WATCHMAKING ON **FAST FORWARD**

If the sports watch is a male obsession, speed is yet another...

THE EVOLUTION OF THE WATCH, as well as of everything surrounding it (technology, communication, marketing etc.) has today endowed speed with the status of a primary concern of the watchmaking world.

IN A SERIES OF 'INTERVIEWSparallèlesVITESSE', the key protagonists of watchmaking speed reply to a set of personalized questions on this topic.

JEAN-FRÉDÉRIC DUFOUR defends the cause of the undisputed high frequency champion for more than four decades, namely the El Primero, and talks to us about the phenomenal exploit of Félix Baumgartner, a Zenith on his wrist.

PIERRE GYGAX, COO of Ulysse Nardin, recalls the early days of 4 and 5Hz at Locle, when his father, René Gygax, being a watchmaker at Zenith, was able to contribute to Zenith's great successes in the competitions of the Neuchâtel Observatory.

WILLY SCHWEIZER, curator, conservator and historian in charge of the patrimony of Girard-Perregaux, shares with us the true story of the birth of the first wristwatch beating at 5Hz, the Gyromatic HF by Girard-Perregaux, four years before the El Primero!...

JEAN-CHRISTOPHE BABIN recounts, with the maestria of a Master Watchmaker, the fascinating high frequency revolution achieved by TAG Heuer in recent years.

DEMETRIO CABIDDU, Technical Director of Montblanc Villeret, initiates us into the secrets of one of the most interesting watches of recent years, the sublime Montblanc TimeWriter II Chronograph Bi-frequency 1000, which beats at 360,000VpH [50Hz], but which can equally calculate the thousandth of the second.

KARL-FRIEDRICH SCHEUFELE, great racing car amateur and exceptional pilot, even at Chopard Manufacture's helm, presents the new L.U.C calibre, beating at 8Hz.

JEAN-CLAUDE BIVER talks to us about the only watch in the world that allows us to select the speed of the passage of time, the Hublot Key of Time, while also sharing with us the secrets of his extraordinary operating and creative speed, as well as that of his partners Ferrari and Usain Bolt, who are also high-speed champions.

GRÉGORY BRUTTIN initiates us into the magical world of the Roger Dubuis Excalibur Quatuor, which has once and for all changed watchmaking's 'ticking', with its 4 balances offering the unique 16Hz.

JEAN-PIERRE GOLAY explains for us how the tourbillon cage of the Franck Muller Thunderbolt makes a complete rotation in just 5 seconds.

PHILIPPE DUFOUR, with exemplary serenity, evokes for us the tranquillity of his Vallée de Joux, which he upholds through his work.

MAXIMILIAN BÜSSER recounts for us his magical relationship with the speed of time, or how he manages to make us wait for one year for the presentation of his new timepiece and stir up an international media storm in just a few minutes by presenting it!...

JEAN-PIERRE MUSY, Patek Philippe Technical Director, comments on high frequency and its parameters, always aiming at absolute precision.

JEAN-FRANÇOIS RUCHONNET, 'enfant terrible' of Haute Horlogerie and the creator of some of the 'craziest' watches of our times (TAG Heuer V4, Breguet Double Tourbillon, Cabestan Winch Tourbillon Vertical etc.) talks to us about his great passion, speed.

JEAN-MARIE SCHALLER, CEO of Louis Moinet has just, at the moment when I thought I had made all the interviews on the subject, presented the '1/60th Timer' of Louis Moinet, the arrival of which had come to trouble the waters of Haute Horlogerie History, with its 30Hz, from as early as 1816!...

PHILIP PONIZ, horological historian, Expert-in-Chief at WatchInvest, Inc., where he advises high-end watch collectors and investors, Head Expert at Antiquorum during its glory years, Court Expert and Master Restorer reveals for us all the little and big secrets of high frequencies in watchmaking.

** Unfortunately, we have not, until the time of publication, received a response from the historical Breguet House, an important actor in the high frequency domain, with its Type XII ref. 3880 beating at 10Hz.*
**The Japanese House of Seiko, also with an important history in the creation of high frequency watches, has informed us that it will soon be sending us its responses on this subject.*
**And we wait Nivarox - FAR answers, with impatience.*

– A –
The tranquil Vallée de Joux

– B –
The fastest hand in the watchmaking world (TAG Heuer Mikrogirder)

JEAN-FRÉDÉRIC DUFOUR

THE UNBEATABLE KING OF HIGH BEAT

On the subject of high frequency Jean-Frédéric Dufour, the President of Zenith, has pride of place, since the El Primero is the undisputed 'King' of high frequency! With an enormous output of movements over its 44-year history, no one will attempt to contest its value.

CONSTANTIN STIKAS: ***What do we gain with high frequency?***

JEAN-FRÉDÉRIC DUFOUR: You know as well as I do that high frequency was invented at a specific juncture in time, due to the fact that watches were subjected to more and more movements and their slow balances were influenced by gravity to an unduly high extent. Those were balances with high inertia and one therefore had to use very powerful springs. When we downsized the case of the watches and, as a result, also the watch movements, switching from the pocket watch to the wristwatch, we had to find ways to compensate for this loss in accuracy, due to the decrease in the size of the balance, by increasing the frequency.

However, I do not believe that we can talk about high frequency and omit to mention the parameters of amplitude, etc. High frequency is important, but subject to certain conditions being met.

In response to your question regarding the El Primero, what we have gained is accuracy. The balance, by speeding up, divides time into smaller spans and, the smaller the spans, the less the watch is subjected to external influences, which are the result of physical forces, such as gravity, fluctuations in temperature etc.

What is at risk with a high frequency watch?

What do we risk losing with high frequency? That's a good question... Some people claim that we lose reliability, because there is more wear. At Zenith, it has been 44 years that we have been manufacturing the El Primero and I have never seen an El Primero with a worn escapement. Therefore, I believe that it is an invalid argument.

Evidently, we can lose a bit of power reserve, but today we have managed to have springs that compensate for this, thus the power reserve remains the same. So, I do not believe that we lose something.

But, take heed. I am only talking about 5Hz!... It is true that, when we are on the subject of very very high frequencies, there we lose out in many ways.

You had told me in another interview that Zenith had also invented the 4Hz. Would you like to talk to us about this?

Zenith's quest, during a historical juncture when watches had to be precise, in order to be recognised as reliable instruments, has led to our brand being awarded 2,333 chronometry prizes!... At the time, teams were conducting research into improving precision.

– A –
Jean-Frédéric Dufour

– B –
The first Zenith housing the El Primero movement (1969)

– C –
Zenith
El Primero
Striking 10th

It was not me who talked about the invention of 4Hz by Zenith. It was Pierre Gygax, the current COO of Ulysse Nardin, who told me that his father, who at the time was a watchmaker specialising in chronometry at Zenith, had been talking to him about research that they had been conducting in order to move from 3Hz to 4Hz.

For decades, the El Primero was the only movement in the world to have attained this performance. Why had the other brands not attempted to manufacture a movement operating at 5Hz and even Rolex was relying on the El Primero for its Daytona?
JFD But, you know, manufacturing a chronograph is complicated. Today, with the information technology that we have at our disposal, we have managed to conceptualise a chronograph in two or three years, but then one must produce it industrially, make it reliable etc. It takes an enormous amount of time. The El Primero was there, it existed. It was reliable. Why should we not have used it? That is what one must ask oneself.

Why do we see a plethora of Haute Horlogerie Houses presenting watches with high frequency movements today?
I think that perhaps it is an effect of fashion. On the contrary, this makes sense in terms of the spirit of TAG Heuer, since TAG Heuer is well-known for its sports stopwatches and in a sense high frequency permits one to divide time into smaller chunks, therefore when one wants to mechanically calculate the one hundredth and then the one thousandth of a second, it is amusing to talk about high frequencies.

In this case, the El Primero is suitable because it divides the second into ten; therefore it mechanically measures the one tenth of a second, a performance that is largely sufficient for a contemporary wristwatch.

What is the difference between the El Primero and the 5, 8 or 10Hz that we have been seeing in recent years by other Haute Horlogerie Houses?
Legitimacy! Reliability! Credibility! History! The other houses have made 1000 pieces or even 300 pieces and we, we were supplying Rolex for 15 years, in addition to the movements that we have been manufacturing for 44 years for Zenith's El Primero collection. What do retailers around the world tell their clients in order to sell the El Primero? They tell them that it is the best chronograph in the world! Therefore, it is not just me who says so. It is professionals all around the world!...

What is the difference between the El Primero and the concept watches that have been beating the high frequency record with their 50, 500 or 1000Hz?
A concept watch represents a quasi-artistic performance. It is manufactured in a limited edition, or even in a 'one shoot' and therefore it is primarily conceptual, whereas the El Primero stands for over 50% of our turnover.
It is imprinted on our genes, it is something that we have been manufacturing every day for more than 4 decades!...

There are people who have stated that the eye, the hand and the brain are incapable of following the hundredth or the thousandth of a second. What do you think about that?
It is true but, at the same time, when we are timing sporting events, the thousandth does indeed play a role a times in car races or in skiing competitions etc. since competition has intensified. At the time the difference between the first and the second, in a car race, was in the range of one minute. Today we often see differences in the range of hundredths or thousandths of a second.

At Zenith, have you already considered conducting research on a movement that will be faster than the El Primero?
Yes. We even began it, but we discontinued it. We decided to focus on precision and I believe that in order to attain the greatest precision there is not only high frequency to consider. There are also the effects of gravity and other parameters. We therefore concentrated on all this, by making the Christophe Colomb.

Félix Baumgartner beat a high speed record, which seemed to be beyond human capabilities, a Zenith on his wrist. Would you like to talk to us about this unique experience?
To us, this event represents something very important. First, it allowed us to do something that no other watch had ever done before, while at the same time it ensured us our inclusion in a very exclusive club of mythical watches associated with groundbreaking moments in the history of humanity. There is the watch that was on the Moon, the one that was at the greatest depth underwater and the one that was at the highest point on Earth and today there is our watch, which was on the wrist of the man who surpassed the sound barrier with his body!

What is your personal relationship to speed?
This is always very pleasant, because it makes one's adrenaline rise, regardless of whether one is skiing, sailing or on a motor-boat etc. By car it has unfortunately become increasingly difficult and dangerous. Therefore, one must be careful or do so on an organised race track. Speed is an exhilarating affair. Usain Bolt runs at a speed of 30 km/h, but I can't. Therefore, if I manage to reach 300 km/h, it is something fascinating...

Do you believe that a speed limit should be imposed on motorways and, if so, that it should be set at how many km/h?
With the increase in traffic, we are obligated to impose speed limits, because otherwise it would become too dangerous. At the time, when there were no cars on the streets, it was a different matter. But today one must impose stricter rules; otherwise the situation deteriorates into anarchy.

– UP –
The Zenith Stratos Flyback that Félix Baumgartner was wearing during his space dive

– RIGHT –
Félix Baumgartner while making his historic space dive

PIERRE GYGAX

CHILDHOOD MEMORIES

Childhood memories of Pierre Gygax, COO of Ulysse Nardin today, but equally 'childhood' memories of high frequencies, since every day of his life, Pierre Gygax aspired to acquire the watchmaking know-how of his father, René Gygax, an important watchmaker at Zenith, during the mythical era of the competitions of the Neuchâtel Observatory.

CONSTANTIN STIKAS : ***The President of Zenith, Jean-Frédéric Dufour, told me in his interview that you had informed him that your father, who was watchmaker at Zenith at the time, had spoken to you of research that they were conducting into moving from 3Hz to 4Hz. Could you give us more information on this?***

PIERRE GYGAX: I effectively talked with Jean-Frédéric Dufour about my childhood memories of the time when my father René Gygax was the Head of the 'Accuracy Adjustment' [Réglage de precision in French] Department at Zenith, and he had taken part with great success in the competitions of the Neuchâtel Observatory with (..and against) his friends/opponents at Longines (Vaucher) and Oméga (Ory).

At that period (late '50s, early '60s), the advantage of increasing the frequency of the balance spring was taught at the « Technicum » (currently Engineering Faculty). Therefore, we cannot say that 'someone invented' high frequencies.

From the moment it was possible, numerous brands launched themselves into pilot, then industrial production of movements at 4Hz (28,800VpH) and 5Hz (36,000VpH). I recall very vividly that, during my adolescence, my father had offered me a Zenith watch that he had equipped with a prototype, which he had modified from 3Hz to 4Hz.

The increase in the frequency of the oscillator is seriously deteriorated due to the harmful consequences on the functioning of the escapement (inertia, angle traversed between 2 ticks and tacks). We can therefore state that all watchmakers had realised the advantages of a higher frequency, and it was FAR (currently Nivarox) that was the only technological R&D organisation in the field of the escapement and of the oscillator, and thus permitted the realisation of calibres at high frequencies thanks to the utilisation of the 'Clinergic 21' escapement.

The classical Swiss anchor escapement made use of a wheel comprising 15 teeth for movements at 2.5Hz and 3Hz (18,000 and 21,600VpH, respectively). By passing to 21 teeth, this innovative escapement allowed brands (Bühren, Zenith, Girard Perregaux,.. from what I can recall, there may have been others too) to produce watches at 4 or 5Hz. At the time, FAR and Nivarox were not affiliated to any brands and worked in the field of R&D for the benefit of all their clients.

If we must designate a 'leader', we must therefore assign this title to FAR (Simon-Vermot, subsequently Dubois).

WILLY SCHWEIZER

WHEN INNOVATION RHYMES WITH DISCRETION

Willy Schweizer, curator, conservator and historian in charge of the patrimony of Girard-Perregaux, reveals a passionate and important story to us, which had, for decades, discreetly been kept in the confidence of a few initiates into the true history of Haute Horlogerie.

CONSTANTIN STIKAS: ***What do we gain with high frequencies?***
WILLY SCHWEIZER: Accuracy, without any doubt.

