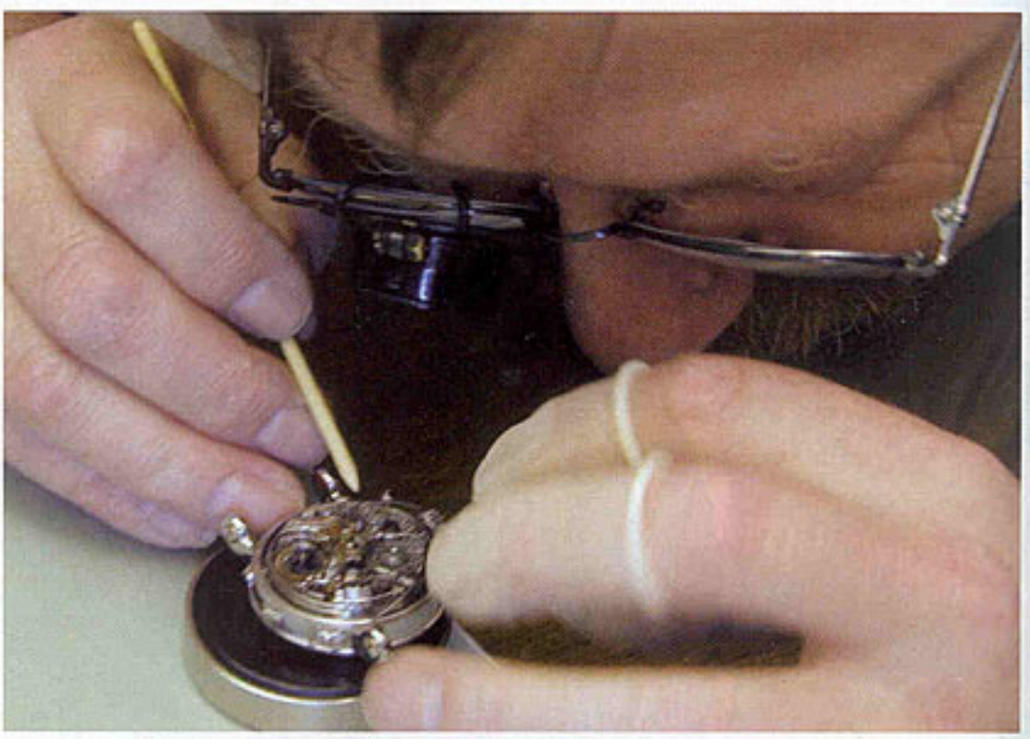
WORLD'S MOST COMPLICATED WATCH

Part II of a three-part series on Paul Gerber's work of art

BY MAGNUS BOSSE AND JOHN DAVIS



Paul Gerber really was not in an enviable situation when he accepted Lord Arran's challenge to develop the world's most complicated wristwatch. Sure, much reputation was to be gained and, of course, to work on such an exceptional movement represents a watchmaker's dream, but there were three challenges that really made his life much harder:

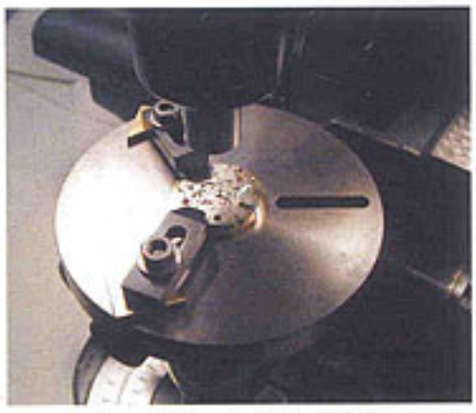
- There were no construction plans to start with.
- There was no space in the case to accommodate the requested complications.
- He had to work with a "piece unique," meaning he could not afford any mistakes.

This chapter will shed some light onto the way Paul Gerber dealt with these three obstacles.

No Plans

You are a lucky watchmaker if your task is to modify a well-documented movement: Take the technical data sheet, feed your CAD program with the data and develop your mechanism on the computer. Not necessarily easy, but a job that can be done. In this case, however, Gerber was confronted with a 100-year-old movement. Even a common watch was not serially produced after a strict specification table, and especially not such a complicated and rare piece. The task Paul Gerber had before him required CAD, so the only way out of this dilemma was to measure the cornerstones of the movement.

