Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

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SUBJECT: Cleaning and Oiling

CLEANING

Among the functions of a watchmaker when repairing any kind of watch, cleaning and oiling are perhaps the simplest and yet in the long run the most important. Watch movements in recent years have been so reduced in size and so increased in delicacy that any small piece of dirt or lack of proper lubrication in any of the jewels will lead to erratic performance and stopping. The finest repair job can be spoiled in the course of a few months' time due to some slight oversight in the cleaning procedure.

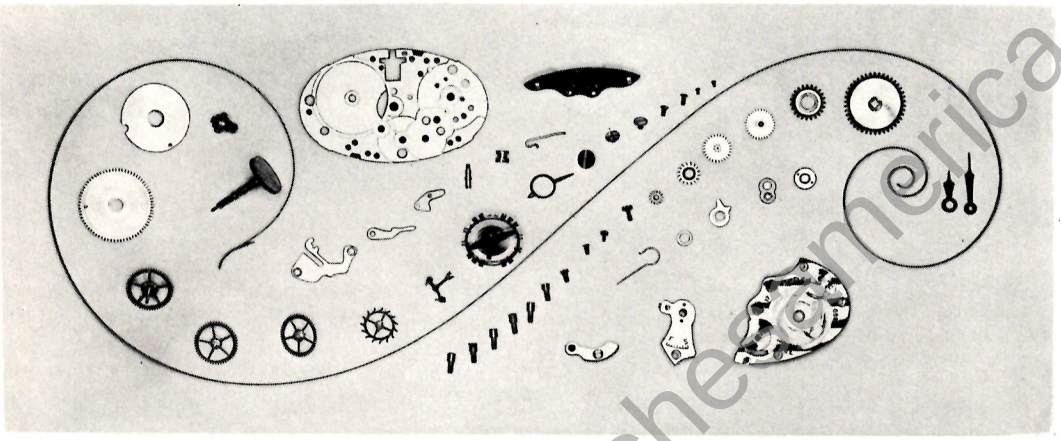

Figure 1. Hamilton 21/0 size, completely disassembled, ready for cleaning.

Engineers in Hamilton's research laboratories have devoted considerable time and study to this problem. They have found that in addition to creating an attractive appearance by brightening bridges and jewel settings, a proper cleaning procedure should leave all jewels, pivots, wheel teeth and pinion leaves chemically clean. Several attempts have been made to reduce the number of operations and cleaning solutions necessary to produce these results, but it has been found that any reduction beyond the following suggested method will not produce the desired results.

It is, therefore, highly recommended that every watchmaker familiarize himself with the cleaning methods suggested here, and that he make every effort to maintain the high standard of workmanship so necessary for satisfying and retaining customers.

Preparation for cleaning should, of course, begin with disassembling the movement so that all its component parts are separated to such a point that cleaning solutions can reach every piece. The accompanying illustration (*Fig. 1*) shows a watch fully dismantled and ready for cleaning. Notice that all stem work has been removed from the pillar plate, endstone caps are not left in their respective recesses, and the mainspring has been withdrawn from the barrel. It is highly important that no piece be left in contact with another, as improper rinsing will result if this precaution is not followed. In the event that old oil in the watch movement about to be cleaned has become thick and adheres to the jewels, it is advisable that this residue be removed with pointed pegwood before proceeding with cleaning operations.

Cleaning machines which are now available have proven their worth in that with them it is possible to thoroughly clean a watch movement without the use of sawdust for drying, thereby eliminating the hazard of a piece of foreign material spoiling a good job. Most of these machines are equipped with wire mesh baskets, subdivided so that large parts and small ones are not placed together. *Figure 2* shows a suggested arrangement of the various parts of a watch movement in the basket of a typical cleaning machine. Notice that the balance and hairspring and the mainspring are not included with the other parts. The balance unit should be cleaned separately by suspending it on a wire and dipping it in the cleaning solutions. This procedure is obvious because of the damage which would necessarily occur to the hairspring if placed in a cleaning machine with the other parts. The mainspring should be cleaned by wiping it carefully with a soft rag or tissue paper saturated with a degreasing agent, being careful not to distort the shape of the spring.