What do we risk losing with high frequencies?
Problems may appear in terms of power reserve and lubrication. Moreover, in principal, the higher the frequency, the smaller the balance, which can render the adjustment a delicate procedure.

Few people know of the role of Girard-Perregaux in the birth of 5Hz. Could you talk to us about the participation of the House in the evolution of high frequencies?
We were very simply the first Swiss manufacturers to have presented a high frequency watch in 1965. One must know that, from as early as 1953, Girard-Perregaux had its own in-house R&D Department. Its first notable development was the Gyromatic, presented in 1957: it is an original self-winding system, without a cog-wheel.

Subsequently there were high frequencies. In order to maintain the project confidential until its completion, it was Hattori, the general agent of Girard-Perregaux in Japan, who was entrusted with producing, in great secrecy, the special escapement necessary for the functioning of the first high frequency prototypes. The first Gyromatic HF models were presented in 1965. These literally overturn the conditions of the period in terms of chronometry.

– A –
Willy Schweizer

– B –
The back face of Girard-Perregaux Constant Escapement

– C –
Girard-Perregaux manufacture

GP, in effect, was presenting pieces randomly chosen from its lines at the Observatory (these have been equipped with escapements made by the 'Fabriques d'Assortiments Réunies' -FAR-), which were winning in all tests next to watches that had been prepared with great care for weeks by their competitors. This led us to win the centenary prize at the Neuchâtel Observatory in 1966. Moreover, high frequency was for a long time considered as the last useful perfection in regard to mechanical watches.

It is noteworthy that the ensuing studies are orientated towards quartz, with the first Swiss quartz watch produced in 1971, the famous 32.768 Hertz frequency of which became a universal standard.

During these years, did Girard-Perregaux always have 5Hz models in its collection?
No. We had HF models until the mid-'70s.

Man has conquered 4Hz, he remained at 5Hz for more than four decades, and then TAG Heuer achieved 50Hz, two months later 500Hz and one year later 1000Hz!... Are there any limits to watchmaking?
No. But one must not focus on high frequencies: there are equally also constant force and new materials.

Maximilian Büsser said in his interview that, "following the invention of quartz, in Watchmaking, we can state that it is the equivalent of relying on steam power in the era of the TGV. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered machine that is 5 or 10% faster than that of its counterpart..."
And after that, Jean-Pierre Musy, Patek Philippe Technical Director, replied to this remark by Maximilian Büsser: "When we are talking about high-quality watches that have a chronometrical bulletin, their COSC values range from −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amounts to more than one minute per week! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?

Max Büsser is correct: a mechanical watch is an anachronism. More than the steam engine, I would compare it to the automobile, always of a superior performance, but the energy output of which remains lamentable, since the majority of the energy furnished by the motor is dissipated in the form of heat and only a fraction of it reaches the wheels. As for Mr. Musy, he is also right: we can do better, but high frequency is not a panacea. As it concerns us, the R&D Department worked on a revolutionary escapement functioning at a constant force, which permits it to maintain a perfectly equal harmony throughout the entire winding period. In order to achieve this, we resorted to silicon. In the sphere of new materials, there is a lot of new ground to explore. We are presenting the result of our research on our site, and also of course at Basel.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we have seen Horlogerie regularly beating high frequency records... What is your opinion on this?
Seen from the outside, we may have this impression, which is reinforced by the total apathy of our political authorities. By contrast, this is not the case in cutting-edge technology industries. There is watchmaking and the CERN, but also universities such as EPFL, or the CSEM in Neuchâtel, with which we collaborated in the development of the product which I talk about above.

What is your personal relationship to speed?
I would say one of love-hate. I participated in my first car races from as early as the age of 18 and I evolved in Swiss and European rally championships over a 10-year period. Since then, I have always kept one or two sports cars for pleasure, but these have cost me a prolonged confiscation of my driver's license for seriously exceeding the speed limit. It is infuriating to be a constrained and enforced pedestrian...

Do you think that a speed limit should be imposed on motorways and, if yes, that it should be set at how many km/h?
The problem is that learning how to drive today in no way prepares for high-speed driving, actually quite to the contrary. Moreover, in Switzerland, you can learn really well on a Clio and, with your driver's license in your pocket, you may offer yourself a Ferrari without anyone asking you the least bit of information regarding your driving skills. There is therefore a double danger. Having said that, a differentiated limit of between 120 and 140 on motorways and 80 and 110 on the road would seem reasonable to me. But, unfortunately, that is pure utopia, even if one only considers the insurance company lobby, to which a good driver is a driver who has come to a halt...

– A –
Girard-Perregaux Gyromatic HF

– B –
Gyromatic HF's movement

– C –
Girard-Perregaux Constant Escapement's movement

– D –
Girard-Perregaux Constant Escapement

JEAN-CHRISTOPHE BABIN

MOLTO VELOCE

The Maestro who orchestrated the rise of TAG Heuer into Haute Horlogerie wonderland, as a virtuoso of the most cutting-edge watchmaking technology, narrates for us the adventures of his team in their research into high frequency pushed to the extreme!...

CONSTANTIN STIKAS : ***First of all, are we able to define what the meaning of high frequency is today?***

JEAN-CHRISTOPHE BABIN : TAG Heuer goes up to 1000Hz. We make from 4 up to 1000Hz. On average, we make 10 times faster than what used to be considered as high frequency and we can go up to 200 times 5Hz, reaching 1000Hz! Thus, TAG Heuer is not the high frequency specialist, but the very high frequency specialist!

What do we gain with high frequency?

What high frequency offers us, is the division of time into infinitesimal units. Mastery of the hundredth, of the thousandth and of the ten-thousandth, which corresponds to the mastery of extreme precision. Because if you are able to break down a second into a hundred hundredths, a thousand thousandths or two thousand two-thousandths, in a way you have the most precise second in the world. The essence of high frequencies is the essence of mastering time.

What is at risk with a high frequency watch?

High frequency, like in Formula 1 engines, consumes more than low frequency. Therefore it is clear that the great challenge posed by high frequency is the power reserve. TAG Heuer, conscious of this challenge, opted from the outset, with the Calibre 360 in 2005, and afterwards with the Mikro-family, Mikrograph, Mikrotimer, Mikrotourbillon and Mikrogirder, for dual chains. These were used for separating the standard time (hour, minutes, and seconds) power reserve, from the very small time interval power reserve, thanks to their two separate barrels. Thus, the TAG Heuer system is the system reconciling the marathon with the sprint. It is very difficult for a sprinter to run a marathon, he will collapse from exhaustion. And a marathon runner will be very slow running a sprint. TAG Heuer took note of that and so the hour-minutes-seconds part, is like a marathon runner who never stops, since at 4Hz there is no problem posed by consumption, and then, when you need to run a sprint you go up to 50 or 500Hz, with a power reserve that will be weaker but that will have no chronometrical impact on the accuracy of the hour, minutes and seconds. Because the problem of high frequency is not solely that it consumes a lot of energy, but that it intervenes with the hour, minutes and seconds indication's chronometry. By contrast, using a dual chain, there is no negative influence on chronometry. That is one reason for which a watch with a chronograph cannot obtain the COSC. Because from the moment you start the chronograph on a single-barrel watch, you completely deregulate the chronometry of the movement of the watch and you also influence the power reserve, which will pass from 50 hours to 2 hours.

Man has conquered 4Hz, he remained at 5Hz for more than four decades, and then TAG Heuer achieved 50Hz, 500Hz two months later and 1000Hz one year later!...

Are there any limits to watchmaking?

Are there any limits to the projects of TAG Heuer's R&D Department?

Jean-Christophe Babin

By definition, there are no limits to innovation. The human-being is fashioned in such a manner that he is always imbued with a curiosity for venturing further and exploring new technologies. Moreover, it is thanks to the limits of the Mikrotimer that we reinvented the regulator with the micro-blades that allowed for the creation of the Mikrogirder. In fact, with the Mikrotimer we came to the realisation that, from 500-600Hz and up the consumption began being very high and we especially began experiencing a loss in precision. These are the limits of Huygens's system. Huygens's system is extraordinary at 4-5Hz and good at 50Hz, but it reaches its limits in the vicinity of 500Hz. And, however, in the Mikrotimer, let's not forget that there is a set that does not even have a balance. Because there is such little amplitude whereas the balance normally acts as the corrector of the amplitude. Therefore, on a standard movement you have 270 degrees of amplitude and you have a balance for the return, on the Mikrotimer we have 20 degrees of amplitude and we no longer have any need for a balance. Therefore, the set of the Mikrotimer is extreme. However, it remains a classical set, since there is a spring. But that is until 500Hz. In order to go higher than that, we were obligated to think differently, and that was how we came back to the principle of D'Alembert. His principle of the violin cord, namely of vibrating waves.

That is why I have stated that there are no limits to innovation. We reached a limit to innovation with the 500Hz, which is the limit of the system of Huygens. And then, by using D'Alembert's principle on vibrating waves, we went up from 5 to 1000Hz in a single step. Now we know that, with vibrating girders, we can reach at least 1000Hz, even higher.

Maximilian Büsser stated in his interview that "…after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing… In Watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart…" What do you think about this?

I believe that, in the automobile industry, the electrical engine has existed for more than 100 years, while the internal combustion engine has existed for more than 150 years. And, finally, the internal combustion engine remains the one largely predominant today. We have witnessed that, in the progress made by the best engineers in internal combustion engines, we have attained consumptions of 2 to 3 litres per one hundred kilometres. Thus, ultimately today the electrical engine is a big 'question mark'. The famous erupting motor that has existed for a long time thanks to innovation today, it is always by eruption, but it has an energy performance that no one could have imagined 20 years ago.

The mechanical movement is more or less like that: yes, it is mechanical! There is an horological chain, which conceptually has remained the same for 300 years. But the output of this movement today is incomparable to what it was 30 years ago.

Even the first automatic chronograph of Heuer from 1969, the Chronomatic 11, when compared against the 1887, it is like comparing the cars of the '70s to the cars of today. They consumed a lot more; they were a lot thicker and much less reliable. Yes, concepts have not changed, similarly to the automobile industry. But reliability, precision, energy efficiency, all these have immensely evolved.

Jean-Pierre Musy, Patek Philippe Technical Director, replied to the remark by Max Büsser: "When we see high-quality watches, they have a chronometrical bulletin, COSC values, meaning −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amount to nearly one minute every minute! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?

We can attempt to correct daily variation ad infinitum. It is primarily a question of adjustment. But I believe that there will never be a mechanical watch that will be as precise as a quartz one, especially in regard to daily variation. By contrast, it is primarily reliant on the adjustment. We can decrease the error margin to less than one second per day. Subsequently, can we decrease it to one hundredth of a second per day? I do not think so. Now, is that so serious? Knowing that people owning mechanical watches today, they usually have more than one and will therefore need to reset the time numerous times per month, this becomes a bit academic. It is as though a Ferrari, which has 300km of autonomy, but no one cares since no one will do the trip Zurich-Hamburg in a Ferrari. You mainly see people touring the Alps in a Ferrari. Thus, it would be of no use to have 1000km autonomy in a Ferrari. And must put the problem in perspective and remember that quartz has less deviation, but it is not noble. Whereas the mechanical watch is noble. It is 300, 400, 500 components that are very small in size and that have been assembled together. Aesthetically it is admirably beautiful and if it has an error margin of 1, 2, 3, 4 seconds per day, it is not so serious. We frequently have 3-4 watches; in any case we often have one stopped watch that we need to adjust. And, that way, they are always set to the right time.

Until now, we have seen 4 magnificent Concept Watches. What does the everyday watch gain, or what is it capable of gaining, from this experience and from the acquired know-how?

High frequency already represents the ultimate mastery in the operation of a movement, regarding the spring, the balance and the escapement. Therefore, it is clear that if you manage to mastery 50 or 500Hz, you are in a position to much better understand the operation of your 4 or 5Hz movements. From brands like TAG Heuer, we can imagine future optimisations to traditional sets. Not necessarily using silicon, because in any case that is more an issue of marketing, but by using our imagination. For example, on the Pendulum we have made a movement without a spring. On the Mikrotimer we have made an movement without a balance. We cannot remove the balance, the spring and the escapement all at once, because there would be nothing left.

TAG Heuer Carrera Mikrograph 1/100th, TAG Heuer Carrera Mikrotimer Flying 1000 and TAG Heuer Mikrogirder

But we see that by working with high frequency we can manage to rethink certain components which, until 4 or 5 years ago, were considered obligatory. Until 2010 we used to say that a spring is necessary. With the Pendulum we demonstrated that this is not the case. Until 2011 we used to say that a balance is necessary. With the Mikrotimer we demonstrated that this is not the case. Finally, we stated that a spring and a balance are both necessary. With the Mikrogirder we demonstrated that this is not the case. The interest of high frequencies is that they lead the mechanical escapement into new territories that will have applications for lower frequencies as well. The Mikrogirder, it was initially at 1000Hz, but there are probably very good applications for it at 50Hz, that would provide the same degree of precision as the escapement we are using here, but probably with a lot more power reserve. Because, effectively, the advantage of the vibrating micro-blade is that it has very low energy consumption compared to traditional sets. Not only does it go up to higher frequencies, but it has much lower consumption, because in effect if we speak about the Mikrotimer it has an amplitude of 20 degrees, but if it is with micro-blades it has an amplitude of 3 degrees. And the weaker the amplitude, the less important consumption becomes. Thus, the application of 1000Hz to 50Hz can, in theory, permit attaining 50Hz, with a power reserve that is three or four times more important. We see that all this research work can have very interesting applications.