Basically, you fix your movement on a precisely movable table and decide which point of your movement should serve as a reference point, preferably a pivot. All further points will be measured for their relative position to the reference point via a microscope and micrometric indicators. This is done with an old but highly precise



The old but highly precise machine used for measuring the movement

machine, the use of which is very time-consuming.

The movement is then advanced to the first point you want to know the position of by operating the X- and Y-axis knobs. You center it carefully with help of the microscope, and the exact position relative to the reference point can now be read on the X- and Y-axis scales. You continue like this until you have all points measured. The accuracy of the final diagram is dependent on, in addition to the slight inaccuracies inherent in the machine itself, how precisely you set the reference point and how carefully you centered all other

Sketches of the different functional units of the movement Paul Gerber made using a CAD computer program.

points. Imagine what it means to measure a complicated movement like this Piguet movement.

Then, Paul Gerber made sketches of the different functional units of the movement by hand

Paul Gerber employed modern CNC tooling machines to obtain the desired precision for the parts.

and later also by CAD computer program. Not only the mechanics but also the aesthetics like the inscriptions and engravings were rendered using twenty first–century computers.

Finally, modern machining tools could be applied to the movement. It is understandable that Gerber went to these extreme measures for a unique and historically significant movement. You absolutely want to test and modify the additional levers, wheels and gears before beginning to put your hands on the unrecoverable mechanism.

Paul Gerber also employed modern CNC tooling machines to get the desired precision for the parts. After cutting them out, the parts were tested and, after the master's approval and fine finishing, found their place in the movement.

No Space

After the first modifications were completed by Franck Muller, the owner, Lord Arran, was in the possession of a beautiful, highly

The movement inside the world's most complicated watch is an artistic and precise arrangement of gears and levers.

complicated watch with an elegant and classy case and dial, both of which were finely handcrafted after his own wishes. On top of the already difficult work, Paul Gerber also had to keep the dimensions of the watch and place the indications to be added in a way that the existing dial could be used.

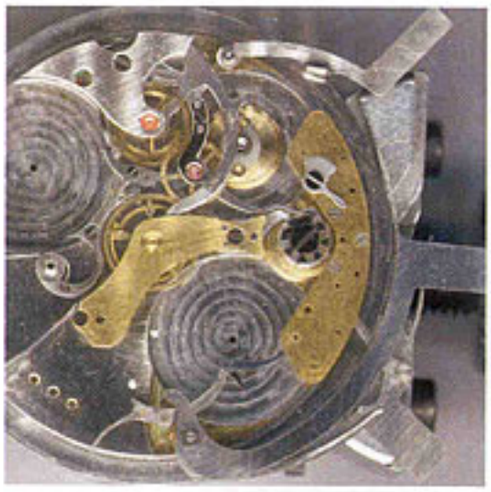
Some most unusual solutions were found to meet these demands. The jumping minute counter was placed concentrically with the small seconds hand at the 6 o'clock position. The power reserve mechanisms found their way onto the back of the movement.

The jumping minute-counter mechanism is not only implemented as a small mechanical delicacy (being more sophisticated and difficult to manufacture than the common semi-instantaneous minute counter), but also as a measure to place a chronograph into a movement where there is no space reserved for it. It is in some ways easier to transport mechanical energy via tiny levers than with a series of wheels: smaller parts can be made, less space is occupied and, in the end, less friction is produced as well.

The thinness of the clockwork also dictated the flat split-seconds control mechanism. The column wheel for the split-seconds is more an octagonal rim wheel than a classic column wheel, an extremely clever and aesthetic construction!

No Mistakes

If you make a mistake when modifying such a movement, it is gone for good; this puts a tremendous weight on the watchmaker. Paul Gerber was well aware of this responsibility and took every effort possible to ensure that the new mechanisms would only be added

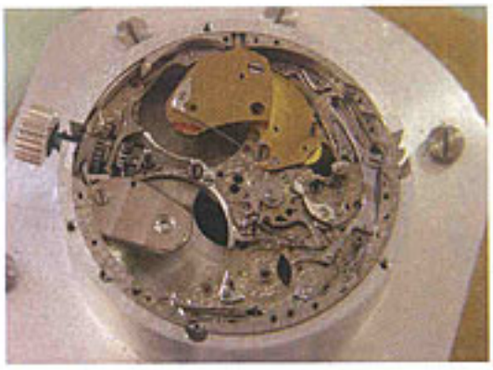


Top: Chronograph with dummy bridges and plates; **above,** completed watch next to a dummy plate

