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METHOD OF LUBRICATING A TIMEPIECE MOVEMENT

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ABSTRACT OF THE DISCLOSURE

A method for lubricating a timepiece movement. The surface of the pieces are given a rugosity lying between a preferred range. The pieces are then treated in a centrifugal barrel wherein lubricant carried by a mass is deposited onto the pieces. A pressurizing mass fixes the solid lubricant onto the pieces.

The present invention relates to a method of lubricating a timepiece movement, more particularly its escapement.

The lubrication of the escapement of a timepiece is a problem for which an absolutely satisfactory solution has not yet been found. The generally used method consists in depositing by means of an oil-pike a drop of a suitable oil used in watchmaking on the impulse faces of the pallets of the lever. Owing to the successive passages of the teeth of the escape wheel, the drops of oil deposited on the pallets are swept, so that the major portion of the oil is carried outside the functional surfaces, where it can no longer take a part in the lubrication. If this oil excess were discharged into a zone where it would be localized, the harm would not be so great, after all, but it spreads over the whole piece in the form of a film which is more or less thick as the case may be and it reaches functional places on which it is indispensable to avoid the presence of a lubricant, or else the rate of the timepiece is greatly disturbed. It is obvious that numerous solutions have already been proposed to overcome this drawback. However, none of them was up to now entirely satisfactory from a technical and economical point of view.

It has been proposed by Swiss Pat. No. 430,589 to apply onto the surface to be lubricated, by means of a micro spraying-pistol, a solid lubricant with a small admixture of a liquid lubricant. This method gives good results and overcomes the above-mentioned drawbacks occurring on applying a liquid lubricant. However, the application by means of a micro spraying-pistol is relatively long and, therefore, little economical. In addition, the thus deposited layer, while presenting a sufficient adherence for the function to be assumed, presents the disadvantage that it is damaged or disappears when it is brought into contact with a liquid such as a cleaning liquid. Due to this fact, the layer disappears on the first repairing of the watch.

The present invention aims at overcoming the several above-mentioned drawbacks. It has just been mentioned that the application of a solid lubricant gives good results in the watch. The lubricating method of the invention aims at increasing the adherence of a solid lubricant on the base material in such a manner that the lubricating layer cannot be destroyed by the conventional cleaning processes used in watchmaking. The present invention is based upon the property of certain solid lubricants of strongly adhering to the surface onto which they are applied, inasmuch as the application is made under a

strong pressure and the finish of the surface is such that it promotes a "catching" of the lubricant.

The lubricating method of the invention comprises the steps of treating the surface of the pieces so as to give them a rugosity lying between .1 and 1μ, and then treating the pieces, brought into this state, into a centrifugal barrel the acceleration of which lies between 1 and 20g and in which are contained, besides the pieces to be treated, a solid lubricant in powder form, a carrying mass for the latter and a granulated mass adapted to produce a pressure for fixing the solid lubricant onto the pieces to be treated.

In order to obtain the desired rugosity of the surface to be lubricated, this surface may be subjected to different types of preparations. It is possible to give to the surface, by a mechanical process, a suitable rugosity, which may be obtained by a grinding, polishing, sanding or any other similar operation. Another process of preparing the surfaces may consist of a chemical or galvanic treatment. Among the former, let us cite, for instance, the phosphatation. It is also possible, in order to obtain the desired surface finish, to perform a chemical attack of the surface; in the case of pieces of brass, for instance, the desired rugosity may be obtained by an attack with an acid such as nitric acid or any other bath having the same action. In order to obviate changes in the dimensions of the pieces during the above-described processes, a galvanic process is preferably used. By way of example, it is possible to proceed as follows: The piece to be treated being made of steel, a first deposit of gold of normal constitution is effected. This deposit serves for promoting the adherence of the next deposit of gold which is effected in such conditions—by reducing the contents of free cyanide of the bath and by adapting the current intensity—that it presents a porous constitution and a rough surface. The thus obtained rugosity is easily adjustable by choosing the conditions of the galvanic deposition. A gold deposit is preferably effected, since its coefficient of friction with respect to ruby is favourable, but it is also possible to use other metals such as rhodium, silver or alloys such as lead-tin or nickel-tin alloys.