During the presentation of the Mikrotimer someone asked you if the eye, the hand and the brain are able to follow such an unimaginable performance. What do you think?
So, as for the hand, yes, because in effect the human being, at the cerebral level, has the tendency to apply the same force for short periods. If I start and then I stop a chronograph my finger –and this has been confirmed by lab tests– applies the same force. Thus, the flaw that I introduced on START, I will correct it on STOP. So, if you like the famous debate "Why the thousandth, the ten-thousandth or the tenth?" knowing the finger is inaccurate, it is true in theory, but unsubstantiated in practice. Because every time that I press the START button, I am introducing a flaw into the system, and when I click on STOP I am correcting this flaw. Therefore, at the level of the hand, it is the hand that is the corrector. Especially when we are talking about short spans of time.

Now, for the eye. It is clear that above 50Hz, the eye does not see anything. But that is not important, what is important is that when we stop it, that the indication is readable. Seeing the hand turning is not what is important. What is important is that when you stop the chronograph, that you can read the exact indication. What is probably even more important than frequency and precision in the Mikrograph, Mikrotimer and Mikrogirder models, it is the legibility. And there is nothing simpler than if I stop a Mikrograph here, that I know that I am at 89 hundredths of a second. TAG Heuer is the brand that was not only the most innovative in high frequency, but especially that was also the most creative mechanically, in order to have an architecture in its movements that would facilitate the legibility of the indications. Up until the tenth of the second, it is easily readable. But from the hundredth onwards, it becomes complicated. At the thousandth, there are three digits. At the ten thousandth, there are four digits. Therefore, the entire Art of high frequency consists, beyond precision and frequency itself, in being capable of having a construction of the movement that will permit reading the ten thousandth, or the thousandth or the hundredth. And it is in this domain that TAG Heuer was certainly more pioneering than in frequency itself. Jack Heuer always said "there is no interest in being accurate if one cannot be legible".

In TAG Heuer's research one encounters a synthesis of the innovative watchmaking spirit with the practical dimension of perfection in the domain of race-car event timekeeping. Can you specify the benefits brought to timekeeping by watchmaking know-how?
At the beginning, there was a very close relationship, since car-race timekeeping was done mechanically. We had wrist-worn chronographs and Stop Watches. As of the '60s, specifically in 1966 with the Microtimer, we pass into the electronic era. And we pass from the hundredth to the thousandth of a second. And that was when the paths separated. Today, TAG Heuer is among the world leaders in sport timekeeping: automobile, equestrian, skiing etc., but with devices that are exclusively digital. And that have no direct horological application. Thus, if you want to make a digital chronograph like the one we made in 2002, the Microtimer, will be suitable for that purpose. Otherwise, sports timekeeping and the mechanical watch are two completely different worlds.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we have seen watchmaking regularly beating the high frequency record… What is your opinion on this?
I am not convinced that Switzerland is 'slow'. Switzerland is, above all, a coherent country. And, from time to time, we confuse coherence and slowness. We have a tendency to think that a country that moves about a lot is dynamic. We are dynamic if we consistently move in the same direction. And if we move in many different directions, we are dispersive. Switzerland is a very determined country, with very specific objectives at the technological level, at the industrial level, at the political level, at the institutional level and that remains very coherent. We tend to confound coherence with slowness, but that is not 'slow', it is only efficient.

Watchmaking, in particular, is one of the most dynamic sectors in the world. Even if it was founded on Huygens's principles three centuries ago. And this does not impede Watchmaking industry from being one of the most innovative in the world and presenting the highest growth index in the luxury goods world. This means that is poses greater interest than the other sectors, above all through the power of its creativity.

What will be your next creation in the field of high frequencies?
Now the next step is high frequency in high-tech materials. Thus, it might be the theme of the following year. Because we have seen that this year, TAG Heuer, with its Carbon Matrix Composite, has also introduced new materials and not exclusively a new movement.

What is your personal relationship to speed?
I adore it. I am one of those people who are 'speed-aholics'. Thus, I am really fond of speed in skiing, I am really fond of speed in windsurfing, on a catamaran, during a TAG Heuer Formula 1 Driving Experience, I am very fond of speed in Formula 1 racing, personally I really like everything that is fast.

Do you think that a speed limit should be imposed on motorways and, if yes, at how many km/h should it be set?
I believe that there are experts, specializing in car safety technologies. They specify the reasonable speed limits. I am the first to say that on a motorway, for example, more than 120km/h is madness. Because, if you talk to engineers, the smallest accident, from 120-130 and up, there is no longer any safety system that can keep you alive. Until 60 you risk practically nothing if you have properly fastened your seat-belt. Between 60-120 you start being exposed to significant risk and above 120, even if you have fifteen air-bags and shock-absorbers... The speed limits that are currently in effect are scientifically reasonable ones, if the aim is to eliminate casualties and injuries. If you want to drive at high speeds, go to a race-car circuit, rent a one-seater, twenty years ago this option was not available, now they are everywhere. If you want to drive fast, have fun, but do so in a secure environment, without placing your life, nor that of others, in danger.

– A –
TAG Heuer Carrera Mikrotourbillons

– B –
The escapement of the TAG Heuer Carrera Mikrotimer Flying 1000

– C –
The revolutionary oscillator of the TAG Heuer Carrera Pendulum

DEMETRIO CABIDDU

THE ART OF MASTERING SPEED

Montblanc is one of the two main protagonists of very high frequencies, with its sublime Montblanc TimeWriter II Chronograph Bi-frequency 1000. The Technical Director of Montblanc Villeret, Demetrio Cabiddu, presents all its fascinating parameters to us...

CONSTANTIN STIKAS: ***Can we define what is meant today by high frequency?***

DEMETRIO CABIDDU: I do not believe that there is a strictly fixed rule for determining based on what value we can designate a movement as a high frequency one. Usually, when I talk about high frequencies I tend to think that they start at 28,800VpH [4Hz]...

What do we gain with high frequencies?

High frequencies certainly allow one to obtain operating accuracy (adjustment) faster. High frequencies are less influenced by certain defects of the escapement and are less exposed to the strains caused by movements when worn on the wrist.

What is at risk with a high frequency watch?

In order to obtain a high frequency movement, we must play around with the interplay between scale and force (couple). In order to obtain a higher speed, we must either decrease the regulating component (the balance) or increase the energy (barrel), sometimes at the expense of the aesthetic quality of the movement, the dimensions and power reserve. A risk undertaken concerns long-term longevity: use, as well as deterioration of the oilings can, in the medium term, modify the accuracy achieved at the beginning.

Man has conquered 4Hz, he remained at 5Hz for more than four decades, then we have seen watches at 50Hz,

– A –
Montblanc TimeWriter Chronograph Bi Frequency 1000

– B –
Montblanc Villeret manufacture

– RIGHT –
Demetrio Cabiddu

500Hz and even 1000Hz!... Are there any limits to watchmaking?
The compromise of 28,800VpH [4Hz] was the golden ratio, in my opinion. 36,000VpH [5Hz] poses an advantage for the reading of the tenth of the second, but this frequency demands a perfect mastery of oilings and of wear, which is not something one can take for granted. This argument is valid notably for watches equipped with only one component regulating its unremitting operation. This is different for timers or watches equipped with a double regulating component, entailing a 'classical' speed for the watch and a higher speed for the chronograph, as in the Montblanc TimeWriter II Chronograph Bi-frequency 1000.

There are everyday watches operating at 5, 8 or 10Hz and watches that are better categorised as concept watches operating at 50, 500 or 1000Hz. What is the difference between a high frequency watch that will remain a prototype and a high frequency watch that will be mass produced?
High frequency must permit an accurate observation during timing. Therefore, according to the activity that is being timed (sports or industrial production), different fractions of seconds and minutes are necessary and are researched, such as the 1/10th, the 1/36th, the 1/60th, the 1/100th or the 1/1000th (non-exhaustive list). Except for this usage, the rest is of little use in my opinion.

At Montblanc you have presented the TimeWriter II Chronograph Bi-Frequency 1000, beating at 50Hz, which in addition to the 1/100th of a second, also measures the 1/1000th of a second. Would you like to explain your approach to us?
I have already explained it, in part, in my previous responses. To Montblanc, it was important to take into account the beauty of the movement, as well as use, the oilings etc...

Thus, the first step was to have two regulating components, permitting us to regulate the display of the time in a classical and tested manner.

The second step was to seek a reasonable compromise between functionality, use, easy legibility and the power reserve, on a chronograph with a high-definition display. Our soon one-hundred year experience of timers beating at 360,000VpH offered us some information. Therefore, we did not wish to surpass those limits, since we wanted to retain the conventional escapement. That led us to seek different solutions, while at the same time respecting the principles that are close to our heart.

Would you like to explain for us the use of the two different balances and how you proceed?
Every balance is driven by its own autonomous power source, this permits us to isolate the functioning of every system and to manage the various VpH separately. Thus, for example, if you are not making use of the chronograph, this energy reserve remains constantly available without necessitating of winding.

Minerva is a historical House. In what way is the watchmaking know-how you have attained important to the realisation of such a reolutionary watch and how does one chart new paths?
We always seek to innovate, while simultaneously respecting the tradition and know-how handed down to us from preceding generations. This may appear constraining at times, but ultimately it is very positive and challenging because, once our method of operation has been complied with, it allows free rein to our imagination and encounrages our inventiveness.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland, and today we have seen Horlogerie regularly beating the high frequency record… What is your opinion?
Switzerland is a tranquil country, which likes things that have been executed well!! Making things well and calmly often leads to making them in a well-thought out manner. This permits, in reality, to move a lot faster than those who, in their haste, are forced to start over again several times in order to reach the same objective.

What is your personal relationship to speed?
Outside the watchmaking context... Speed makes me think of motor sports and the inebriation that this sensation can induce, but my attraction is more human and athletic events have always aroused a great admiration in me, not only for short-distance sprints but also for endurance sports such as 10,000m events and marathons, where resistance and speed must be correctly combined and which demand a mastery that is clearly superior to that entailed by only mastering a single baseline speed.

Do you believe that a speed limit should be imposed on motorways and, if yes, that it should be set at how many km/h?
The legislators who establish the rules are always susceptible to criticism and I often disagree with certain limits that are not very reasonable... It would be appropriate to adapt speed limits in relation to specific sections of roads and to the density of traffic. The speed limit in Switzerland is set at 120km/h and I find it too restrictive...

– A –
Montblanc Villeret's workshops

– B –
Montblanc TimeWriter Chronograph Bi Frequency 1000

KARL-FRIEDRICH SCHEUFELE

PASSION AND RESPECT FOR **HIGH SPEED**

The Vice-President of Chopard, well-known for his passion for vintage racing cars, is also renowned for his wisdom. He stands for what we call the 'calm force' in Haute Horlogerie. We clearly see the reflection of his personality in the L.U.Chopard collection of movements. Among them, there is a watch released in 2012, which beats at 8Hz!

CONSTANTIN STIKAS: ***In the sphere of high frequency, there was only a single protagonist since 1969, operating at 5Hz. In recent years we have seen watches beating at 5, 8, 10 even at 50, 500, or 1000Hz! So how can we define high frequency in relation to watchmaking mechanics today?***

KARL-FRIEDRICH SCHEUFELE: The high frequency movements that you have just cited were made possible thanks to new technologies that were not yet available during the '70s. We can mention the components made of silicon, which offers the benefit of not requiring any lubrication. This is already a basis allowing one to work on a high frequency movement.

What do we gain with high frequency?

High frequency, if we make use of it in a rather conservative manner, the way we do at Chopard, represents more advantages than disadvantages. By using high frequency we gain in precision, especially in sport watches that are frequently submitted to many shocks. Every time the balancer receives a blow, it imperceptibly slows down or speeds up. A high frequency movement will be a lot less perturbed and it will revert to its original beating more quickly than a movement beating at a lower frequency.

This is the biggest advantage represented by high frequency movements, since they offer a higher degree of precision in everyday activities, especially for sportspeople.

You may not realise this difference if you make normal usage of the watch, but only if you use it under extreme conditions.

To us, the principal advantage is that the system that we have developed can be adapted to various movements in our line and truly endows them with added value in terms of reliability and shock-resistance.

One must also not neglect its advantage of allowing the measurement of much shorter time spans, which is especially significant when talking about chronographs.

And I will not hide from you that, for us, the logical development will be the development of a chronograph also beating at 8Hz!...

What is at risk with a high frequency watch?

At the outset of our research, we thought that we would lose out in terms of power reserve, but in fact we ascertained that the power reserve of the movement in question did not change in the least. We have the same power reserve as in the movement beating at 4Hz.

Therefore, to my knowledge and to date, I do not find any disadvantage in high frequency movements. All the tests that we were able to conduct until the present were positive. We began delivering the first pieces in our first series out of 100 of the L.U.C 8HF, at the close of 2012.

– LEFT –
Chopard
Mille Miglia GT
XL Chronospeed

– DOWN –
Karl-Friedrich Scheufele behind the wheel of one of his vintage cars

How difficult was it to produce a manufacture movement beating at 8Hz?
It necessitated an enormous amount of research and development, over a period of numerous years, but I can't say that it is more difficult to produce this movement today, compared to another. I would say that it is the process that was quite long and difficult in terms of research and development.

This is all the more so since we had to manage to measure the various data of the movement, since there were no measurement instrument capable of testing a movement beating at 8Hz, given that all measurement instruments in watchmaking have been made for 4Hz and therefore we had to invent and create new measurement instruments in order to be able to test our prototypes.

I emphasise that we are not engaged in a high-speed race, nor in a competition as to 'who makes the highest frequency?' Our interest is more fundamental than that. That is to say, it is more about us being engaged in seeking our own self-improvement as regards the production of our already existing movements, through the use of high frequency.

The second question we asked ourselves is whether we are able to implement a high frequency system that will adapt itself to existing L.U.C movements. Once we were able to answer 'yes' to these two questions, we launched the project.

Our aim was not to create a prototype, just for the sake of presenting something somewhat out of the ordinary. On the contrary, for us it entailed fundamental research.