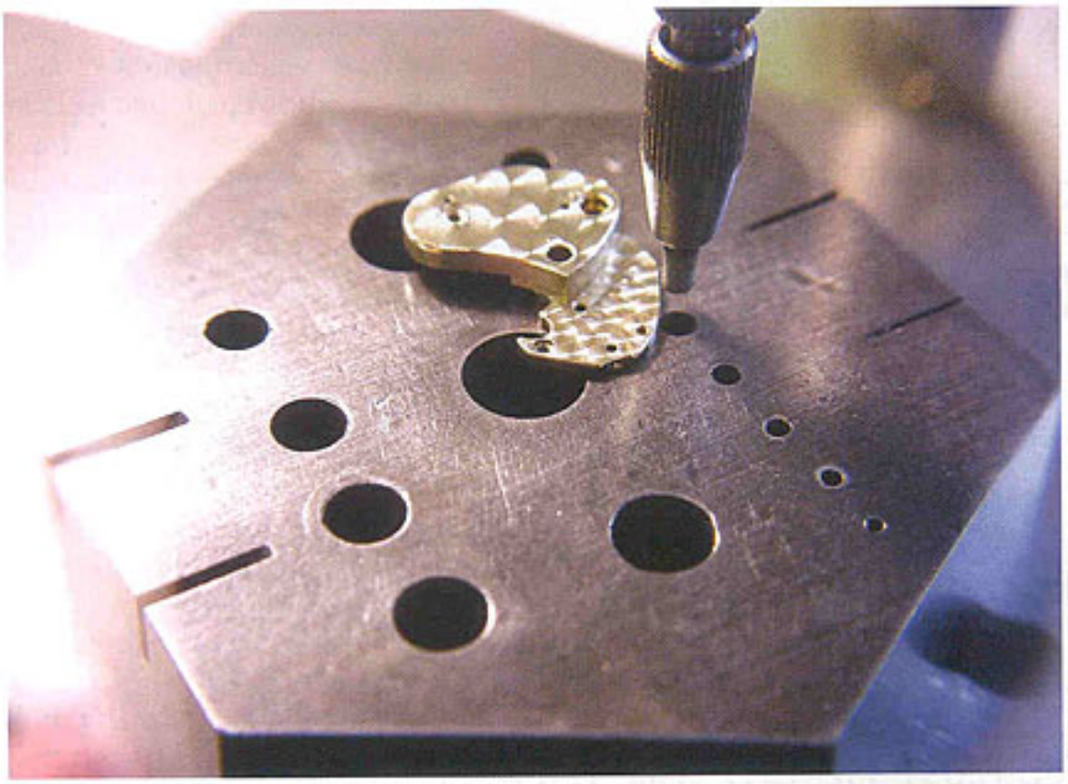
Column wheels (top) and levers (above) were tested and discarded if they didn't meet Gerber's precise specs.

to the movement after thorough testing and evaluation. He counted not only on his experience, his calm and serene hands and his CAD drawing, but he also did something that we know from the automotive industry: modeling and prototyping. He built whole (non-working) movement plates from scratch to test the chronograph mechanism before modifying the movement (which was the first step that could not be reversed).

Many corrections and improvements turned out to be necessary after these preliminary tests. Levers turned out to be too weak or not smooth enough in operation. One modification caused another, and after several rounds of further perfecting the components, the final design was achieved. Almost every part, especially the chronograph, went through this procedure. With all these rejected parts, one could entertain the thought of making a completely new watch. After Paul Gerber finished shaping the



From top: The irreplaceable mainplate; after shaping the steel parts, Paul Gerber hardened and tempered them using heat; as part of the fine finishing procedure, perlage is applied.



steel parts, he hardened and tempered them with heat.

Finally, Gerber began with the most responsible part of his job: milling out the holes from the mainplate. Confronted with the fact that any mistake would destroy this beautiful movement, he had to proceed with a century of human imagination pressing on his shoulders. With the help of his innate modesty and well-learned reverence for the past, Gerber had no problem managing this.

