving detailed guidance when selecting lubricants:-

+ Chronometers or other pieces with heavy balances will require a thicker oil for balance and escape wheel pivots, such as D5. Oils of this type, D3, D4, and D5 are more prone to spreading than HP series oils and for this reason are not listed as generally recommended. HP 1300 is equivalent to D5. HP500 is equivalent to Moebius 9020.

++ Automatic calibres may have different metal combinations for the slipping mainspring end and the barrel and manufacturers instructions must be followed.

* Moebius 8200 series greases include types containing molybdenum and types suitable for barrels with different materials. For barrels in non–automatic movements, some watchmakers prefer their own recipes such as a mixture of molybdenum disulphide paste and heavy mineral oil.

** Pallet pins on pin lever escapements require a lubricant which will remain in place. Either a stabilised grease, (such as Microtime stabilised grease) or 941 and 9415 are suitable depending upon calibre.

3.4 Storage of Lubricants:-

In daylight, oils deteriorate due to ultra violet light; this is the reason for red dye being used for protection. Bottles and oil pots should therefore be protected and exposed to daylight as little as possible. Bottles must be kept stoppered, cool but not cold, and in the dark.

3.5 Surface Treatment and its Application:-

Surface treatment may be recommended to avoid oil spreading to other components in the movement. Use Moebius Fixodrop FK BS-10 or BS-20 ‘Epilame’ for parts such as pallet stones, automatic reversing wheel, in some instances centre second wheels, and shock resisting balance jewels.

Method of application – other than pallets:-

Items Required:-

1. A bottle with a waisted neck and flat surface to the fluid tight screwed lid.
2. A basket for small watch parts.

Suitable bottle and basket for immersing items in Fixodrop

The watch parts (escape wheel, balance shock resisting jewel etc) requiring the treatment are placed in the basket which is then positioned in the top of the bottle.

The stopper is firmly screwed into place to make a fluid tight seal, the bottle is then inverted. The fluid flows into top compartment of the bottle wetting the parts.

After two minutes, no more, the bottle is righted allowing the fluid to return to the bottom of the bottle thereby leavening the basket to drain thoroughly.

The basket is then removed and dried with the use of a hairdryer, for at least four minutes. This is to speed up the evaporation of the alcohol and prevent rust forming on the parts. (Waisted neck bottles ("Rolex Bottles") can be obtained from A1 Laboratory Supplies, Unit 6, Plaza Business Centre, Stockingwater Lane, Brimsdown, Enfield, EN3 7PH, Telephone: 0208 8059958/www.al-labsupplies.co.uk – price around £27.00 each)

Method of application for pallet stones:-

Application of "Fixodrop" to the whole frame can cause a loss of action, the pallet stones only should be treated.

A small amount of the fluid is tipped into the upturned stopper and the pallet stones only are immersed in the fluid and then dried with the hairdryer.

3.6 How Much Lubricant to Apply:-

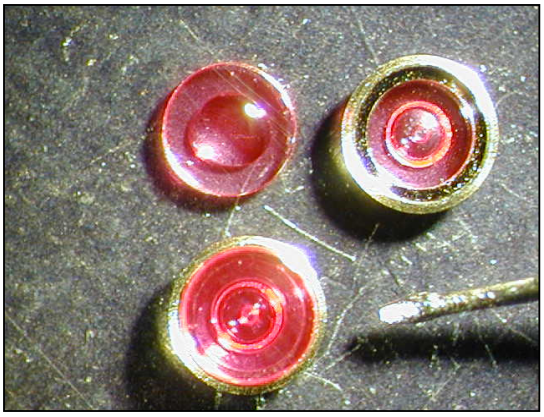
Service manuals for a particular calibre of movement will usually provide definitive advice on the type, quantities of lubricants and where to apply them. For older calibres such advice may not be available. The following guidance can therefore be adopted.

Balance pivots - shock and non-shock resistant jewels:-

The amount will depend on whether *Epilame* surface treatment has been used.
If the jewels have been treated then, when the endstone is assembled with the jewel hole, a ring of oil should be visible covering ⅔ of the diameter of the endstone; if not treated then it should cover ½ of the diameter of the endstone.