The Chopard L.U.C 8HF is the only high frequency watch to have obtained COSC certification. What does this represent?
Let me go back to the advantages that I mentioned at the outset. From the beginning, I told our engineers that if we intend to claim to have manufactured a high frequency movement offering advantages such as superior precision etc., it would be necessary, at the minimum, that this movement also obtains COSC certification. To me, this was a non-negotiable condition that had to be met before I would begin developing this movement. It would not be worthwhile to develop a movement that would not obtain COSC, which is a certification that we have already been awarded on other of our movements.

Therefore, to us COSC certification stands for an objective guarantee of our high frequency movement.

Chopard is associated with the Mille Miglia vintage car race. Would you like to talk to us about this long-established adventure?
I will not hide that fast driving has always fascinated me, but what fascinates me even more are vintage cars that took part in the Mille Miglia race. Chopard has been the sponsor of Mille Miglia for more than twenty years and it has been a long-standing history marked by passion, a history that is also personal, as it regards me personally, as well as professional. I also missed a single event during this entire period. Mille Miglia is an absolutely perfect link between the measurement of time and exceptional automobiles. It represents a magnificent adventure for Chopard and a partnership that has caused many people to talk about Chopard, as well as stirring lively discussion on the Mille Miglia event, which a lot of people around the world had hitherto not been aware of.

To most people, Switzerland is a 'slow' country. However, the CERN is located in Switzerland and today we see watchmaking regularly beating high frequency records… What is your opinion on this?
I think that there are two sides to this. Speed always has a physical aspect, but at the same time it also has a symbolic meaning. It is true that in Switzerland we have the tendency to ensure and move forward in a controlled and well-thought out manner, but this is often qualitative. Regardless of whether this is in watchmaking or in the activities of CERN –in fact here at Meyrin we neighbour CERN and we can even nearly see what they are doing– I think that advancing slowly but surely is a very positive quality of Switzerland, which moreover suits our image. Evidently this does not prevent us from being very quick at times, as regards certain developments.

What is your personal relationship to speed?
I believe that regardless of whether it was cars, skis or bicycles, from a very young age I have always felt –simultaneously– a passion and a respect for speed. I will not hide that, also in cars; I am a fan of high speed, as long as one exercises caution and as long as it takes place on a race track and not a public road. Speed is something that fascinates me. Thus, my relationship to speed is a rather impassioned one.

Do you believe that a speed limit should be imposed on motorways and, if so, that it should be set at how many km/h?
I think that the speed limits in effect today and that are imposed in quasi-draconian manner in Switzerland are thoroughly well-adapted. It is difficult to do something else, because not all drivers have the same skills and, moreover, today drivers are not always careful enough when it comes to controlling the speed of their car, since cars are more and more comfortable and easy to drive and, unfortunately, many people make use of communication devices while driving.

Therefore, I believe that the speed limits as they are enforced today are largely justified and that the person who effectively wants to have some fun will go to a race track to amuse himself, but on the road it is becoming more and more risky to drive at higher speeds.

Is it different in Germany?
On German motorways there are still sections where one is allowed to drive at higher speeds, but these sections are becoming more and rarer and, given the traffic, honestly fast driving is no longer a pleasure. This is one of the reasons that I so love driving a vintage car, because even at a slower speed, one has great fun, since one has the impression that one is driving faster!...

Chopard
L.U.C 8HF

JEAN-CLAUDE BIVER

HIGH-SPEED CHAMPION

Jean-Claude Biver is a... supersonic man!... He is always there: with his retailers, with his clients, with forum members, with the press, with his watchmakers, with his ambassadors. The only man in the world who can be considered as being faster, even than his friend Usain Bolt!...

CONSTANTIN STIKAS: ***We are going through an era of large-scale global transformations. Do you believe that we must slow down or speed up?***

JEAN-CLAUDE BIVER: We must slow down the time intervals between the crises engendered by capitalist society and we must speed up when it comes to the ethos and moral integrity of the behaviour of rulers and citizens.

The Key of Time is the only watch in the world with which we can select the speed of the passage of time! Can a revolution in watchmaking have philosophical connotations?

The philosophical or cultural dimension is, at the end of the day, of fundamental significance in Art. And if we wish to elevate watchmaking to the level of Art, there is no better path.

You are known as someone who acts fast. In what way is speed important in business?

Speed is the most important ingredient in life. One second too much or too little could mean death. And what holds true for people evidently also holds true for their working life or their achievements. I ceaselessly assert and preach that speed is one of the most important ingredients on the path to success.

However, you are someone who loves Swiss tradition and who shares the values that are often linked with the slow passage of time. It takes time to make good-quality wine, sometimes one must wait to taste it, in the same way that it takes time to make a good cheese etc. However, the CERN is also located in Switzerland and today we witness watchmaking breaking high frequency records on a daily basis. What do you think about this?

There is not just one single speed or one single time in life. The art of managing it is being able to adapt and manage each time and each of its speeds.

Give us a domain where speed is important and another where it is best to be slow.

A great problem necessitates a simple solution, but time is necessary for finding this simple solution. Discovering simplicity is a process that only takes place afterwards. It is, finally, the fruit of time and wisdom. In promotion or sponsoring, by contrast, good ideas are rare and when we find one, one must know how to swiftly appropriate it, because frequently everyone is having the same ideas at the same time.

For a very long time in the domain of high frequency, there was only the El Primero. Today, we see TAG Heuer attaining unimaginable records. These two Houses form part of the LVMH Group, like Hublot. What do you think of this?

It is a sign of the wisdom of the LVMH Group to allow each of its brands independence and their own autonomy. The two brands adopt a different approach, something which renders them nearly complementary.

The high frequency domain will one day provide the backdrop for Hublot to demonstrate its technical capacity?

Why not? There are no postulates and no limitations either...

You have forged partnerships with the swiftest man in the world, Usain Bolt and with the automobile brand that has been the symbol of high speed for decades, Ferrari. Is Hublot a House that loves speed?

Hublot likes to be First, Different and Unique. In order to attain this, one must be fast!...

What is your personal relationship to speed?

I like the varying speeds of life and of the seasons. They are what endow it with its charm and rich diversity. How monotonous it would have been, if we just had a single speed...

– A –
Jean-Claude Biver next to his Ferrari

– B –
Hublot Key Of Time

– C –
Jean-Claude Biver, cheese farmer

RICHARD MILLE

THE ACCELERATION CHAMPION

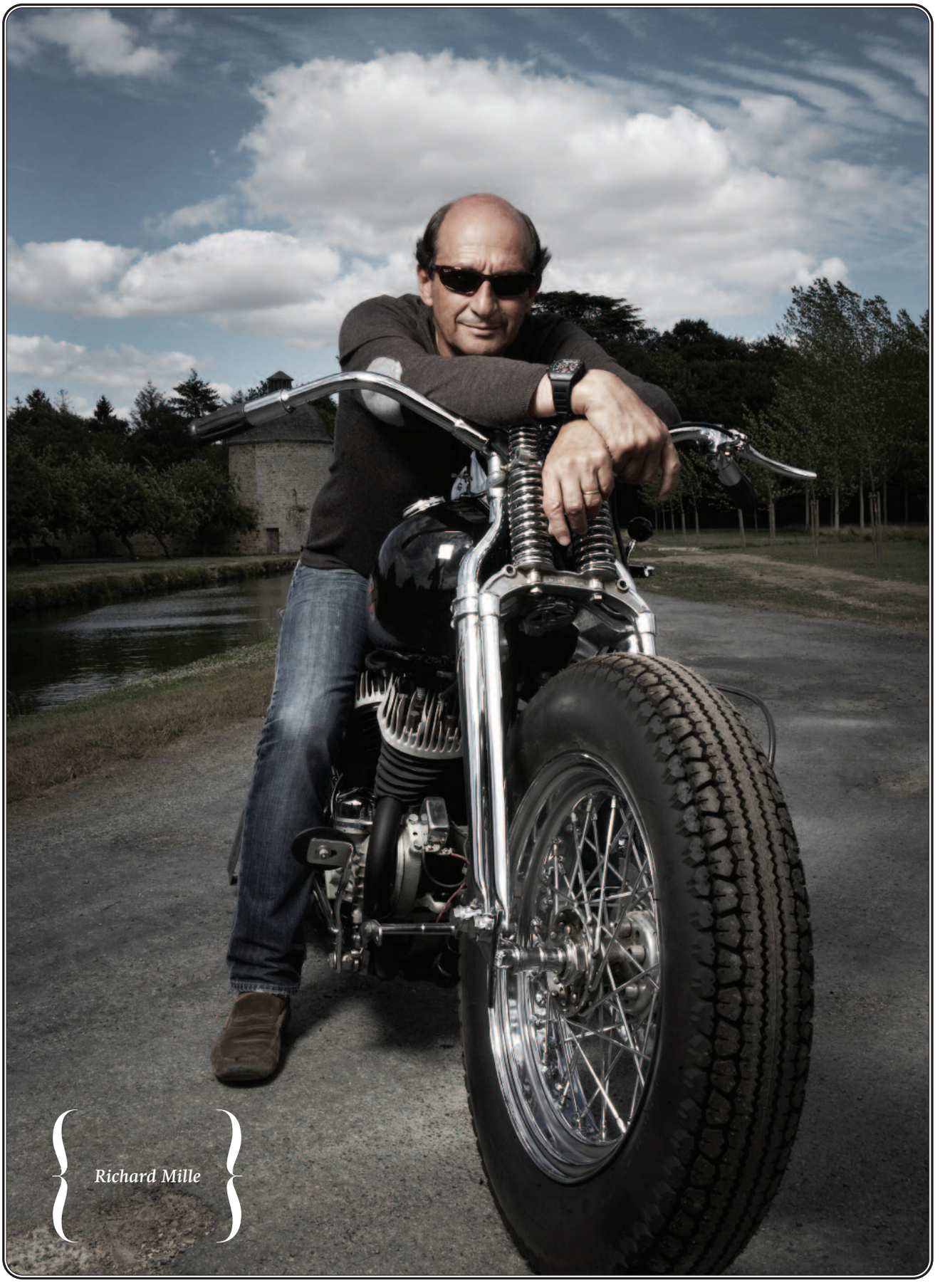
Speed has been despised by many, acceleration by no one!
Richard Mille proved himself a real champion of acceleration from the very first moment when he presented the watches that bear his name, taking his creations to the peak of Haute Horlogerie in record time. One decade later, he presented the first watch that allows you to measure acceleration...

CONSTANTIN STIKAS: ***Aside from the aesthetic value of your watches, you have always had a very close and deep relationship with the world of speed, either through your cooperation with F1 pilots and polo teams, or your collaboration and friendship with Rafael Nadal, Yohan Blake etc., or even with your personal profile. How do you see the relationship between speed and watchmaking?***

RICHARD MILLE: Timekeeping in general has always been related to speed. The watch as a timekeeper came into widespread use to assist in accurately measuring a three-dimensional position — and therefore speed — in regards to the question of calculating longitude. Agreed, in that case we are not talking about the speeds of an F1 racing car of today; nonetheless, speed and time are interrelated on many levels, even more so when we add relativity to this mix.

Even at the level of a watchmaking brand's evolution you gave lessons in speed and efficiency with the inclusion in record time of the Richard Mille house in the exclusive "club" of the most important prestigious companies in the world. What are the ingredients of such speedy success?
Timing also plays a role in the case of success, in the sense of finding the perfect moment when you can combine your philosophy of not accepting any compromise with the process of rationalizing all aspects of the watch as a three-dimensional, holistic entity, inside and out. Together they spell out my success.

Man has conquered 4Hz, remained at 5Hz for more than four decades, and then TAG Heuer achieved 50Hz, two months later 500Hz and a year later 1000Hz!...
Richard Mille already has a watch that beats at 5Hz in its collection. Do you think this is the ideal frequency for a precision watch? What do you think of the "race" for the highest frequency?
The concept of performance, whether chronometric or technical, has been my obsession ever since the brand was founded. I think reducing the search for accuracy to a discussion of reaching an ever-higher speed for the escapement is



a rather simplistic way of working. The problem is much more complex, and, if one ignores other aspects of the question, a higher speed of escapement will not make any difference whatsoever. This is why I spent so much additional time on all aspects of the RM 031 High Performance calibre in addition to the high-speed escapement used. The going train is extremely important as the transmitter of energy from the two winding barrels to the escapement, so, inspired by automobile transmissions, all the wheels of the movement were optimized with a special tooth profile providing a pressure angle of 20°. This guarantees continuous transfer of power along the entire going train. There are many issues like this at the heart of the watch's accuracy, and the speed of the escapement is only one of several issues that need to be addressed to achieve such exceptional results. Everything in my RM 031 was mechanically "fine tuned" – not just the escapement – in order to achieve spectacular timing results. The timing of the RM 031 alone takes almost 3 months to complete before a certificate can be given that guarantees a deviation of less than 1 second a day, with all the testing results recorded for the owner.
Again I stress that the speed of an escapement is only a specific part in the creation of high-performance, accurate timepieces in this class.

Maximilian Büsser stated in his interview that "…after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing… In watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart…"
And after that, Jean-Pierre Musy, Technical Director at Patek Philippe, replied to Maximilian Büsser's remark: "When we see high-quality watches, they have a chronometrical bulletin, COSC values, meaning –6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amounts to nearly one minute every week! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one-minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?
Again, I refer to what I just said previously: the speed of the escapement alone will never provide the answer to accuracy for mechanical watches, this is simply dead-end thinking... This is not my own discovery; the old makers already knew this in the 18th century! What many people seem to completely ignore in this discussion is the very simple fact that ships' chronometers were exceptionally accurate with beat rates much lower than represented here in these discussions. The problem is that we have to pay attention to the same issues those historic makers did more than two hundred years ago. This was in essence what I put into the RM 031, a symbol of the mechanical performance pushed to the extreme. The important thing is that the escapement together with extreme attention to the going train, the profiles of the wheel teeth, the baseplate, the internal chemical atmosphere of the watch, the winding barrels, the finishing of all communicating parts for the lowest friction possible and a dozen other aspects achieved an extreme accuracy of less than 1 second a day. Each of the 10 pieces of the RM 031 tested only vary from 20 seconds a month and one of them gets a variation of 1 second a month. The RM 031 is my wristwatch "tribute" to those fabulously accurate ships' chronometers, and represents a holistic approach to the questions behind accuracy.