The basket of the cleaning machine should then be immersed in solutions in the following order:

1. Degreasing agent—preferably carbon tetrachloride.
2. Denatured alcohol
3. Soap solution
4. Tap water
5. Distilled water
6. Denatured alcohol
7. Denatured alcohol

CARBON TETRACHLORIDE, a clear chlorinated liquid, is an excellent solvent for oils, fats, greases and waxes. It is a non-inflammable liquid in contrast to naphtha, benzine and the like. It mixes well with many organic solvents, including denatured alcohol, but only very slightly with water.

SUBJECT: Cleaning and Oiling — (Continued)

SOAP SOLUTION used in the above cleaning procedure should be free rinsing and should be readily miscible with distilled water. The jewelry cleaners now available are considered fairly satisfactory. If a strong ammonia soap is used, polished brass surfaces should not be exposed to this solution for any great length of time as pitting may result. Most cleaning solutions contain volatile solvents and should, therefore, never be allowed to stand exposed to air. Evaporation of these volatile solvents will greatly decrease the cleaning properties.

TAP WATER is considered satisfactory for removal of excess soap cleaner. However, work should never be dried after a tap water rinse as salts dissolved from the earth or added for purification leave a white deposit or stain on the work. For this reason DISTILLED WATER is recommended in the above procedure.

DENATURED ALCOHOL is a universal organic solvent. It is a clear, volatile, water white inflammable liquid that mixes well with both carbon tetrachloride and water. Because of this property it is used as an intermediate rinse following carbon tetrachloride in the cleaning procedure. The chemical purity of alcohol is such that very little or no residue remains when evaporated to dryness. For this reason it is used as a final drying rinse for watch parts.

CYANIDE can be used where necessary, but has been omitted from the procedure mentioned above because it must be handled with such great care. It is a clear, colorless liquid giving forth the odor of bitter almond. *It is an intense poison.* It should never be taken internally nor its fumes inhaled. Its aqueous solution is strongly alkaline and rapidly decomposes. It can be successfully used to remove certain tarnishes and stains, but is not an answer for all cleaning problems. Extreme care must be exercised in using cyanide on gold and silver plated parts as these metals are readily soluble in cyanide at certain concentrations. It is difficult to remove cyanide from watch parts and thorough rinsing in running water is, therefore, essential. Any traces of cyanide which remain on the parts when immersed in some types of soap solutions will form a blue stain. Because of the dangers encountered and the necessity for complete control for its use, cyanide has been eliminated from our cleaning procedure.

The basket of the cleaning machine when immersed in each of the above solutions should be rotated, thus forcing the solutions to contact each part thoroughly. This rotation should be stopped two or three times in each solution in order that air which becomes trapped in the basket may escape. This is important, as air thus trapped in the basket will prevent the solutions from doing their work.

When the basket is removed from a solution it should be allowed to spin for a few seconds, in order that any excess solution be expelled before immersion in the next bath.

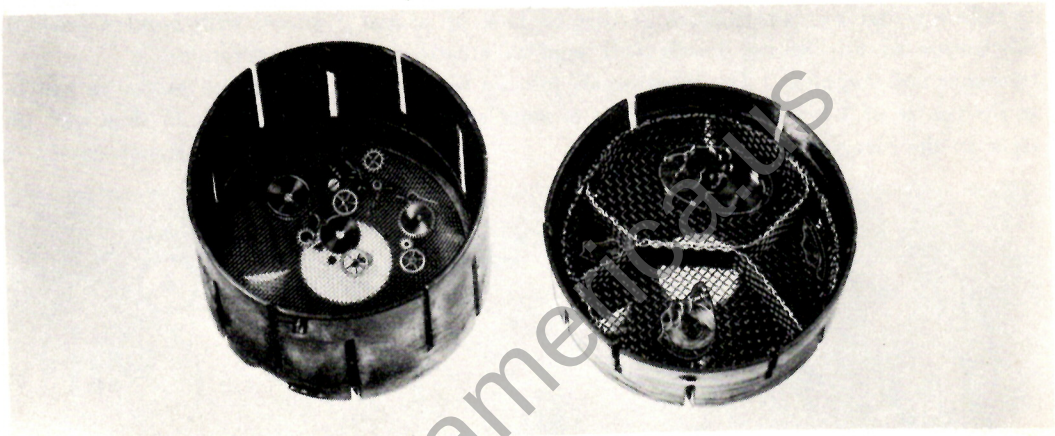

Figure 2. Suggested arrangement of watch parts in basket of cleaning machine. To prevent damage, separate more delicate pieces from others.