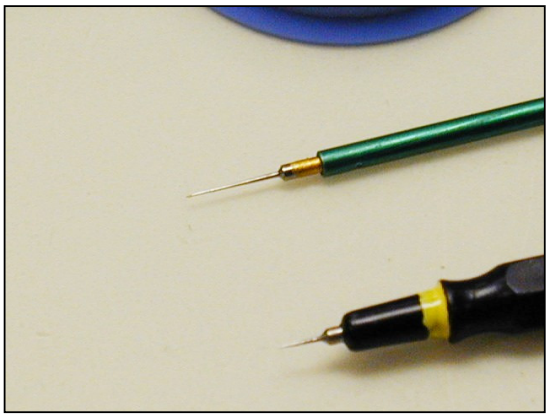
Three alternative methods:-

1. Applying oil first to the cap jewel and then lowering the jewel hole onto it. This method is the best of the three as no oil is applied to the oil sink but a great deal of practice is required to achieve consistently reliable results. The oil diameter should be consistent; it is important to learn the oiler's capability and how much oil to pick up from the oil pot.



Placing oil on the endstone and lowering the jewel hole in place

2. Oil through the assembled jewel hole and cap jewel by applying oil to the jewel hole. It is then drawn through the hole onto the cap jewel with a pointed oiler, such as an oiler with the nib stoned off which is made especially for the purpose. This method risks filling the setting and leaving an amount of oil in the "oil sink" that can be dislodged down the balance staff. It is the only approach for permanently fixed end stones.



Fine oiler for drawing oil through the jewel hole onto the endstone

3. The automatic oiler can be used in a similar manner to approach number 2.

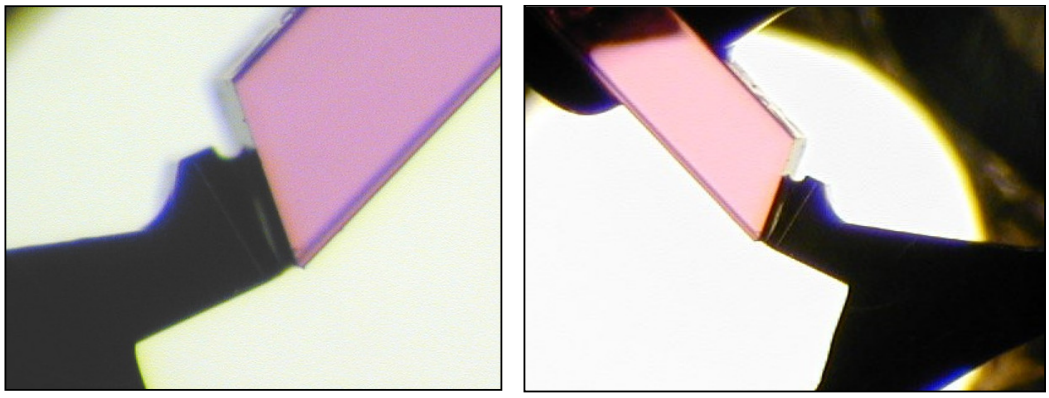
The Pallet Stones:-

The impulse faces of the pallets should be oiled so that, after oiling, no oil should be present on the top or bottom surfaces of the pallet stones or escape wheel.

There are two main alternative methods for lubricating the pallet stones:-

1. The lubricant is applied to the stones *before* the lever is fitted in place in the movement. This requires care to avoid the oil being transferred to other components.
2. The lubrication is applied to the stones *after* the lever is fitted using one of the following methods:-
    a. The lubricant is applied with the lever *stationary* before the balance is fitted. The oil is applied to the impulse plane of the exit stone, usually from the top and the lever moved from side to side to advance the teeth. When three or four escape wheel teeth have passed the process is repeated until all the teeth have been equally and evenly lubricated.
    b. The movement is turned over and the exit stone is lubricated through the inspection hole in the main plate and the lever moved from side to side to advance the teeth. When three or four escape wheel teeth have passed the process is repeated until all the teeth have been equally and evenly lubricated.
    c. A small amount of the lubricant is applied to each of the escape wheel teeth. The movement is turned over and the escape wheel teeth are lubricated through the inspection hole in the main plate. The oiler is charged with oil / grease and then lowered to a position that allows the moving escape wheel teeth tips to pass through the oil/grease, one by one, until all teeth and pallet stones have been equally and evenly lubricated.