You have introduced the RM 036, the first watch in the world equipped with a G-sensor. Would you explain your approach, and the relationship of this watch to road safety?
Actually the G-force theme is one coming into play for watches from the world of motor sports; a number of car manufacturers are planning to or already have put such sensors in their cars as an extension of road safety awareness. It gives the owners of such high-end cars an additional source of information about their driving characteristics, and I felt it would be very useful to place this concept within a watch for the same reasons. It also fits in perfectly with the road safety action campaign of my friend Jean Todt, who is now president of the FIA, which is why the RM036 was named after him. And indeed, since men are fascinated by all kinds of mechanical constructions, it adds depth and "sex appeal" to the watch's fascination for owners.

To most people, Switzerland is a "slow" country. However, the CERN is located in Switzerland, and today we have seen Horlogerie regularly breaking the high-frequency record. What is your opinion?
Because the Swiss are a very thoughtful people, they can afford to take the time to really examine precision on all levels with patience and thoroughness. I think that is what drives their fascination with the world of details.

What is your personal relationship to speed? Motorcycle or car?
I love the looks of motorcycles as a kind of ultimate expression of speed and form taken together. However, my main passion is really grounded on racing cars.

Do you believe that a speed limit should be imposed on motorways and, if so, that it should be set at how many km/h?
If I want to enjoy my cars on regular roads, I have to go to Germany for that. I see no reason to drive 130 km/h when the road in front of me is totally empty; but the authorities in countries other than Germany think differently from me...

A.
Yohan Blake

B.
Richard Mille RM 036

C.
Richard Mille RM 031

D.
Felipe Massa

GRÉGORY BRUTTIN

THE UNIQUE HEARTBEAT OF THE QUATUOR

Grégory Bruttin, Master Watchmaker for Roger Dubuis, presents for us the Excalibur Quatuor, the first watch in the world to house four balances which add up to 16Hz and a novel and magnificent manner of 'ticking'!...

CONSTANTIN STIKAS: ***What do we gain with high frequency?***
GRÉGORY BRUTTIN: Thanks to high frequency, we gain a better functioning of the watch, due to an improved operational stability. There is also less vulnerability to shocks.

What is at risk with a high frequency watch?
The problems caused by high frequency in mechanical watches are due to the strains caused by wear. The approach that we adopted for the Quatuor was to use a stable frequency (4Hz) that eliminates this risk. A high frequency consumes an enormous amount of energy, which impacts on its power reserve.

Man has attained 4Hz, remained at 5Hz for more than four decades, and then TAG Heuer attained 50Hz, two months later 500Hz and one year later 1000Hz!... Are there any limits to Horlogerie?
The nature of man in itself is to push back boundaries. By taking this principle as one's starting point, we will see the impact that this will have on the Horlogerie sector with the passage of time. The possibility that Horlogerie will have the same fate as IT processors cannot be ruled out. To count ever faster! But this will surely entail a series of small revolutions.

There are everyday watches beating at 5, 8 or 10Hz and watches that are better classified as concept watches beating at 50, 500 or 1000Hz. What is the difference between a high frequency watch that will remain a prototype and one that will be mass produced?
It is very difficult to control high frequency. As previously mentioned, the main concern is related to wear. For this reason, the higher the frequency, the more difficult to produce in large quantities. The significant consumption caused by the increase in the frequency limits the use of the type of product on an extensive scale.

– UP –
Grégory Bruttin is happy with his creation, the Excalibur Quatuor

– RIGHT –
Roger Dubuis Excalibur Quatuor in rose gold

At Roger Dubuis you recently presented the Quatuor, which represents a true revolution in the sphere of high frequency watches. Would you like to explain your concept for us?
The way of creating the Quatuor was to work with a frequency we have already mastered (4Hz), which resolved the wear issue. We have coupled the oscillations with the aid of differentials, in order to obtain an average rate. For example, if we listen to the watch, we will count 16 oscillations per second, offering a unique reading of the time. The approach we adopted is that we wanted to compensate for all the errors generated by gravity. What does a tourbillon do in order to compensate the problems generated by gravity? A tourbillon will place the balance and the anchor in all possible positions, by making them rotate in the cage once per minute. What we basically did, was to place four balances in such a way as to allow them to adopt all possible positions too. We have therefore four balances that are placed at 90 degree angles from one another. This makes, four times 90 degrees, namely 360 degrees. You can admire this originality on the watch's front face.

And what results did you arrive at?
Today, our watches are controlled by the Geneva Seal organization (Poinçon de Genève). The Geneva Seal has developed a machine that takes a photo every 24h, and by comparison we will calculate the angle of variation of the seconds' hand, which will allow us to measure the precision of the watch, to an accuracy of one tenth of a second.

To date, there are around 10 timepieces that have been made, and we easily comply with the standards of the Geneva Seal, that is to say, 10 seconds in one day, or roughly 1 minute in one week.

What is the importance of the use of silicon in creating the Quatuor?
The aim of the Quatuor is not solely to increase the frequency, but equally to resolve the issues due to gravity. Silicon, being a material that is extremely light, and combining this case in silicon with the Quatuor movement, allowed us to attain a consistent concept between the movement and materials.

Maximilian Büsser stated in his interview that "…after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing… In Watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart…" What do you think about this?
And after that, Jean-Pierre Musy, Patek Philippe Technical Director, replied to this remark by Maximilian Büsser: "When we see high-quality watches, they have a chronometrical bulletin, COSC values, meaning −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amount to nearly one minute every minute! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?

I think that it is of a certain interest, since this error margin of approximately one tenth of a second per day, or one minute per week, is quite significant. If, therefore, we manage to diminish it, in a noteworthy manner, I think that it is something important. There has always been a race after accuracy, throughout the History of Watchmaking. That is why today we have witnessed the comeback of Chronometry competitions, since there is a desire to prolong what has been attained throughout the History of mechanical Watchmaking. I think that we will never arrive at a precision equal to that of quartz-powered watches, but conversely there is in any case an interest in improving watches' accuracy, and today we believe that there really is potential in this.

In our days, a mechanical watch is potentially a highly avant-garde object, since it does not run on fossil fuels. It therefore has an extremely long operating life. It may represent the energy of the future.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we have seen Horlogerie regularly beating high frequency records… What is your opinion on this?
Despite its reputation as being a slow and folkloric country, Switzerland has known how to set itself apart and distinguish itself for its technological strengths and innovations, particularly in the domains of cutting-edge machinery and in the Watchmaking Industry, in which boundaries are ceaselessly being pushed back. Everything is a question of equilibrium.

What is your personal relationship to speed?
I am a big fan of speed, but it must pose a certain interest, and it must be controlled. Those are very important parameters in relation to speed.

Do you think that a speed limit should be imposed on motorways and, if yes, that it should be set at how many km/h?
I am very Swiss. I follow the rules and conform. I think that speed limits are justified. There are experts who have made sound decisions. It is not acceptable to drive on the road in an excessive manner. There are racetracks for that. Everything has its proper place.

– UP –
Roger Dubuis
Excalibur Quatuor in silicon

– LEFT –
The RD101 calibre front face

– RIGHT –
The RD101 calibre rear face

JEAN-PIERRE GOLAY

THE QUICKEST TOURBILLON IN THE WORLD

Jean-Pierre Golay, who conceived the Franck Muller Thunderbolt, the quickest tourbillon in the world, talks to us about the unique tourbillon cage to complete one full rotation in 5 seconds.

CONSTANTIN STIKAS: ***What do we gain with high frequency?***
JEAN-PIERRE GOLAY: With high frequency, the gain is a better dynamic behaviour of the oscillator.

What is at risk with a high frequency watch?
That is an aesthetic question; the movement of the balance is no longer visible.

Man has conquered 4Hz, remained at 5Hz for more than four decades, and then TAG Heuer achieved 50Hz, two months later 500Hz and a year later 1000Hz !... Are there any limits to Horlogerie?
That is incorrect. At the beginning of the previous century, Heuer was producing the Micrograph, a chronograph offering a precision of 1/100th of a second, of which the balance oscillated at 50Hz. The limit of a conventional oscillator seems to be around 100Hz, but there are also non-conventional oscillators, even ancient ones (Hipp's Chronograph), at 1000Hz.

There are everyday watches beating at 5, 8 or 10Hz and watches that are better categorised as concept watches beating at 50, 500 or 1000Hz. What is the difference between a high frequency watch that will remain a prototype and a high frequency watch that will be mass produced?
Very high frequencies are not appropriate for the movements that show time. Their power reserve is too weak.

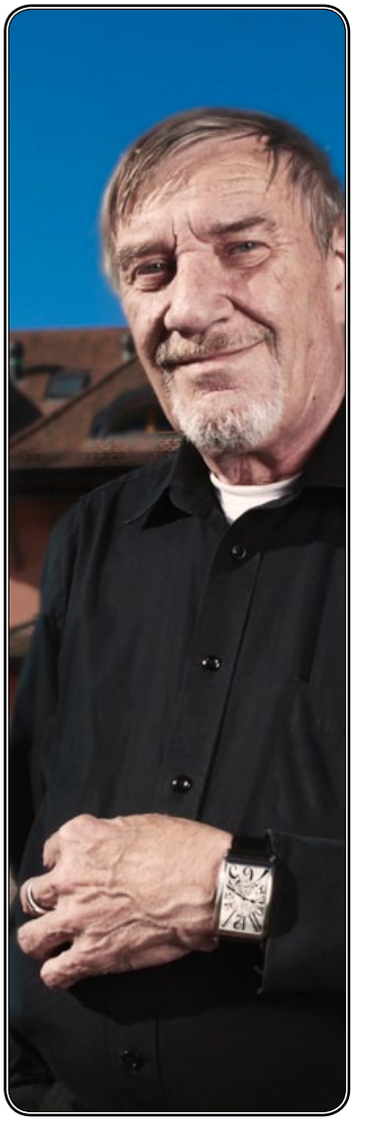
At Franck Muller you presented the Thunderbolt, the quickest tourbillon in the world. Could you explain the concept for us?
The concept underlying the Thunderbolt is to complete one quick rotation of the tourbillon cage without increasing the frequency of the balance, which remains at 3Hz.
In this manner, the dynamic compensation of operating errors, especially for a wristwatch, is much more efficient with this rapid rotation.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland, and today we have seen Horlogerie regularly beating the high frequency record... What is your opinion?
Switzerland has always been a pioneer in high frequencies, particularly in atomic watches, which are a point of reference, and which have served as the timekeeping basis in the Galileo satellites.
One must not confuse speed with rushing. The concept of the Thunderbolt was finalised after 3 years of reflection.

Do you believe that a speed limit should be imposed on motorways and, if yes, that it should be set at how many km/h?
The gearbox is one of the most accident-prone elements. It is therefore necessary to set a limit and to impose a realistic speed to everyone.

– LEFT –
Franck Muller Thunderbolt, the fastest tourbillon in the world

– DOWN –
Jean-Pierre Golay



PHILIPPE DUFOUR

THE CUSTODIAN OF THE SPIRIT OF THE VALLÉE DE JOUX

He is the custodian of the spirit of the 18th century, by remaining a true Haute Horlogerie Master in the 21st century. The watchmaker who astounded the world with his simplest watch, shares with us the tranquillity of his Valley, which he so loves...

CONSTANTIN STIKAS: ***What do we gain with high frequency?***
PHILIPPE DUFOUR:. I think that we gain in accuracy. In the '60s-'70s there was only Switzerland that was winning in chronometry competitions, and when the Japanese arrived on the scene with the 36,000VpH, they won first prize in the competition, and that was how the Swiss discontinued the competition, since Seiko was winning with its high frequency watches.

What is at risk with a high frequency watch?
I think that we risk at losing reliability in the long term. In the sense that they are movements that function faster, which produces more important couplings and more wear compared to an 18,000VpH movement. The more we increase the frequency, the more there is stronger pressure, producing premature wear. We can compare these watches to Formula 1 that necessitates more frequent follow-up by engineers, whereas a watch like the one I make at 18,000VpH with a good adjustment, it will work for 4, 5 even 6 years.

In the sphere of high frequency, there was a single protagonist since 1969, the El Primero, which operated at 5Hz. In recent years we have seen watches operating at 5, 8, 10, 16 and even at TAG Heuer at 50, 500 and 1000Hz! What do you think about this?
It's a trend. It's a fashion. It's a brand proposing a high frequency watch and everyone leaps into the breach. In order not to stay behind. It is primarily a marketing effect. However, I think that it is good for leading brands, which have the financial capacity to spend on R&D, work on this type of things. It is very good. I personally cannot allow it to myself. But fashion is like that, there was a whole tourbillon fashion, today it is less glamorous to launch a tourbillon, everyone has done it, the Chinese etc. and therefore the myth of the tourbillon has subsided somewhat, without having died out and that is where we create a new myth. That of high frequency.

Time in the Vallée de Joux goes by more slowly? In general, Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we have seen Watchmaking regularly beating high frequency records… What is your opinion on this?
We may be slow in expressing ourselves, but we are quick in our way of thinking and in our thoughts.

In a watchmaking world travelling at full speed, you are one of the rare watchmakers who produces very limited quantities. We would say workmanship with greater affinity to the 18th century. What do you think?
It's traditional Watchmaking. It is my way of expressing myself in

– A –
Philippe Dufour Simplicity

– B –
Philippe Dufour in his workshop

– C –
Philippe Dufour Grande Sonnerie

Watchmaking, by trying to perpetuate a beautiful and true Watchmaking.