Since the pieces to be treated are very small, it is important that the rugosity of the surface is adapted in such a manner that the geometry of the piece is not altered and the tolerances of manufacture are respected. For this purpose, the rugosity of the piece must lie between .1 and 1μ (maximum height of the asperities) and its mean quadratic deviation preferably lies between .06 and .7μ. The mean quadratic deviation is, as is well-known, the square root of the arithmetic average of the squares of the deviations.

After the pieces have received the desired surface preparation, they are put in a centrifugal barrel. The latter is loaded with a mixture of a solid lubricant in powder form (e.g. molybdenum disulfide, graphite or tungsten diselenide), of a carrying mass for the latter (consisting for instance of a plastic material or simply of sawdust) and of a granulated mass, preferably metallic, acting as a charge and serving for producing, when the centrifugal barrel is running, a pressure sufficient for causing the lubricant to penetrate into the surface of the piece and strongly adhere thereto. The said granulated mass may consist for instance of balls of lead or steel, having a diameter of 1–2 mm.

The centrifugal barrel provokes accelerations lying between 1 and 20g (g=acceleration of gravity), the value of these accelerations and the diameter of the balls of the granulated mass being adapted to the mechanical resistance of the pieces to be treated.

After the passage of the pieces in the centrifugal barrel, they may be dipped in a final bath and then dried.

The final bath comprises, for example, 1–2% of oil used in watchmaking in dissolution in a solvent such as Freon or benzine. The latter treatment still improves the lubrication.

Pieces of escapement treated in the described conditions, have shown, upon tests made in laboratories, an excellent resistance to the action of the cleaning baths, as well as an excellent behaviour in the watch. The invention really brings a solution to the problem, up to now not satisfactorily solved, of the lubrication of the escapement. Other friction pieces of the watch, treated by this method, have also shown a most favorable behaviour, entirely competitive on the technical point of view with the conventional methods, with the additional advantage of a lubrication of greater duration.

What is claimed is:

1. A method of lubricating a timepiece movement, more particularly its escapement, characterized by treating the surface of the pieces so as to give them a rugosity lying between .1 and 1μ, and then treating the pieces, brought into this state, into a centrifugal barrel the acceleration of which lies between 1 and 20g and in which are contained, besides the pieces to be treated, a solid lubricant in powder form, a carrying mass for the latter and a granulated mass adapted to produce a pressure for fixing the solid lubricant onto the pieces to be treated.

2. A method according to claim **1**, characterized by treating the surface of the pieces so as to give them a rugosity the mean quadratic deviation of which lies between .06 and .7μ.

3. A method according to claim **1**, characterized in that the desired rugosity of the surface of the pieces is obtained by subjecting said surface to a mechanical treatment.

4. A method according to claim **1**, characterized in that the desired rugosity of the surface of the pieces is obtained by subjecting said surface to a chemical treatment.

5. A method according to claim **1**, characterized in that the desired rugosity of the surface of the pieces is obtained by subjecting said surface to a galvanic treatment, the adherence to the base metal being obtained by a first deposit effected in normal conditions, followed by a second deposit effected in modified conditions so that this second deposit has a porous constitution and a rough surface.

6. A method according to claim **1**, characterized by using molybdenum disulfide as a solid lubricant.

7. A method according to claim **1**, characterized by using graphite as a solid lubricant.

8. A method according to claim **1**, characterized by using tungsten diselenide as a solid lubricant.

9. A method according to claim **1**, characterized by using a plastic material in powder form as a carrying mass for the lubricant.

10. A method according to claim **1**, characterized by using sawdust as a carrying mass for the lubricant.

11. A method according to claim **1**, characterized by using metallic balls as a granulated mass.

12. A method according to claim **1**, characterized in that, after the passage of the pieces in the centrifugal barrel, the pieces are dipped in a final bath and then dried, said bath comprising a little oil used in watchmaking in dissolution in a solvent.

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