If there is the correct amount of lubricant, a “wedge” of oil can be seen between the escape wheel tooth and the pallet impulse face. When the leading edge of the tooth is at the discharge corner the “wedge” of oil should be approximately ⅔ of the distance along the pallet impulse face.



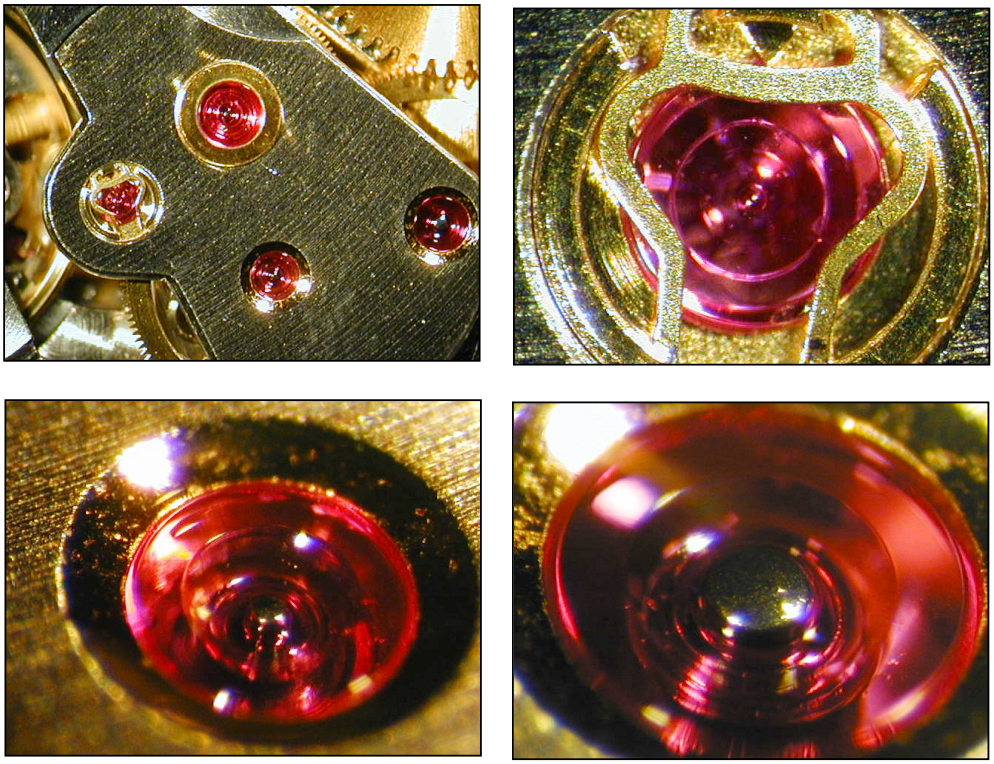
The correct amount of oil is visible on the impulse face, a trace of oil can be seen on the locking face but no oil should be present on the other surfaces of the pallet jewels.

Lever Pivots:-

Pivot jewels under 13 ligne are never lubricated.

Train Pivots:-

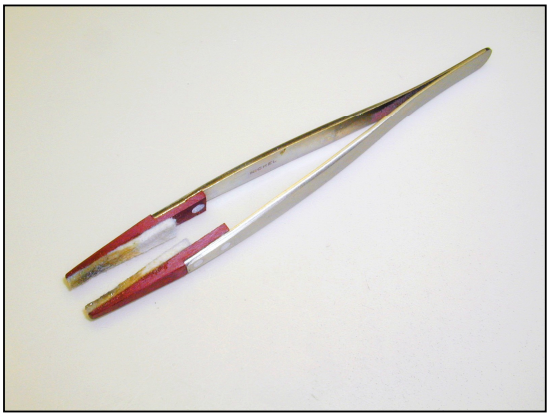
The oil sinks of the jewel holes should be about half full; there must be no oil on any other part of the jewel.