You presented the Simplicity in 2000 and it took you 11 years to produce the 250 pieces of the limited edition. How much time do you need for presenting your next creation?
It took me an enormous amount of time to create the 250 Simplicity. I would never have thought that it would have taken me so long. That also stems from the fact that I did not manage to create the team that I would have wanted. It may be a disappointment. At the moment I am working on a Grande Sonnerie, which had been commissioned 4 years ago and then, alongside this, in the evenings I work on my new project, which I hope to present at the end of 2013 or the beginning of 2014.

What is your personal relationship to speed?
I like speed very much. I like downhill skiing. Then, I also like speed in a car to, if the roads are good. As for example at the Col du Marchairuz.

Do you believe that a speed limit should be imposed on motorways and, if yes, that it should be set at how many km/h?
I think that it is necessary, for security reasons. There could also be hours where fewer limits are imposed. For example at night, when there is little circulation, we could be allowed to drive a bit faster.

MAXIMILIAN BÜSSER

SPEED UNDER CONTROL

Maximilian Büsser, the exemplary Swiss Watchmaking Art creator, reveals for us the secrets of the magical Swiss recipe, or how to drive fast, but wisely...

CONSTANTIN STIKAS: ***We are undergoing significant changes in our societies. Do you think we should speed up or slow down?***

MAXIMILIAN BÜSSER: I believe that it is not up to us to define that. It is society that is accelerating, due to media acceleration and communication becoming faster and faster. I see how I work today compared to how I used to work ten or twenty years ago. A few years back we barely just had a fax and it was customary to receive a reply within a week. Today, if we don't receive a reply within half an hour we wonder what is going on...

I think that the world is accelerating, but it is not up to me to define in what direction it should be heading.

MB&F is one of the rare Houses that take their time when preparing a new watch. You have just presented your 5th Horological Machine, after 6 years of activity. Would you like to talk to us about it?

We take the maximum amount of time that we can. Creating a movement from scratch in 3 years (that is our average time for creating a new movement), is a quite good performance in comparison to the companies where I used to work before.

If we take the HM5, 'On the road again...' that we have just presented, it is a project that is –as usual– extremely personalised. A project that has been maturing in me for a very long time. I purchased my first vintage Amida 7 or 8 years ago and I told myself "I must create a tribute to this piece", which is wonderful and supermale, while it arrived at the worst moment in mechanical watchmaking history, in 1976, when no one wished to see a mechanical movement.

The project of realising the HM5 took a lot more time than we had anticipated, because at the outset –and since it is an optical system for indicating time and we are not specialists in the field– we had found a French company specialising in optics that led us in the wrong direction, by telling us that we need parabolic mirrors. Thus, we developed everything on the basis of parabolic mirrors, it took us a year and a half to find someone who would accept to manufacture microscopic parabolic mirrors for us –which what is more cost a fortune– and when we finally mounted the first prototype, it was absolutely impossible to read the time!... We threw it all in the trash and started again from scratch. Movement and case.

Maximilian Büsser playing with a Lamborghini Miura model car

Therefore, the HM5 is a project that necessitated 5 years of research and it is the slowest and the most complicated that we have implemented for MB&F.

However, you are among the fastest when it comes to communication. A few minutes after the presentation of each of your watches, we see it making headlines everywhere…
I don't know about that... I only know that we understood how to forge close ties with the media. And what is extraordinary is that we did not forge them through advertising, since we do not do advertising and thus our relationship is not tinged by fiscal concerns, but it is characterised by essential qualities: one is total transparency –we are completely transparent in everything we do, there is no 'bullshit' among us, we tell you who made each element, how he made it, what type of problems we had, how we arrived there etc.– and the other is that every year we release a piece that is always very polarising, very surprising, very different and that provokes a certain anticipation amidst media outlets and clients, "what surprise do they hold in store for us this year?' And this fits nicely, since I also ask myself what surprise am I holding in store for myself this year!...

Also on the same subject and concerning speed, we also treat everyone in the same manner. It's Swiss democracy!... There are no niceties, there are no VIPs. Everyone receives the same information at the same time. And therefore everyone is treated with the same respect. There is not someone receiving better treatment than another and that is also very important.

You have just been awarded a double prize for the LM1. After years of work, 5 minutes at the podium of the Prix de l'Horlogerie de Genève, how can they influence the history of an Haute Horlogerie House?
I did not know what to expect. And I had not expected this prize. Today we have a waiting list for the LM1, but I am very–very surprised by the amount of congratulatory messages from around the world, from retailers, end-clients, fans, media outlets, suppliers...

I had 5 beautiful minutes at the podium, but this was followed by some very beautiful days, where we realised that people loves us and take pleasure in being satisfied for us, and that is magnificent!...

You create watches that exhibit great technical interest. In the high frequency domain, since 1969 there was a single protagonist, the El Primero which beat at 5Hz. In recent years we have seen watches operating at 5, 8, 10 or even, at TAG Heuer, at 50, 500 and 1000Hz! Are there any limits on this quest for the unexpected?
I am the worst person to answer this question! I find high frequency to be an extremely interesting subject, but one that I take no interest in!... Let me explain myself: high frequency interest me, because I adore Watchmaking, but the reason for which Houses engage in this 'quest' after Hertz evades me somewhat.

Today we are all in agreement that after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing. Of course, there is an enormous number of other reasons – traditional, artistic or emotional reasons, reasons relating to good craftsmanship, but there are no practical reasons. In Watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart and this causes me to laugh somewhat!

At the end of the day, we make steam-powered engines. People don't buy our pieces because they run faster. They buy our pieces because they are works of Art.

From my point of view, high frequencies pose absolutely no interest. I have always stated, we make watches that tell the time, but not for telling the time!...

The El Primero is a movement that hundreds of thousands of people have been wearing on their wrist already for 44, while all the other high frequency watches and especially the TAG Heuer, champions in the field are what we would term "concept watches". Given that your watches are technical marvels, which are however produced in very limited quantities, what do you think about the difference between an everyday watch and a concept watch?
One evidently needs both, but I think it is important for a concept watch to be wearable, usable and reliable. The time when one purchased a Ferrari and kept it in the garage because if one drove it he stood a 50% chance of mechanical failure has gone by... That is no longer acceptable. Today, all the creators of prestigious high-end cars no longer have an excuse. They must make a race-car which is uncompromisingly difficult to drive, which is not all about comfort and is not 100% safe but, by contrast, it must be reliable. The images of the synthesis of products that would never work, that really does not interest me... And unfortunately that is also a great field of expertise in our profession.

During the presentation of the TAG Heuer Mikrotimer someone asked if the eye, the hand and the brain can follow such an unimaginable performance (1/1000th of a second). What do you think about this?
I look at the race for constantly improved technical performance from the road... In the same way that I watch cars passing by. I don't really have an opinion. The performance that interests me is Art performance and not technological performance.

Could high frequency also be an interesting subject for MB&F?
So, we have no interest in high frequency, since we create Art machines.

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we see Watchmaking regularly beating the high frequency record… What is your opinion?
It is Switzerland's slow speed that has saved the country. Switzerland, not having evolved as fast as the other countries, has not entered the same path as other countries and it is for this reason that today it is an island in the middle of Europe (which by the way is a topic of great interest), where there is still 3% unemployment, where salaries are very high etc.

It is because we have not become part of the American 'grid' system, nor in the European system of total assistance scheme towards workers. In Switzerland, one can dismiss someone as one wishes. There is no labour protection, but nevertheless there is respect for the employee. I have 14 people who work for me, they are all extraordinary people and it is my responsibility as their employer to make them happy. It would be a catastrophe if they were to leave.

Switzerland has been built on quality. Everyone makes a huge fuss when companies relocate to China, but Switzerland underwent this one hundred years ago. Because, for Switzerland, China was Italy, France, Spain, where industrial costs were much lower than here. And suddenly, in the beginning of the previous century we lost all the production and we adapted ourselves by providing superior quality and by proclaiming "it is better quality, so you will pay more for it."

Switzerland specialised in engineering, pharmaceutics, geochemistry, in everything where we could be the best. We knew that if we were to talk in terms of volumes, we didn't stand a chance. Therefore, Switzerland has been built on quality and also on confidence. We were until not long ago trustworthy and respectable people and that is why the 'Made in Switzerland' label stood for high quality.

Speed is derived from the fact that, being a slow country, we are a country that perennially exists and that remains strong.

What is your personal relationship to speed?
Personally, I am someone who moves very very fast and who is also very impatient. Patience was never one of my good qualities. There is an old Pirelli advert that encapsulates it all: "Power without control, is nothing." I will paraphrase this: "Speed without control, is nothing." Because if you drive fast but are not in control of the car, you veer off course. After 21 years of professional experience, I have learnt that you can drive fast, but that you must be in control of your car when you drives fast. In my personal life I drive in race tracks for some years now, and it is a great lesson in humility. Because at first I would step down on the gas and I would veer off course. It was an important lesson: in order to start driving fast, one must first learn how to be in control of his car.

Do you think that a speed limit should be imposed on motorways and, if so, at what km/h should it be set?
Honestly, if you would have asked me the same thing 15 or 20 years ago, I would have said absolutely not, look at Germany, everything works fine without speed limits, but today I would reply that yes, one must impose limits, because there is a generalised lack of responsibility among users and if we don't impose limits on them –like on children– this becomes very dangerous. Conversely, it is true that I would prefer a slightly higher speed limit than the one we have today...

I remember that when I was a child, my father who loved Lancia cars used to drive at 170km/h. But today, when I think that those cars didn't have proper brakes, not even seat belts etc, if the least thing were to happen we would have all been dead...

Cars today are ultra-safe and, moreover, speed limits mean that we have fewer injuries and casualties than before.

JEAN-PIERRE MUSY

IN SEARCH OF ACCURATE TIME

Soon he will be completing 35 years at Patek Philippe, Jean-Pierre Musy was initially hired at Patek to conceive the celebrated Calibre 89, continuing with Star Caliber, Sky Moon Tourbillon etc., but today he is mostly proud of his little 'baby', the Annual Calendar, which became a trend in various brands. For the last 10 years he has been working on improving the precision of Patek watches.

CONSTANTIN STIKAS: ***In the sphere of high frequency, there was a single protagonist since 1969, the El Primero, which operated at 5Hz. In recent years we have seen watches operating at 5, 8, 10 and even at TAG Heuer at 50, 500 and 1000Hz! Are there any limits in this quest for the unexpected?***

JEAN-PIERRE MUSY: It is an interesting subject indeed. I worked on Grandes Complications at Patek from 1980 to 2001 and then, in 2002, I changed field and I have been working for 10 years on improving base calibres with the aid of new technologies. We thought from the outset that there were improvements to be made on oscillators and it was for this reason that we began our research on silicon. We made a new spring, a new escapement and a new balance, therefore a complete oscillator using this material and we named it Oscillomax.

With the Oscillomax we have attained an extraordinary degree of precision. I believe that we are going to leave our mark on an entire era, because we have made considerable progress in the precision of watches thanks to silicon.

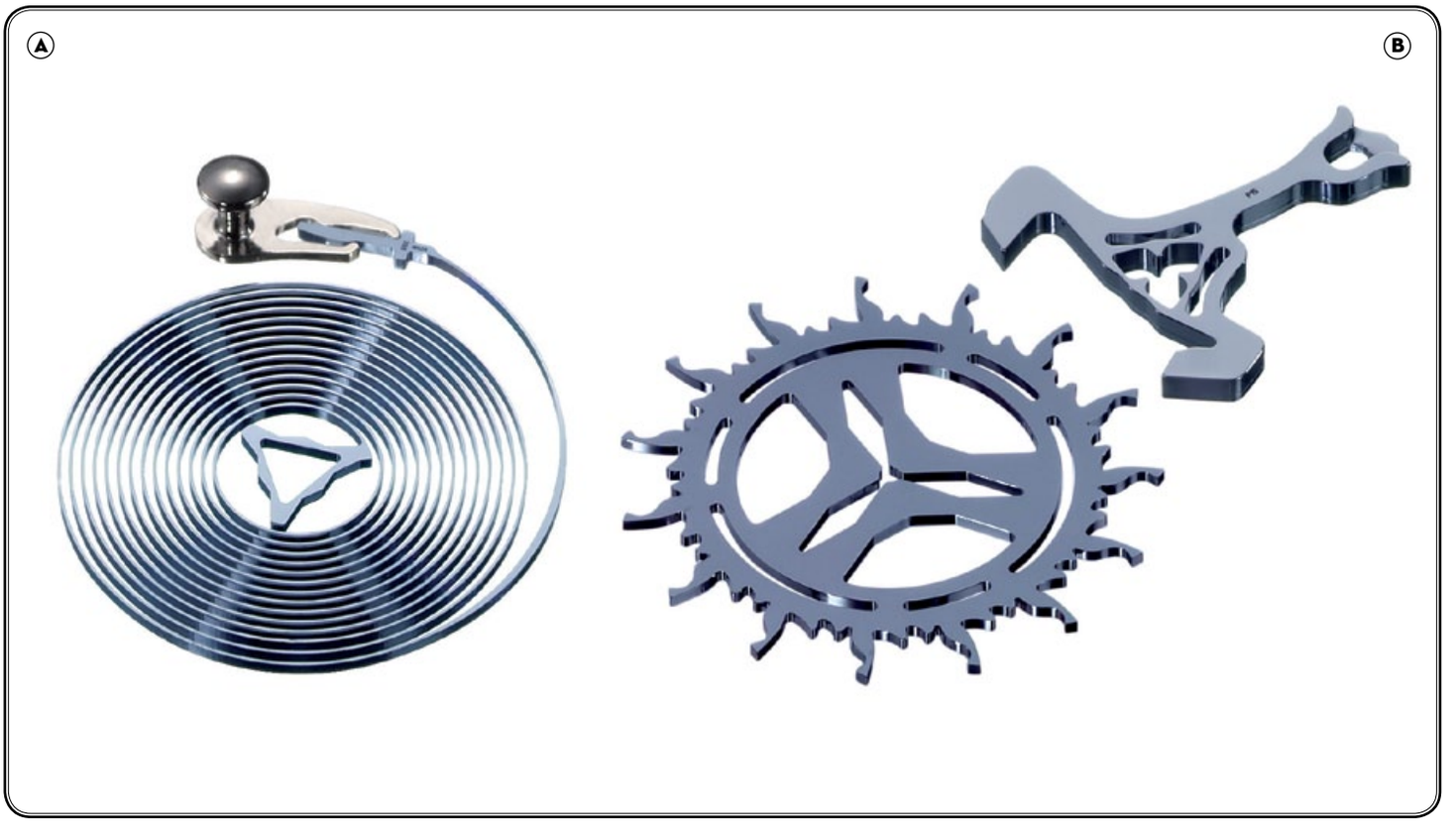
This in any case also changes the image of the tourbillon…

I would say that it renders the tourbillon obsolete!... Because the tourbillon corrects an error by means of another error, that's all. But by contrast it does not correct the intrinsic precision of the oscillator. Therefore, I would say that we no longer have any need for the tourbillon!... So we no longer work on tourbillons at Patek! In any case, historically we have not made many tourbillons, because they consume energy derived from the balance for making the cage turn. Huygens worked on the pendulums with an immense amount of inertia. And the tourbillon consumes this inertia in order to compensate the errors. In my opinion, it is not a good solution.