For the very last steps, Gerber applied the final finishing touches. A very sensible work, since the surface integrity of all parts should fit to the original movement: Levers were polished and grained, plates perlaged and chamfered, wheels skeletonized and the spokes anglaged. As a distinct aesthetic finesse, the heart discs of the chronograph resetting mechanism were skeletonized.

With the watch nearly complete, new hands had to be made. After initial drawing on the CAD program, Gerber sawed and filed them from steel, followed by a hardening and heat-bluing treatment. Last but not least, all three artists found their names engraved on the movement and on the caseback: Louis-Elysée Piguet, LeBrassus; Franck Muller, Geneva; Paul Gerber, Zurich.

Contemplating these challenges, one comes to the conclusion that only a modest, calm, dedicated and exceptionally skilled artist like Paul Gerber could master this work. My eyes are still blinded, and all my efforts and time spent trying to find a fly in the ointment are foolish, a product of neurotic overassessment, and I stand calm, devout and sublimated in front of a masterpiece that speaks for itself. The aesthetics of the construction, a pure but complicated form-follows-function approach, proves the old thesis: beauty comes from inside.

Therefore, I ask you to follow us to the next chapter (December), to journey into the mechanical marvels inside the movement. →

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INTERVIEW WITH MASTER WATCHMAKER PAUL GERBER

AFTER ALL WE HAVE READ about master watchmaker Paul Gerber, we'd now like to hear directly from him about this masterpiece, which set his life's pace for eleven years. The interview was conducted in German in Mr. Gerber's atelier in Zurich, Switzerland on March 1, 2003, by Magnus Bosse, who lives in Zurich. Bosse is currently finishing his Ph.D. thesis in molecular biology at the University of Zurich. He runs his own watch site, Ornatus-Mundi [Latin for beautiful harmony] and moderates the official Blancpain watch forum since April 2003. He is a frequent contributor to the watch-discussion forums The Purists.com and TimeZone.com.

Magnus Bosse: Mr. Gerber, how do you feel after completing the world's most complicated wristwatch?

Paul Gerber: Well, first of all, I'm happy that this is finally over. It took several years, and I feel like having a holiday now!

What would you consider the greatest challenge during the construction of this unique piece? The tourbillon, which was your first one, or the rattrapante?

The implementation of the tourbillon since it cost me quite an effort to work with the milling cutter on this watch. It was the first non-reversible engagement in an already superb movement. I was very delighted that this worked out well.

Then, the chronograph, which came from Lord Arran. This was where I fooled myself: I thought it was much easier to do, but I never before made a chronograph. In contrast to the tourbillon, which could be made as a whole block and then could be placed in the movement, the chronograph had to be designed around the movement with only very few points to fix wheels, levers and gears. So the chronograph itself wasn't difficult, but the special situation that forced me sometimes to split a lever into two because I had to bypass other movement parts somehow.

The watch itself is not only the most complicated wristwatch in the world, it is also a "piece unique." That means that you could not allow yourself any mistakes. What technical resources did you use?

Yes, first I had to measure the movement since there simply were no plans. After that, I made drawings by hand and by CAD. But I wasn't comfortable relying on that. Therefore, I made a prototype plate with the exact dimensions of the movement. After the chronograph mechanism worked well there, I dared to modify the Piguet movement and transferred the chronograph.

Did you make all parts by hand or did you use modern methods like CNC?

I'm a strong believer in the concept "the more precise you start, the more precise the product will be." Therefore I did all construction work using CAD programs (I do all my constructions exclusively with CAD now) and cut all parts with a CNC machine, to ensure the best possible precision from the beginning. But most of the work comes afterward: adjusting, fitting and finessing. All that is a pleasure to view; this needs much more work than the basic cutting of parts.

The Piguet Minute Repeater/Sonnerie movement, which is the basis for this timepiece, is now more than 100 years old. Did you try to construct the chronograph with respect for the movement's age?

After Lord Arran requested the chronograph, I checked to see if it would fit. I realized it would, and then I tried to create a chronograph that reflects the tradition of Louis-Elysée Piguet. The complete movement should be one entity, but of course, I cannot be sure that Mr. Piguet would have made the chronograph the same way I did [*he says with a smile*]. He would have integrated the chronograph from the start, I guess.

