The Auguste Lebret electric winding system for clocks and watches

Lebret's patent for electric winding was applied for in December 1900 and accepted in November 1901. It specified two versions, one rewinding once a minute and the other every four minutes. This document refers to the one minute version.
It is usual where patents are concerned that very many more ideas/inventions are patented than ever become a practical item made in quantity. Having examined the Lebret, it is abundantly clear that his design for electric winding falls into this category and had no chance of succeeding for reasons explained below.
This does not mean that the Lebret is uninteresting. In the progress of electrical horology, an understanding of the failures as well as the successes is needed to fully appreciate the technical ideas that were in play. We should remember that he patented his method in the days before reliable electric winding of small balance wheel clocks had been proved and become reliable.

1) Lebret's rewinding method

Lebret's patent describes a conventional electro-magnet and pivoted armature being used to wind a movement with balance wheel and lever escapement. However, because rewinding is designed to take place once every minute, only three wheels are needed; namely, the spring barrel to provide the power, the 2nd wheel which controls the switching, and the escape wheel being part of the clock's regulation.
A switch comprising two spring blades is closed once every minute by a cam carried on the extended pivot of the 2nd wheel. Current from an external battery then passes through the magnet's windings, attracting the armature to the pole piece of the magnet.
The armature carries a hook which engages with the teeth of the mainspring's ratchet wheel and winds it by one tooth. A conventional detent spring (also called a click) engages the ratchet wheel to prevent it unwinding.
Unfortunately, in the movement examined, it is immediately clear that there is no circuit present to carry out the switching operations as described. This is because all the switching elements are missing, comprising the two spring contact blades with platinum contacts and part of the contact cam arrangement that controls the switching action.

2) Problems in Lebret's design

The magnet coil (which is definitely original) is made of 0.5 mm diameter copper wire, cotton insulated. This is very thick wire by normal later standards and the resistance of the entire coil is only one ohm. This presents what is almost a short circuit to the battery supplying the current and means that a 1.5 volt single dry cell would be required to deliver 1.5 amps and two cells 3 amps. These are astonishingly high currents to be carried by the very small contacts in a pocket watch sized movement. In addition, at the time of Lebret's patent, the dry Leclanché cell was a new development and the size appropriate for such currents would have approximated to a pint bottle.

In very rapid switching systems, periodic on/off at high current can be delivered by dry cells of sufficient capacity because current only flows for about 1/10 of a second during the switching operation.
However, Lebret's switching by rotating cam method is seriously flawed in that it does not provide a rapid on/off of the current. The switch remains closed for a significant period of time whilst the cam rotates to the point at which the contacts open.
In the absence of an instantaneous on/off switch action (as used later by all successful electric rewind designs) heat at the contact points would be generated by the high current. Because of this, it is likely that the contact elements are missing because they were badly oxidised, both by high current and by spark erosion and then removed; probably with a view to improvising a repair.

It is not surprising to find poor electrical design features in a patent dated 1900.
Successful instantaneous switching of current for electrically rewinding balance wheel clocks was first patented two or three years later by David Perret in Switzerland and several other successful designs by other makers soon followed. Significantly, the resistance of the coils in these later electro-magnetic systems was much higher than in the Lebret and the current much lower, enabling small domestic cells (just becoming available for torches) to be used and housed within the clock case.

3) Motion work and hand setting.

Because the wheel train actuates a one minute remontoire, it consists of only three wheels; the spring barrel, a 2nd wheel and the escape wheel. In this arrangement there is no hour wheel placed in centre of the dial plate with its extended arbor carrying a cannon pinion and the minute hand.

The motion work (now missing) was, therefore unconventional and driven by a pinion carried on an extended lower barrel arbor. This would have engaged (presumably through an intermediate wheel) with a minute hand pinion riding on a post planted in the centre of the dial plate with an intermediate wheel and hour wheel following in the normal way.

Unfortunately all this is missing including the centre post.

There is also no provision for setting the hands to time except by moving the hands themselves. To do this a friction clutch must have formed part of the motion work now missing.

4) Setting up the mainspring.

It is a safe presumption that the amount wound each minute by the electric mechanism equals the amount unwound during that minute. It follows that the winding system only maintains the amount set up in the first instance.

In the event of the mainspring unwinding completely it would have been necessary to fully rewind it. In spite of this, there is no winding square for manual winding and it is not clear how the mainspring should be first set up, or subsequently set up after a period out of use for servicing or any other reason.

It would be possible to wind the clock electrically to the set-up level by shorting the contacts several times; this way bypassing the normal closure of the contacts every minute by the 2nd wheel cam, but this would not be a satisfactory procedure for a non technical owner and the correct answer remains a puzzle.

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