Following the last rinse in alcohol the basket should be rotated at high speed for several minutes in order that all alcohol be expelled and complete drying be achieved. Watch parts thus cleaned are free from all traces of old oil and cleaning solutions. They may then be said to be "chemically clean."

All parts thus cleaned are now ready for assembly. Great care must be exercised, however, that none of the jewels or pivots be touched with the fingers, with pegwood or with a buff stick. Such contact will destroy the value of this cleaning procedure. Any piece which accidentally comes in contact with any foreign substance should be recleaned through the entire procedure. This may appear unnecessary, but it has been found that any trace of a greasy substance on the surface of a jewel will subsequently cause oil to spread.

OILING

Before final assembly of the movement, endstones should be replaced and capped jewels oiled. Be careful when replacing these endstones that no traces of lint or dust remain. A blast of air from an aluminum bellows, or from a compressed air jet is usually sufficient to remove such foreign matter.

To place oil in a capped jewel a small drop should be placed in the oil cup and fed into the space between the jewel and the endstone with a fine pointed wire. The size

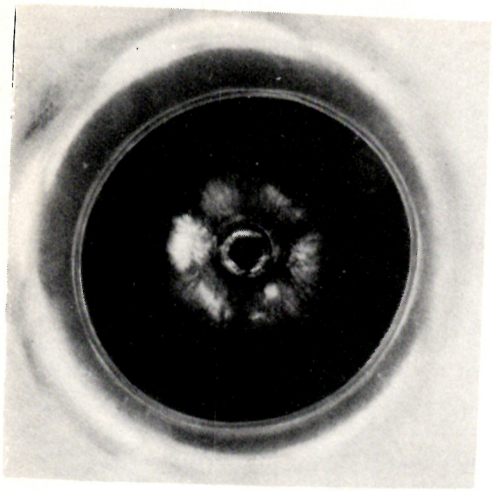

Fig. 3. Proper amount of oil in balance jewel.

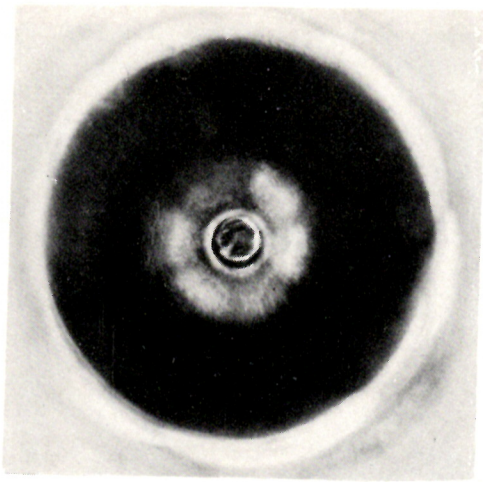

Figure 4. Too much oil.

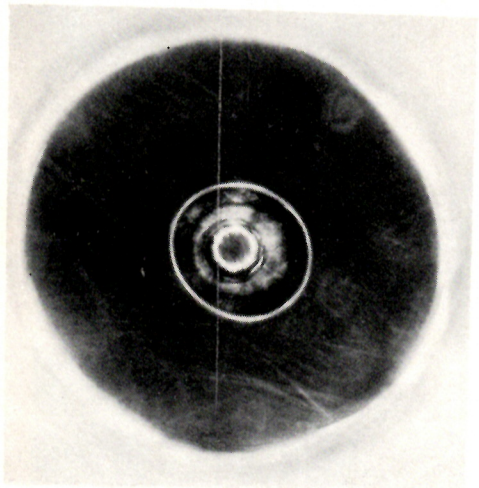

Figure 5. Too little oil.