Examples showing the correct oiling of jewel holes

Barrel Assembly:-

1. Barrel:-
   If the watch is self-winding, then the barrel wall is lubricated at three positions around the circumference with points of grease the size of a small cap jewel as found in a ladies watch.
2. Arbor:-
   The arbor bearing surfaces with the barrel are lubricated as the barrel is assembled. The bearing surfaces for the main plate and the bridge are lubricated just prior to fitting the assembled barrel into the movement. *No additional lubricant is necessary.*
3. Mainsprings:-
   Mainsprings cannot be lubricated whilst in place in the barrel. The mainspring is greased prior to being wound into the mainspring winder with special tweezers for the task. The entire length of the spring is pulled through the tweezers (illustrated) that have grease-charged pads. This ensures both surfaces of the spring are fully lubricated. Care must be taken to prevent contamination of the pads. An alternative method is to use clean acid free tissue paper charged with grease. New mainsprings are supplied ready lubricated and can be fitted without additional lubrication.



Tweezers for lubricating mainsprings

Crown wheel:-

The bearing surfaces of the seating and the core, together with the wheel, are lubricated as they are assembled.

Keyless work:-

When correctly lubricated, there should only be a small amount of grease visible on the specific points mentioned below. If there is any additional grease, then the mechanism has been over lubricated.

1. Stem:-
   The square winding pinion bearing surface, the end pivot, the setting lever groove, and the main plate bearing surface are greased.
2. Clutch wheel and winding pinion:-
   The yoke groove and the teeth on wheel and pinion are greased.
3. Setting lever and spring:-
   The screw of the setting lever in the main plate and the setting lever spring at the contact point with the lever post are greased.

Keyless work, continued:-

4. Yoke and spring:-
   The yoke post in the main plate and the contact point of the yoke and spring are greased.

Motion work:-

1. Setting pinion:-
   Lightly lubricate the post in the main plate.
2. Minute wheel:-
   The post of the minute wheel in the main plate is lightly lubricated on calendar watches.
3. Cannon pinion:-
   The centre arbor "tube" is lubricated with grease over its entire outside length; it is important to prevent any lubricant being present on the inside of the centre arbor "tube" on a centre seconds watch. The lubricant should be applied to the centre wheel tube and not the inside of the cannon pinion.
4. Hour wheel (date and non-date):-
   The hour wheel pipe is ***only*** lubricated on date watches.

Calendar mechanism:-

Guidance should be sought from the manufacturer's technical information because there are very many different approaches for date mechanisms.

1. Jumper:-
   Between the jumper and disc, a small amount of grease is worked through the teeth of the disc; do not rely on the date mechanism to distribute the grease.
2. Calendar wheel:-
   Lubricate the post in main plate and under the screw head.
3. Date/day indicators:-
   As jumper above.

Self-winding mechanism:-

Guidance should be sought from the manufacturer's technical information because some reversing wheels, like those on Rolex watches, are not lubricated but factory treated with *Epilame* only. Other manufacturers, e.g. ETA and Breitling, use special solutions on their reversers.
It is generally appropriate to lubricate the ratchet drive wheel, the reversing wheel and the oscillating weight axle and bearing (jewel or ball):

3.7 Frequency of Servicing:-

The frequency of servicing of a watch movement should be based upon the manufacturer's recommendations. A period of 5 years is normal. Where such guidance is not available the quality and condition of the case will determine its ability to exclude dust etc and more frequent servicing will be necessary. A period not exceeding 2 years is normal for the smaller calibres such as ladies dress watches.

3.8 Platform Escapements:-

Platform escapements are intermediate in size between watches and clocks and should be oiled accordingly; the order for oiling may however differ. End stones will be oiled on assembly whereas escape wheel jewel holes and pallet stones can be oiled after assembly due to the ease of access. Care needs to be taken to ensure that the balance and spring are not contaminated with oil. The types of oil used will be the same as for a pocket watch of large calibre.