Therefore, to revert to your question. I think that when you talk about a frequency that gives you the possibility to show the 1/5th or the 1/2,000th of the second, one must first have attained this level of precision. If precision has not attained this level, the indications remain indications, but without any equivalent level of precision. Zenith has been active in the domain of 5Hz for more than 40 years. In the beginning there were problems from wear on the gear-wheels, but they later managed to resolve those. Today we are able to calculate the amount of wear. I believe that in the future we will see the advent of more watches operating at 5Hz. One must not forget that we have already undergone the 4Hz revolution, which was an important step compared to the 3 or 2.5Hz that we previously had. The other pieces are basically prototypes for experimenting in this field, but I believe that for the time being we will never carry out the production of models beating at such high frequencies.

Maximilian Büsser stated in his interview that "…after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing… In Watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart…" What do you think about this?

I do not agree at all. When we are on the subject of high-quality watches, which have a chronometrical bulletin, the COSC values are from −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, more than one minute per week! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that display an error of one minute



or even more within a week! The mechanical watch must be more accurate than that! In any case, it is in this field that Patek Philippe has worked and continues to direct its activity.

And what is the role of high frequency in the quest for the improvement of the precision of a mechanical watch?
When we increase the frequency, we improve precision anyway. In mathematical equations, we can easily ascertain that frequency influences the definition of a watch's precision to the power of three. Therefore, we can tamper with frequency more easily than with other parameters. Frequency remains the most interesting parameter.

Today, what level of precision has Patek Philippe attained through the use of new technologies?
Today, Patek delivers watches with average times spanning from −3 to +2, meaning a 5 second deviation and we wish to improve on this. We manage this using simulators, which reproduce the movements of a person, in order to test all positions. It is half the COSC limits and I believe that by increasing frequency, we can improve on this even more. Moreover, we conduct the tests with encased movements. The COSC tests movements without the case, whereas once a movement has been lodged in its case its degree of precision drops even more.

Is it for this reason that you have made your own hallmark?
Exactly. That is effectively the reason for which we made our own hallmark. And that is also what I have been working on, on oscillators, in order to improve their precision, but also so that Patek masters all its components and gathers all information in-house, no longer purchasing components from outside, also as regards cutting-edge technologies. We also need our independence...

– A –
The Patek Philippe Spiromax balance spring

– B –
The Patek Philippe Pulsomax escapement

– C –
Jean-Pierre Musy

JEAN-FRANÇOIS RUCHONNET

FASTER THAN ME YOU DIE

The 'enfant terrible' of Swiss Haute Horlogerie is a speed specialist – and this is not confined to watchmaking!... Frequently far ahead of everyone else, he has known how to 'conduct' a spectacular career, by opening up the doors of Information Technology, 3D design and video to watchmaking. If he has dared to create the V4, the Double Tourbillon Breguet and the Cabestan, why should he 'mince his words' when faced with such a riveting topic?

CONSTANTIN STIKAS: ***In the sphere of high frequencies, there was only a single protagonist since 1969, beating at 5Hz, the El Primero. In recent years we have seen watches beating at 5, 8, 10 even at 50, 500 and 1000Hz! So how can we define high frequency in relation to watchmaking mechanics today?***

JEAN-FRANÇOIS RUCHONNET: In any case, the highest frequency is quartz. And then, in the '80s, there was also a Bulova piece, the Accutron. This was a watch with an enormous battery, which had a 'diapason', similar to the one used in music, which replaced the quartz. On these two types of movement there was of course a battery. In my opinion, TAG Heuer is truly the pioneer in this field today.

What do we gain with high frequency?
We gain in accuracy, that is clear.

What is at risk with a high frequency watch?
JFR. Probably the power reserve. This is normal and it happens across all domains: When we want a car to be able to reach higher speeds, one needs horse power. And when we say horse power, we mean energy. There is nothing without nothing. But what is more important for me, is that we also lose in emotion. With a high frequency movement we enter into the irrational, since the escapement becomes barely visible. We could say that there is no longer anything that moves. It becomes less evolutionary, less beautiful. It is no longer a movement, it is a vibration.
We lose emotion by looking for what exactly? With the Cabestan we have arrived at a 5 second divergence per month. And if we remain at a divergence of one minute per week, who cares, everyone today has a mobile phone. So, I find that high frequencies divest a watch of emotion. In watches beating at a conventional frequency there is the tick-tack, there is something going on.

Man has conquered 4Hz, remained at 5Hz for more than four decades, and then TAG Heuer achieved 50Hz, two months later 500Hz and a year later 1000Hz !... Are there any limits to Horlogerie?
Are there any limits to marketing? Sometimes I ask myself: "What else?"

Why do we see a large number of Houses today presenting watches with high frequency movements?
It's just pure and simple marketing. Nothing but that.

The El Primero is a movement that hundeds of thousands of people have been wearing on their wrist for 44 years already, while all the other high frequency watches and especially the TAG Heuer pieces, champions in the field, are what we would term 'concept watches'. What do you think about the difference between an everyday watch and a concept watch?
I am the one who conceived the TAG Heuer V4, so I can't say that I don't like concept watches. Thanks to the V4, TAG Heuer embarked on this beautiful adventure. And there is a tendency today to forget that the V4 was also the creation of a man who represents traditional Swiss Horlogerie, Mr. Philippe Dufour and when you fuse the traditional with the modern, you achieve nice results.

– A –
Jean-François Ruchonnet in front of his Ferrari 599XX

– B –
The new creation of J-F Ruchonnet, CXL

Notwithstanding, concept watches had to evolve. There were Richard Mille, TAG Heuer, MB&F or even HYT, a project in which I also worked.

Every time, they would tell us "This will never work!" I heard the sane thing about the Hydrotimer, about the Cabestan ("a vertical tourbillon, that will never work"), whereas it suffices to seek to innovate, and every time this works and even does so very well.

So I only think favourably of concept watches. Like I can only think favourably of the El Primero, because it is a movement that is magnificent and that has proven itself.

During the presentation of the TAG Heuer Mikrotimer Flying 1000 someone asked of the TAG Heuer President if the eye, the hand and the brain can grasp the thousandth of a second. What do you think about this?
I think that it is just marketing. It has no use. We don'r give a damn about the thousandth of a second. If watchmakers could arrive on time and within the established time limit, and if they could deliver their watches within schedule, that in itself would not be bad. And I am the first in this. I found it difficult to deliver my Cabestan within the time limit.

I have never seen people working in the time industry being on time. They are never on time to appointments, always in love and never on time. Be on time, deliver your pieces on time, make them in good quality, and stop pestering us with thousandths of a second.

Maximilian Büsser said in his interview that, "after the '70s and the invention of quartz, the mechanical movement has no practical reason for existing... In Watchmaking, we can state that it is the equivalent of relying on steam power in the era of the TGV. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered machine that is 5 or 10% faster than that of its counterpart..."
And after that, Jean-Pierre Musy, Patek Philippe Technical Director, replied to this remark by Maximilian Büsser: "When we see high-quality watches, they have a chronometric bulletin, COSC values, meaning −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amount to nearly one minute every minute! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?

That s a real question!... I think that 300 components housed in a 38mm case, machine manufactured and assembled by hand, we cannot demand to have absolute accuracy. It is not a GPS, it is a mechanical watch. I repeat that the time is everywhere, on a mobile phone etc, and possessing a mechanical watch assembled by true watchmakers falls more within the sphere of Art, even if it has been produced on a large scale.

If it is accuracy you seek, buy a quartz. From the moment we buy a mechanical watch, there are divergences, there are ups and downs. With a mechanical watch, the adjustment time for arriving at a good level of accuracy is enormous. We at Cabestan, at the time dedicated an entire week to adjusting a single watch. Can they do that at Patek Philippe?

Switzerland, to most people, is a 'slow' country. However, the CERN is located in Switzerland and today we have seen Horlogerie regularly beating high frequency records… What is your opinion on this?
Switzerland is a country of tradition, where people take the least amount of risks possible. Thus, it is not slowness, it is intelligence. Consider the example: during the '80s, when quartz ruled the watchmaking world, in France they 'threw everything overboard'. In Switzerland, by contrast, they preserved everything. The Swiss preserve their heritage and are marked by national sentiment. Had we all been like then, we would have preserved our heritage and we wouldn't have handed everything over to the Chinese.

Swiss Watchmaking is strong because of its people and its heritage, of which it has known how to maintain, bring out and perpetuate the values.

What is your personal relationship to speed?
I was never a wise child when it comes to speed: 348km/h in a car, 500km/h in an airplane and 100km/h in a boat. I did circuit racing for 2 years and there is no showing off. It is a different relationship to speed. Either you're good, or you're 'out'!...

Do you think that a speed limit should be imposed on motorways and, if yes, at how many km/h should it be set?
In Germany, there is no speed limit on certain sections of motorways and there are two times fewer accidents than there are in France. Thus, I think that speed is conducive to concentration. I think that all parameters are improved, tyres, brakes, etc. and all this story about speed limits is based on false premises. On country roads, that are sometimes very dangerous, there it is true that speed limits must be imposed. But the place where there are fewer accidents is on motorways. The only problems on motorways are falling asleep at the wheel and alcohol. Today, cars are a thousand times safer than in the past and there is a direct reflection of this on accidents. We have 4 times more cars than in the '70s and the number of deaths has fallen from 30,000 to less than 4,000 per year in France.

Ⓐ

Ⓑ

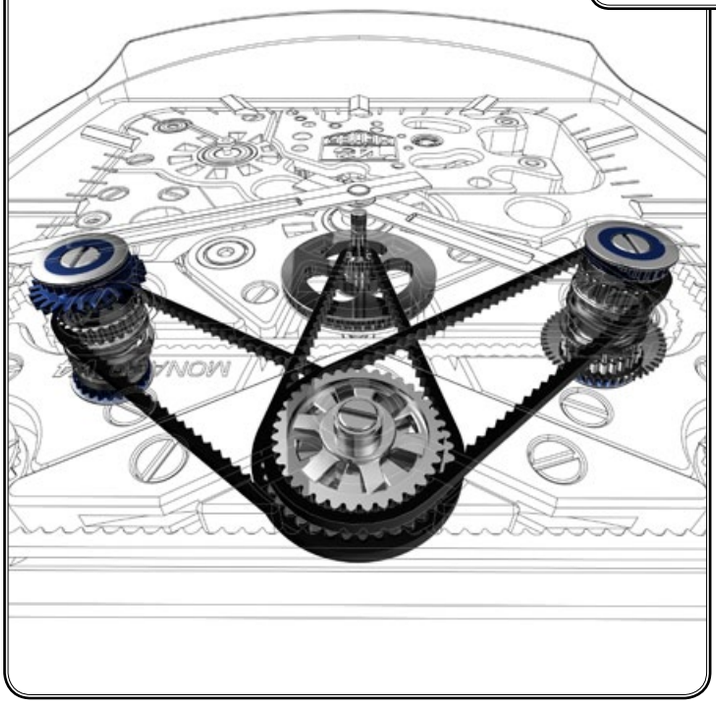
– A –
Breguet Double Tourbillon

– B –
Cabestan Winch
Tourbillon Vertical

– C –
A part of the revolutionary movement of the V4

– D –
The first image of TAG Heuer Monaco V4 in 2004

Ⓒ



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JEAN-MARIE SCHALLER

MEMORIES OF THE FUTURE

We frequently say that everything in watchmaking was invented in the 18th century and Jean-Marie Schaller arrived to prove this to us, on the first day of spring of 2013. The '1/60th Timer' is a spectacular chronograph, beating at 30Hz and which already dates back 197 years, which has come to once and for all change the History of Haute Horlogerie!...