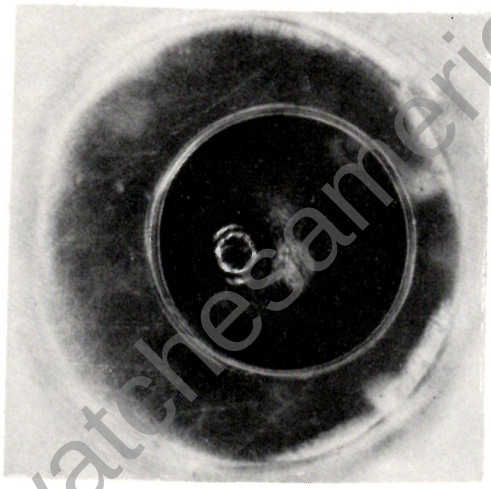

Figure 6. Oil in improperly set jewel.

of the oil bubble should then be examined and increased to its proper proportions by adding a little bit of oil at a time.

Figure 3 shows a photograph of a balance jewel which has the proper amount of oil. Notice that the supply is as large as safety will permit. *Figure 4* shows a balance jewel which contains too much oil. The bubble is so large that it touches the setting, and will soon be drawn away from the jewel. *Figure 5* shows a balance jewel whose supply of oil is too small. Such a small supply will lubricate properly for a short time, but is subject to evaporation or oxidation. *Figure 6* shows one of the conditions which sometimes exists in balance jewels and draws the oil away from the center. Notice that the oil bubble is not concentric with the outer diameter of the endstone. This condition is probably due to an endstone or balance jewel which has not been set flat. Such condition should be identified and corrected. *Figure 7* shows a drop of oil in a balance jewel in which a piece of lint remains. Notice that the oil at the point of contact with the lint is being drawn away from the center of the jewel. This lint will act as a wick and will draw the entire supply of oil away from the pivot, on to the jewel settings.

Examine cap jewels after oiling very carefully for any traces of dust or metal chips which might have been included in the oil. Whenever these are found the endstone should be removed and both jewel and endstone should be cleaned according to the procedure outlined above. Do not wipe these jewels clean with a buff stick, as streaks of grease will remain on the surface of the jewels and, as mentioned before, will cause oil to spread.

After the movement is assembled, oil should be placed in each of the train bar jewels in an amount sufficient to lubricate, but not so large that it will cause spreading. It is difficult to place any limit on the size of the drop of oil in the train jewels, and experimenting on the part of each watchmaker will probably determine the amount he will use. A correct supply should place a film of oil between the jewel and the pivot shoulder, with a small additional quantity remaining in the oil cup.

When placing the oil in a train jewel the oiler should touch the pivot and the bottom of the oil cup simultaneously, so that the oil flows through the jewel hole to the pivot shoulder immediately. When removing the oiler from the oil cup lift it straight up so that any possibility of leaving a track of oil across the top surface of the jewel to the setting is eliminated.

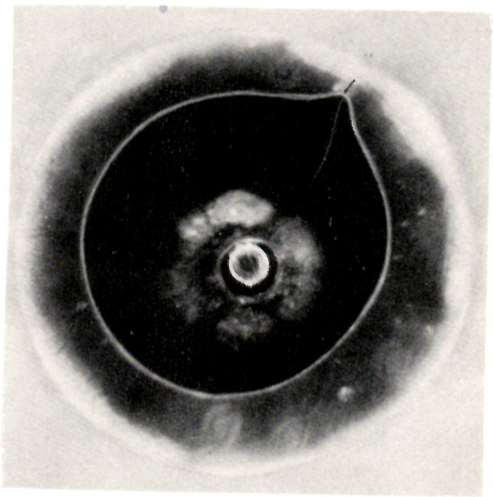

Figure 7. A piece of lint in this balance jewel, acting as a wick, will draw the entire oil supply away from the pivot.

This condition would tend to draw the oil out of the cup and on to the setting. When oiling the center lower jewel, a small quantity of oil should be placed on the center staff so that the cannon pinion will be properly lubricated during setting.

Figure 8. Oil on pallet stone after several months' operation.

After cleaning and winding in the mainspring a supply of oil should be placed in the barrel sufficient to lubricate every part of the spring. This supply, however, should be so limited that excess will not be forced out of the barrel when the mainspring is wound tight.

Suitable grease should be used on the stem work. This should be applied sparingly on the stem, on the square under the clutch and on the pins of the setting lever. Do not lubricate the setting wheels or the minute wheel.