The escape wheel teeth of cylinder escapements should be oiled so that a small amount is transferred to the inner and outer surfaces of the cylinder.

3.9 How to Check Your Work:-

Checking your own work is of paramount importance. In the larger watch houses, during both manufacturing and servicing, there is an inspection department. Your reputation depends on quality work – it is necessary to check standards.

If two or three watchmakers share the same workshop then it can be arranged so that each person's work is examined by one of the others. If you work alone then it is a good idea to look again at the finished work the next morning through "fresh eyes"; it is sometimes amazing to find what you see or didn't see yesterday! This should be applied not just to the oiling but to every aspect of the finished work.

Check if the dial is free from dust and hairs; try the hand and date setting. Are the hands correctly synchronized and with the date changing at midnight? Wind the watch, if it is an automatic; is it smooth when the mainspring starts to move on the barrel wall when fully wound or is it rough and jerky that will cause the watch to gain heavily? Your client expects the timepiece to function and perform as the manufacturer intended; this is what you have been paid to do.

When all is well with the outside, open the watch and check the inside. It should look as if it has just been expertly serviced with plate and bridges free from finger marks, hairs and dust. Check that all the screws are tight, including the setting lever screw, an important aspect often forgotten! Look at the balance and escape wheel cap and jewel holes - are they clean from dust and hairs with the correct diameter of oil, round in appearance, on the end stone? Is the hairspring flat and in the centre in the balance cock? If the watch is equipped with a regulator, is the hairspring clearance between the curb pins at a minimum and the escapement beating evenly? Next the escapement, check the horn and guard shakes; check the locking by moving the balance slowly and observing the tooth dropping onto the pallet stone and then sliding along the locking face to full lock. Remember, this is not the main checking and adjusting exercise; you should have already done that when the watch was serviced. This is only a final inspection and any handling/contact of the cleaned movement must be kept to a minimum. Is the oil in the train jewel holes dust and hair free and the jewels clean and un-smudged; put the watch in the timing machine and re-check the performance.

These checks may seem to be unnecessary but they are easily carried out in a few minutes; if it saves a service return, or worse, a dissatisfied client, then it is worth the time.

4. The Lubrication of Domestic Clocks

4.1 Types of Lubricant – general principles:-

Clocks are on a larger scale than watches and are therefore more tolerant to the choice of lubricants and a number of suitable options are available. Platform escapements, however, will come under the same requirements described previously for watches.

Clock escapements require lubricants of a suitable viscosity, depending upon size, to provide a low friction sliding contact; the lubricant should not be dissipated from where it is required. Use of inappropriate lubricants may influence the timekeeping of the clock, cause wear on the escapement and affect the period before further servicing is required.

Clock pivots require a lubricant of suitable viscosity for the size of pivot and load applied. Use of too high a viscosity will result in a loss of power through the train which may influence the going period of the movement, the action of the escapement or the swing of the pendulum. The period between servicing will be influenced by how quickly the lubricant either migrates or deteriorates. Synthetic oils are beneficial due their high resistance to gumming and ageing.

Sliding surfaces require a lubricant to remain in place during prolonged operation.

Mainsprings require a lubricant which is suitable for high pressure loadings; greases containing molybdenum di-sulphide can be advantageous.

Surface treatment to prevent spread of oils is not commonly used in clocks but can have similar advantages to its use in watches.

Clocks utilising polymeric plastic components in plastic/plastic or plastic/metal contacts require suitable synthetic oils.

The ideal clock oil should have the following properties:-

1. Correct viscosity (thickness) little affected by temperature change
2. Low tendency to spread
3. Low tendency to evaporate – long lasting
4. Low tendency to react adversely with air or metals

The types of oils available are:-

1. Natural, such as neatsfoot
2. Mineral
3. Synthetic

Natural oil has the disadvantage of reduced shelf-life and durability compared with mineral or synthetic oil. Synthetic oil, although expensive, is considered superior to natural or mineral oil. Manufacturer's instructions should be followed carefully when selecting the type and viscosity of oil for a particular application.