CONSTANTIN STIKAS: ***Man has conquered 4Hz, he remained at 5Hz for more than four decades, and then we have seen watches beating at 50Hz, 500Hz or even 1000Hz in the years 2011-2012!... On 21 March 2013 you presented a timer beating at 30Hz and belonging to the very distant and at the same time very glorious past, namely the 18th century. Would you like to recount this so riveting story for us?***

JEAN-MARIE SCHALLER: For me, the story began at the dawn of the 00s. I decided to launch a Louis Moinet revival. This watchmaker, who was very famous during his lifetime (1768 – 1853) had since fallen into obscurity. When I began my project, the only extant references were a biographical notice of about fifteen pages. Ever since, my journalistic quest has been to reconstitute the totality of his work, conceiving of timepieces that he himself may have created, had he been alive today. At the historical level, we have uncovered exceptional pieces, manufactured for prominent personalities of his time: Napoleon, Thomas Jefferson or the King of England, for example. We have been able to acquire certain of these, the most famous of which is the one created for Marshal Murat, King of Naples. Whilst reading through his Treatise (1848), I understood the technological importance of this timer, which he baptised 'Compteur de Tierces', since the word chronograph did not exist. We had sought for this piece over many years. Finally, we were able to acquire it during a Christie's auction, held on May 20th 2012 in Geneva. Up until then, it had formed part of a private collection belonging to a princely European family.

What historical proof is there attesting that Louis Moinet was the first one to realise the high frequency movement in watchmaking, in 1816?
The 4 hallmarks on the back of the case, which have been analysed by the biggest horological experts and historians of the International Horlogerie Museum. This did not come as a surprise to me, because I had acquired Louis Moinet's private correspondence, in which he stated on more than one occasion that he had started making this piece in 1815 and completed it in 1816.

How does the 'Compteur de Tierces' ensure the return-to-zero of the chronograph?
The general principle underlying the return-to-zero of the 'Compteur de Tierces' chronograph is similar to the resetting mechanism of a contemporary chrongraph. However, the return-to-zero does not take place via the intermediary of a column wheel system, but through a system of a double-effect navette acting directly on: 1) the balance, then 2) the escapement wheel, which bears the zero-setting index of the '1/60th Timer'.

What is the chronograph's autonomy?
More than 30 hours.

What are the distinctive characteristics of the chronograph?
Redescovering this chronograph is akin to discovering the Leonardo da Vinci of watchmaking. Louis Moinet was 100 years ahead of his time in the domain of high frequency (216,000 VpH); 46 years ahead in return-to-zero technology (patented by Adolphe Nicole in 1862) and he simply created the most accurate object of his time (measuring the 1/60th of a second, whereas at the time they had only been able to measure up to 1/5th, eventually up to 1/10th of a second in 1820).

Do you intend to present timepieces inspired by the '1/60th Timer' in your current collection of Louis Moinet House?
Yes, we have some ideas for creating an exceptional chronograph.

What is your personal relationship to speed?
I adore driving my car...

Do you think that a speed limit should be imposed on motorways and, if yes, at how many km/h should it be set?
That depends on the quality of the motorway. I think that 130km/h would be good.

– A –
Louis Moinet 1/60th Timer

– B –
Jean-Marie Schaller

– C –
Louis Moinet

PHILIP PONIZ

HIGH FREQUENCIES IN DEPTH

Philip Poniz, horological historian, Expert-in-Chief at WatchInvest, Inc., where he advises high-end watch collectors and investors, Head Expert at Antiquorum during its glory years, Court Expert and Master Restorer reveals for us all the little and big secrets of high frequencies in watchmaking.

CONSTANTIN STIKAS : ***What do we gain with a high frequency watch?***
PHILIP PONIZ : Reliability of the performance in a sports environment and the ability to read smaller time intervals.

What is at risk with a high frequency watch?
Accuracy in the long run. The higher the frequency, the shorter is the free travel of the balance. As a consequence, the watch will run on not a very detached escapement, affecting its rate.

4Hz were considered a high frequency at what point in time?
In the 18th century, even 2.5Hz was considered a high frequency. It was John Harrison who, in his famous H4 tested in 1761, used high frequency which then was a balance of 2.5 Hz, and also recommended 3Hz for smaller watches.

In the high frequency sector, there was but a single protagonist since 1969, namely the El Primero, which operated at 5Hz. In recent years, we have seen watches operating at 5, 8, 10 or even, at TAG Heuer, at 50, 500 and 1000Hz! Why allow so much time to pass and create high frequency timepieces only very recently?
This is not quite accurate. The first 5Hz watch had already been created in the 18th century, not long after Harrison's H4. It was one of the earliest lever watches and was produced by Josiah Emery circa 1770. Clearly, the subject of high frequency watches was evident as early as the 18th century. In the beginning of the 19th century, Edward Massey made a 6Hz timer. 8Hz was patented by William Williams on March 26, 1890, years before Zenith.

The Continental counterparts did not lag far behind. In 1848 Louis Moinet published his Treatise, in which he stated that "a few years ago" he had produced a timer running on a 30Hz balance. It has been assumed that by "a few years" Moinet could not mean more than eight years. Consequently, everyone assumed that the manufacturing date was not earlier than 1840. The instrument was discovered recently and to the astonishment of everyone it appears that the hallmarks indicate the date to be before 1816. The end of the 1800's saw 50Hz timers developed by Nicole Nielsen, or rather, improved from their previous 10Hz ones. The early 20th century Swiss makers of high frequency watches, such as Ed. Heuer, had a well paved road leading to the introduction of the Micrograph.

I do not want to get into details about why brands are interested in high frequency today. There are two parts to this question. Firstly, technical difficulties (which I will explain later in the interview) and, secondly, the realities of today's market.

What else do you think of the Louis Moinet timer?
I would like to be able to examine the case and the return-to-zero mechanism closely.

The El Primero is a movement that hundreds of thousands of people have been wearing on their wrist already for 44 years, while all the other high frequency watches, and especially the TAG Heuer, are champions in the field and are what we would term 'concept watches'. What do you think about the difference between an everyday watch and a concept watch?

Ordinary mechanical watches are becoming a thing of the past. Those who want just a timekeeper on their wrist buy quartz. Today, a mechanical watch must be a 'concept watch', must show an innovation, mystery, beauty, or another remarkable achievement; otherwise the mechanical watch industry will cease to exist.

– A –
Philip Poniz with the only known Breguet tourbillon with constant force escapement

– B –
John Harrison's famous H4

– C –
Emery, the first 5Hz watch and his ten times per second beating escapement

– D –
The first 6Hz watch by Edward Massey, 1813 (British Museum)

– E –
First 50Hz timer by Nicole Nielsen, 1899, retailed by Frodsham

During the presentation of the TAG Heuer Mikrotimer, someone asked if the eye, the hand and the brain are capable of keeping up with such an astounding performance (1/1000th of the second). What are your thoughts on this? Are there any limits to innovation?
Yes, certainly there are limits. Let's analyze the anatomy of a simple chronograph, the time wasted while timing an event using a mechanical chronograph:

1. The human delay from the moment of making the decision to activate the chronograph, to the moment this instruction reaches the finger ordering it to push the pushbutton.
2. The delay between disengaging the hammer and engaging the clutch wheel.
3. The delay caused by the imperfections in the chronograph wheels, i.e. when the clutch wheel is engaged it does not apply torque to the chronograph wheel instantaneously. First it must get rid of the idle space between its teeth and the chronograph wheel teeth.
4. The human delay, as in (1) during the stopping.
5. The inertia of the chronograph wheel at the moment of disengaging the clutch. When the clutch is disengaged the chronograph wheel still turns by its inertia. The wheel has a friction spring which slows the inertia but it does still exist.
6. The delay between disengaging the clutch and engaging the stop (brake) lever.
7. The bouncing effect of the stop lever. If you film the chronograph action with a high speed camera, you will see that when the stop lever is released it hits the chronograph wheel and bounces back, much like a steel rod hitting on another metal. The tension spring dampens the bouncing but it exists. During the bouncing the chronograph wheel is not stationary. There is a similar phenomenon in the lever escapement when the escape tooth hits the pallet, but the effects are not important because they do not affect the balance, which swings freely during the bouncing.

And what is the role of high frequencies in the quest for the improvement of the precision of a mechanical watch?
The quest stopped at 5Hz in terms of improving the long-term precision of a watch. As of now, it improves the precision of the measurements of small time intervals.

Roger Dubuis presented the Excalibur Quatuor model beating at 16Hz (4 balances of 4Hz each). What do you think about this?
I have the Quatuor predecessor – a four pendulum clock with a differential mechanism, like the Quatuor but made in 1887. It was made by Tiffany's in accordance with Conant's 1887 patent. It is considered the most important regulator ever built on American soil. I would enjoy wearing a differential four-balance wristwatch and to be able to check it against its older brother – the most sophisticated and remarkably accurate four-pendulum differential clock built 126 years ago.

Maximilian Büsser stated in his interview that "…after the '70s and the invention of quartz, the mechanical movement has ceased to have any reason for existing… In Watchmaking, we can state that in the era of the TGV we are making steam engines. Therefore, when we move from 5 to 6, 8 or 10 Hz, (and I am not talking about 500 or 1000Hz), it is the same as if we were straining to make a steam-powered engine that is 5 or 10% faster than its counterpart…" What do you think about this?
And after that, Jean-Pierre Musy, Patek Philippe Technical Director, replied to this remark by Maximilian Büsser: "When we see high-quality watches, they have a chronometric bulletin, COSC values, meaning −6 to +4. There is a daily deviation of 10 seconds! In any case, it is significant, 10 seconds per day, this amounts to nearly one minute every minute! Do you believe that there is nothing to be done? I believe that there is something to be done! There is work to be done in order to improve this situation. We cannot allow ourselves to make watches that have upwards of a one minute error margin within the space of a week! The mechanical watch must be more accurate than that!" What is your opinion about this?

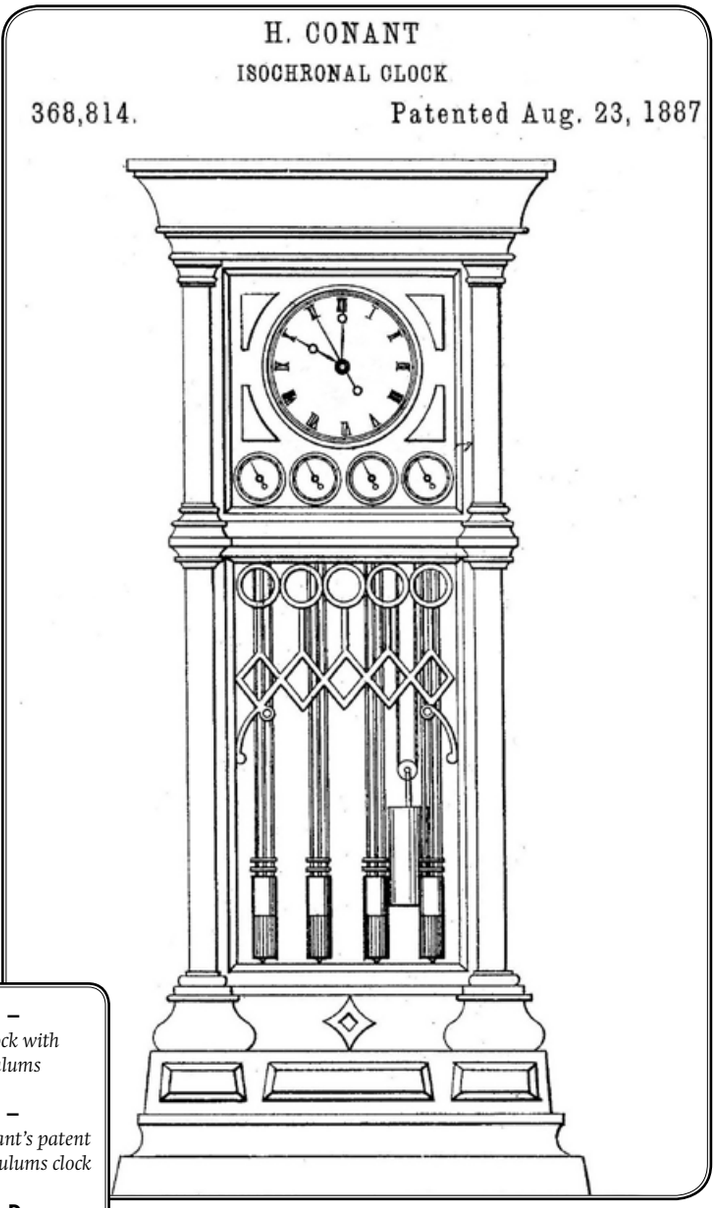
This is a question similar to "Since helicopters are capable of reaching Mt. Everest, do you think there then will be no interest in climbing it?" Of course, there is continued interest. The same principle applies to watches. Mechanical watches have soul; quartz watches do not. This has been true since the time of the Renaissance.

Actually, here history repeats itself: during the Renaissance the mechanical clock or watch was an object of fascination, an object upon which a hand was placed in official portraits, the pride of towns and wealthy owners. None of this was because of its timekeeping ability. A sundial was more reliable. In fact, it was a sundial that a mechanical clock was set by. Yet, our ancestors valued the less accurate mechanical timepiece much more. As we do today.
Regarding the second part of the question, a mechanical watch can be made much better than having a 10 sec. daily variation. In fact, many are. But many are not. It is a matter of economiIt is a matter of how much hand-finish of the final adjustment, after automatic production and/or automatic assembly, the company is willing, or able, to do.

To most people, Switzerland is a 'slow' country. However, the CERN is located in Switzerland and today we see the Horlogerie sector breaking the high frequency record at regular intervals. What is your opinion on this?
The Swiss have changed. Last year they ranked as the most adaptable country among all industrial ones.

What is your personal relationship to speed?
I love skiing fast. But even more so, I want to have full control of how and where I am going.

Do you think that a speed limit should be imposed on motorways and, if so, at how many km/h should it be set?
Today, living in the United States, driving through Utah or Nevada's desert on a straight highway with visibility for kilometres, and no other car on the horizon – having a speed limit is crazy.
I would like to be able to drive as fast as I want on highways not only in Nevada, but I know too many people who, if allowed to do so, would crash, possibly into my car.



– A –
Tiffany clock with 4 pendulums

– B –
The 1887 Conant's patent for the 4 pendulums clock

– C + D –
The differential of the Tiffany clock with 4 pendulums