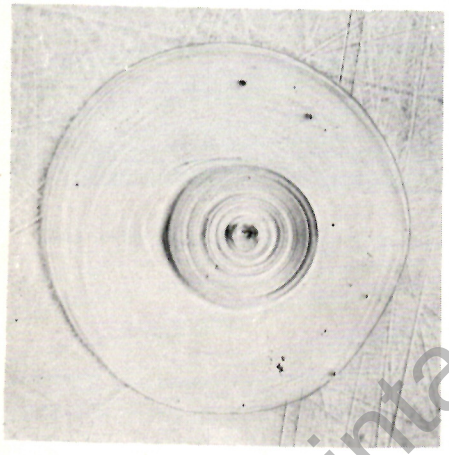

Figure 9. Pitted endstone.

After the movement has been completely assembled a small supply of oil should be placed on the impulse faces of each of the pallet stones. The quantity of oil thus used should be confined to the impulse face. Any excess will spread to the steel part of the pallet and thus cause the oil to flow away from where it is needed. *Figure 8* shows the impulse face of the pallet stone after being in operation for some months. Notice that the track across the impulse face which with an eyeglass appeared dry, is covered with small dots of oil. Some oils are made especially for pallet stones and it is recommended that an oil of this type be used.

DAMAGE DUE TO IMPROPER CLEANING AND OILING

Jewels used in watch movements are made from selected synthetic sapphire because of its extreme hardness and uniformity of structure. This material, however, is subject to wear if an abrasive in the form of dirt finds its way into the oil. *Figure 9* shows a pit in a balance endstone enlarged 500×. All endstones should be examined for such damage.

Figure 10 shows a balance pivot which was removed after running for some time in a dry jewel. Notice that the sides of the pivots have become so badly worn that the only possible correction is to change the balance staff. Damage of this type will occur whenever pivots are allowed to run in jewels which have lost their supply of oil.

EQUIPMENT

Equipment for the foregoing cleaning and oiling procedure is simple and inexpensive. One gallon glass jars as shown in *Figure 11* are recommended for the cleaning solutions.

They should be filled about half way so that when the basket of the cleaning machine is removed from the solution the excess is thrown against the edge of the jar. An additional advantage in using glass jars is the ease with which dirt or other contamination in the solutions can be seen.

Figure 10. Balance pivot damaged from running in dry jewel.

A fresh supply of oil should be drawn each day and can be placed on a round glass disc as shown in *Figure 12*. These discs can be easily cleaned and any foreign matter on them can be readily seen. The main supply of oil should be kept away from direct light and protected from air and contamination as much as possible. A hypodermic syringe shown in *Figure 12* is an excellent tool for this purpose. By using it, it is possible to eject a small drop of oil on to the glass disc as needed without exposing the remainder to the atmosphere. This syringe when not in use should be kept in a light-proof container.

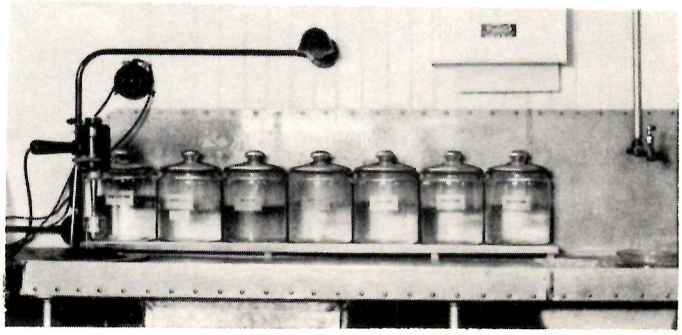

Figure 11. Inexpensive glass jars for cleaning solutions.