4.2 Detailed Guidance for Selecting Lubricants:-

The table shows examples of the oils which are appropriate for the size and frequency of the escapement.

Type	Balance staff	Pallet jewels	Escape arbor pivots	Train pivots	Centre arbor pivots	Barrel arbor pivots	Mainspring
Platforms	9020	941	9020	HP500	HP1300	HP1300	* or 8200
Chronometers	9020	None	9020	HP500	HP1300	HP1300 D5	* or 8200
Domestic clocks	9020 up to HP 1300 depending on size	941, or, for non jewelled pallets HP500/1300 depending on size	9020 up to HP1300 depending on size	HP500 up to HP1300 depending on size	HP1300 D5	HP1300 D5	* or 8200

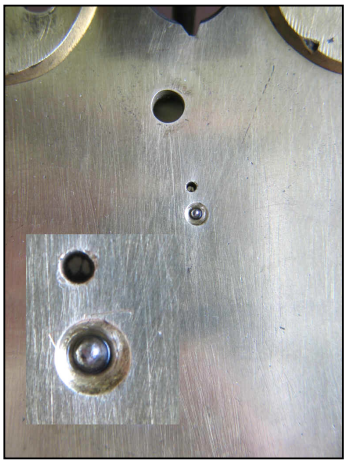
* Some clockmakers prefer their own recipes such as a mixture of molybdenum disulphide paste with heavy mineral oil.

4.3 When to Oil:-

Before dismantling a fusee movement with dry pivots, it is acceptable to apply oil prior to running the train in order to let down the mainspring. Otherwise it is only good practice to lubricate after cleaning and overhaul have been completed.

4.4 How Much Oil to Apply:-

One drop of oil at a time from an ‘oiler’ made from brass wire about 0.6mm diameter flattened at the end and filed to a point. Quantities of oil will depend upon the size and type of clock. Carriage clocks will require small quantities whilst longcase clocks will require considerably more. After oiling there should be a visible presence of oil in oil sinks. Also, a neat ring of oil should be present where the pivot shoulder contacts the plate.



Oil sink on long case clock, enlarged view inset

Oil sinks on back plate of carriage clock

Close up view

Excess oil will lead to it running away from oil sinks and this must be avoided.

Use of oil cups ensures that there is no contamination of the oil in the bottle. It is important to keep the oiler clean during use to prevent dirt being transferred from the movement to the oil pot; any contamination of the oil pot is immediately obvious and the oil can readily be renewed.

4.5 Where to Oil:-

There are many components on a clock to which it is necessary to apply oil. It is therefore very easy to forget to oil a particular aspect, especially if it is one of the less accessible parts of the movement. One such example is the centre arbor in the front plate. It is good practice to have a general check list to ensure that nothing is missed. It is also good practice to apply oil in a particular sequence, such as working along each train separately such as from barrel to escapement.

All individual points which are sliding and / or rotating points of contact should be lubricated. The oil should be applied at a position where it will distribute itself to where it is required, as follows:-

Note: where necessary, the point for oil application is underlined

1. Oil sinks/pivot holes in movement plates, cocks and mainspring barrels
2. Escapement pallet faces
3. Weight pulley bearings
4. Points of contact between:-
    a. Pendulum and crutch
    b. Pin wheel <u>pins</u> and hammer lever
    c. Hammer <u>tail</u> and spring
    d. Hammer tail and stop/counter
    e. Warning wheel <u>pin</u> and detent (best to avoid oiling on carriage clocks since the oil will easily run onto the wheel teeth)
5. Fusee stop iron and spring:-
    a. Fusee click and spring
    b. Fusee <u>click</u> and ratchet wheel
    c. Fusee ‘key plate’ and arbor
    d. Fusee great wheel and fusee body

    N.B. If this is a brass to brass contact then oiling tends to cause problems rather than helping. Oil quickly picks up dirt here and accelerates wear.