If you think about the movement, would you call it a completely new movement, an integrated construction or a base movement with added modules?
Since I tried to integrate my complications, I would not call it a modular construction. Let me classify it like this: the tourbillon is more integrated into the movement; the chronograph has more a modular characteristic. Please let me express here my deepest respect for the impressive work Louis-Elysée Piguet demonstrated with his movement.

With all these complications being added much later than the movement's construction, much more power was required. How did you take care of this?
I was happy that the Piguet movement already had a splendid 36-hour power reserve. But already my first modification, the tourbillon, made it necessary to implement a stronger mainspring. The tourbillon adds two or three additional wheels with bearings; all this needs energy. Now the watch has a power reserve of a little bit more than a day. But during the finessing of the chronograph parts, I had to achieve the least possible friction to minimize loss of power, but still enough to guarantee that the chronograph works smoothly. A tricky challenge since I could not optimize it on the prototype; I had to do it on the movement itself.

Did you put better ruby bearings in the clockwork?
No, the existing were of optimal quality.

I've seen lubrication plans for many contemporary movements, and I assume that none such exist for the Piguet movement. Additionally I believe that the oils that were available a hundred years ago were not of

the same quality than the ones used today. How did you decide about which oil you could use for a bearing?

A difficult question! At Louis-Elysée Piguet's time the oils were mostly animal fats obtained from a sheep's claw, for example. They got thicker after only half a year, and after two years, they were rancid.

Nowadays, synthetic oils are used. To decide which one to use, I rely on my experience from the restoration work I did for an auction house. Basically, you use five different oils. If you cannot really decide which one would fit, I always opted for the thicker one. The higher the pressure in a bearing, the thicker the oil has to be. This is to prevent it from being pressed out of the contact surfaces.

It is very helpful to learn the fingerprint of a movement designer. Piguet is in the tradition of the Geneva school of watchmaking with perfectly hardened steel and beautiful polissage. So, the oil is held in place well since a good polissage is a powerful barrier for the oil.

You are a well-known perfectionist. You made several parts multiple times until you were satisfied. What was your stimulus?

For me, my life only then has substance if I stop to learn. And I'm constantly learning. And if I look back to a part after a time and have ideas how to improve it, I think, Why not? It's worth it! But I have to admit that sometimes these modifications cause many more. Just think of the tourbillon: I wanted to change the cap jewel from ruby to

diamond. Too bad that I could only get one with 1mm diameter instead of the 0.7mm of the ruby. Consequently, I had to make a new cap jewel plate, a new regulator as well as a new top bridge for balance onto the tourbillon cage. Sometimes I feel like my own victim! But I think the result speaks for itself!

And which part did you optimize most often?

The coupling lever. This part combines a pretty bunch of functions. It is engaged by the column wheel, it transports the intermediate wheel, it has to engage/disengage the jumping minute mechanism, and finally, it comes from a completely different side than usual (because of the base movement). I made it three or four times from scratch!

Do you think this watch will be ever be 'finished'?

As well as I know myself, I'll find something I could improve, I'm sure! And if I show the watch to someone else, this person may also find chances for improvements. You have to know that I first had to get it working without thinking about the finish.

Is it difficult for you to hand the watch over to Lord Arran after all these years?

Yes and no. Right at the beginning of a task, I decide for myself if this is something I do for myself or for my wife, or is this a work I'll earn my money with? I stick to this decision, and I never sold a watch that I made for myself—I simply could not stand this! In this case, it was clear from the beginning: This is not my watch. On the other hand, this question is a bit misplaced here since the ultra complication will be my companion for my whole life. It is a very complicated watch, and it would not make sense to give it to another watchmaker for a service.

What did you learn during the construction of this watch?

It was a true study from alpha to omega. It was my first tourbillon and my first chronograph. But I made finicky works before, and that made me confident that I'd master the challenge.

The development of this watch is observed on the watch enthusiasts' discussion forums on the Internet. Do you visit them?

Yes, I'm very interested in them. But there is one issue: My English is too bad to understand the discussions completely ...

Mr. Gerber, thank you very much for this interview and for the time you spent explaining this magnificent watch to me.

I have to thank you and the watch aficionado community for the interest in my work!