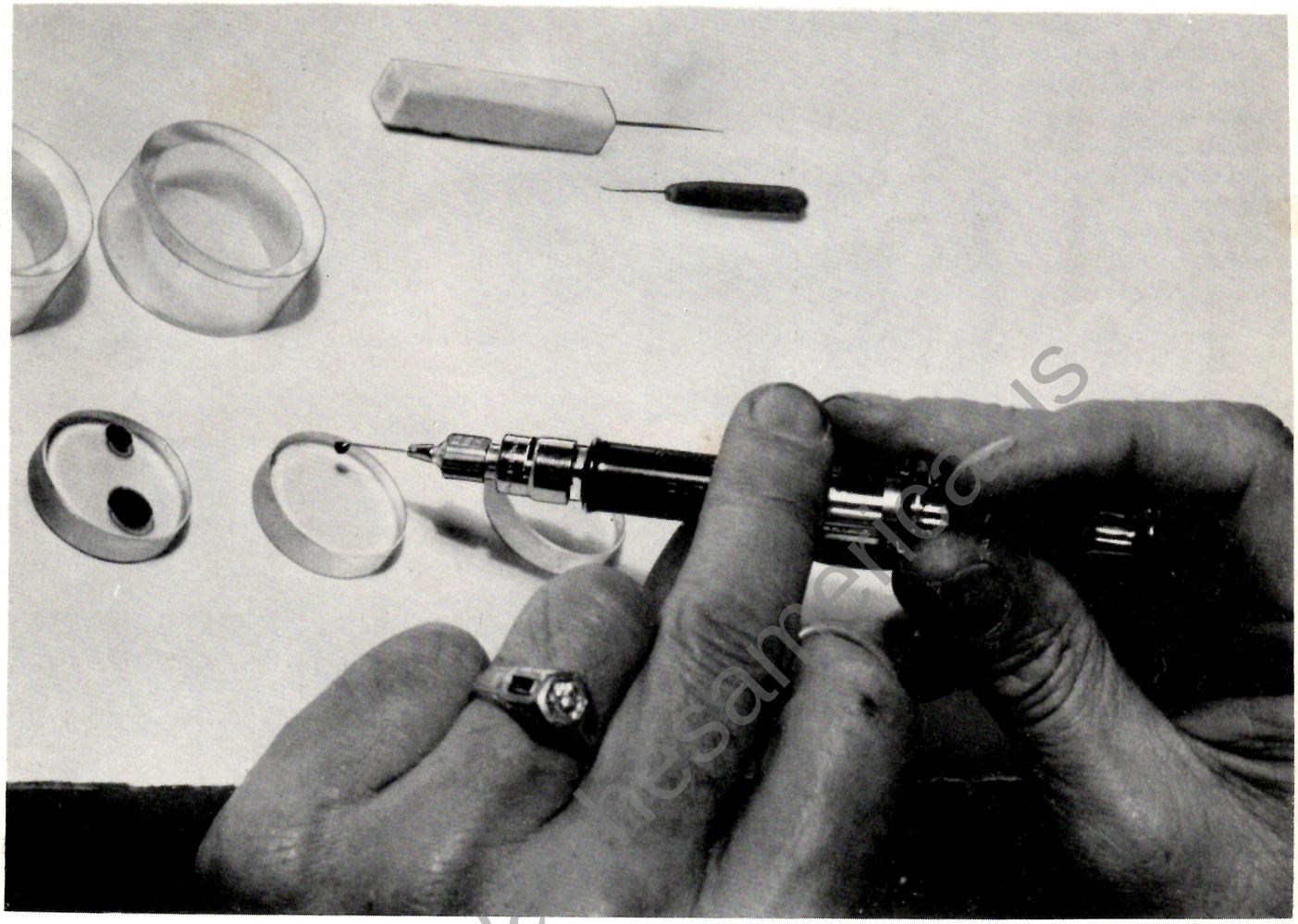

Figure 12. Illustration shows glass disc for oil supply, hypodermic syringe for convenient and safe storage, oiler, and pointer for feeding oil.

The oiler used to place oil in the jewels should be of the type illustrated in *Figure 12*. These can be made from steel wire, or purchased from a regular supply house. They should be cleaned at all times by inserting the tip into a piece of clean pith. The pointed used to feed the supply of oil from the cup against the endstone in a cap jewel can be made from a pivot broach or needle. It should be sharpened to a fine polishing point, free from burrs and strong enough not to break off easily.

OIL

When selecting a watch oil the most important qualifications are that it shall lubricate, that it shall not easily oxidize or become thick with age, that it shall not spread and that it shall not corrode any metal with which it comes in contact. Many types of watch oils are now available. Be sure to select the oil best suited for each particular job.