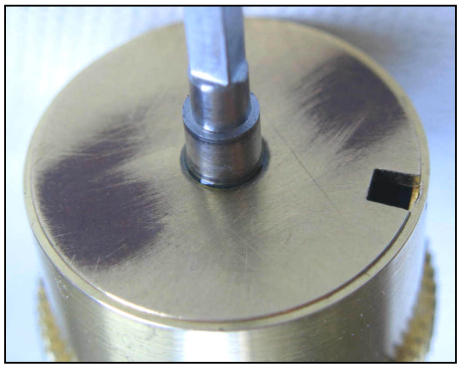
Where to Oil, continued:-

6. Going barrel click and spring:-
   a. Going barrel click and screw
   b. Going barrel click and ratchet wheel
   c. Going barrel Maltese cross and stop finger
   d. Chime barrel pin and hammer tail
   e. Chime hammer block and pin
   f. Chime hammer tail and spring
7. Under-dial work:-
   a. Stud posts
   b. Centre arbor/cannon pinion
   c. Friction spring contact points – to reduce noisy 'squeaks'
   d. Gathering pallet lifting/locking points
   e. Minute wheel pin and lifting piece
   f. Cannon pinion pin and star wheel
   g. Rack hook faces
   h. Point of contact between:-
      i. Rack hook and lifting piece
      ii. Rack and 12 o'clock pin
      iii. Rack tail and snail
      iv. Rack tail and spring

      N.B. Rack and rack hook contact points – best not to oil on French carriage clocks to avoid risk of sticking.
8. Star wheel and jumper - if this is a brass to brass contact oiling is best avoided unless it is to reduce noisy 'squeaks'.
9. Jumper and spring

4 .6 Oiling Mainsprings:-

Clean the mainspring and refit into barrel, replace barrel arbor but leave barrel cap removed. Apply a film of heavy-grade clock oil or a mixture of Molybdenum disulphide paste with heavy mineral oil, around the ends of the spring leaves and fit the barrel cap. Capillary action will ensure that the spring leaf surfaces become fully lubricated. Check that the oil has penetrated to form a ring of oil around the barrel arbor at the positions where it emerges from the barrel since this forms one of the bearings when the barrel is turning.



Visible ring of oil around barrel arbor

4.7 Where it is Inappropriate to Oil:-

1. Do not oil wheel teeth and pinion leaves; the oil will retain dust to form an effective grinding paste.
2. The winding ratchet and great wheel arbor in a thirty hour clock should not be oiled; it is best to use graphite grease instead.
3. It is a waste of oil to apply it to:-
   a. a fusee mainspring pivot hole in the plate
   b. a fusee “solid click” and ratchet wheel since these parts only move during mainspring set-up.
4. Do not oil:-
   a. a carriage clock ‘surprise piece’.
   b. screw pivot on a flirt i.e. the pivot at the 'knee' of the flirt.

4.8 Frequency of Oiling:-

Non-synthetic oil in contact with the air deteriorates due to oxidation which results in the formation of a sticky and sometimes acidic gum. This is usually evident from the deterioration in the performance of the movement as well as the oil darkening in colour. Modern synthetic oils tend to allow mechanisms to run for very long periods, even after the oil has lost its oiliness. Contamination with dust will promote wear in such situations; owners should be made aware of this and encouraged to have their clock movements inspected and serviced at suitable intervals. Oil also retains dust making it both abrasive and more viscous. The environment of a clock will play large part in how rapid is this deterioration. A well sealed case is a considerable advantage since this will be more effective at excluding dust.

In some circumstance re-application of oil to parts of a movement is acceptable. Dry pivot holes should not be re-oiled since abrasive particles will be present but oil can be added to those for which oil is visibly present. Application of fresh oil to a pivot hole can be allowed after drawing out the used oil. However, if the used oil is black this is evidence of wear occurring and dismantling, inspection and cleaning are necessary before re-oiling. Oil tends to migrate from the pallets of a clock escapement and application of additional oil after a period of running will help with performance. Platform escapements should not be re-oiled but stripped and cleaned before oiling.

The frequency of servicing must be acceptable to the customer. A period between servicing of about 5-8 years for a carriage clock and 10-12 years for a longcase clock would be normal. It must, however, be recognised that the more frequently a movement is serviced and lubricated the longer will be its life.