Strictly

When Patek Philippe announced it was going to hold a press conference in Neuchâtel the week after Baselworld, it was immediately clear that something serious was up. Patek Philippe is Genevois through and through (the La Chaux-de-Fonds workshop is barely acknowledged) and the week after Baselworld would hardly seem to be the best time to catch the watch industry's attention. **James Gurney**

The official invitation that followed made things clearer, the conference was to be co-hosted by the Ecole Polytechnique Fédérale de Lausanne (EPFL) at Neuchâtel's Centre Suisse d'Electronique et de Microtechnique (CSEM) and was to include a presentation on Patek's use of silicon-based technologies. In the decade past Patek Philippe had been part of a cross-industry group looking at the sorts of silicon technologies as pioneered by the likes of Ulysse Nardin and Mimotec and had even gone as far as introducing silicon components such as a hairspring and an escape wheel.

This had all been quite low profile, toe in the water in style, to the point that even in the last six months Patek representatives were insisting that traditional alloys such as Nivarox still had a strong future. The assumption made by those summoned to Neuchâtel was that Patek Philippe was going to announce a future pathway to research in the subject with possibly some refinements of the silicon components already revealed.

Tales of the unexpected

That Patek Philippe was introducing a complete silicon escapement system went far beyond expectations. This is, make no mistake, a radical development, but Patek doesn't do radical, does it? Patek Philippe's 'Generations' campaign worked. You might not like every – or even any – of the various iterations, but there's no doubt that the fundamental message works.

Patek is all about the preservation of tradition, craftsmanship and even family values – that Patek Philippe is a family-owned company is explicit from its complementary 'Institutional' campaign. Put together, the message is that of a determined conservatism, a stance that their watch collections bear out. Patek Philippe watches approach the contemporary, but never the cutting edge and if that excites journalists and editors less than it might, this approach goes down a storm with Patek collectors – almost always collectors rather than owners, as to buy one Patek is merely an essential step towards buying a second and third. Arguably, such devotion to tradition does not exclude innovation, but merely acts as a filter by which to judge new ideas.

All the same caution is necessarily the watchword when managing the expectations of such a loyal, and frankly well heeled, clientele. Patek Philippe does, however, have a past rich in overtly radical moments such as introducing ground-breaking technologies – those fabulous Electronic Master Clock Systems with their ultra-modern component racks – and designs – the 1968 Ellipse and the 1976 Nautilus, both of which were considered to be dangerously avant-garde.

Silicon

Above. The ultra-thin, self-winding calibre 240 with perpetual calendar has been chosen as the showcase for the Oscillomax® ensemble, incorporating the patented Patek Philippe Spiromax® balance spring, the patented Pulsomax® escapement, and the patented GyromaxSi® balance. In fact, Patek Philippe has applied for a total of 17 patents in conjunction with the Oscillomax® subassembly as a whole and also for its individual components. The new Oscillomax® configuration boosts the power reserve from 48 to 70 hours.

Strictly

The carefully managed current perceptions of the brand, however, may well discount such antics as interesting history. And the just-announced Oscillomax technology is easily as radical as the Nautilus or the 33 quartz project – particularly given the side announcement, of which, more later. With all the anticipation, it needed to be good!

Total reform

Oscillomax is a complete, silicon escapement system comprising balance wheel, spring, anchor and escape wheel, all produced using nano-scale technology. As mentioned above, Patek has nearly a decade's experience with silicon components and Oscillomax shows just how far the concept has been taken. But, before moving on to outline these developments, it is worth putting this new technology in perspective.

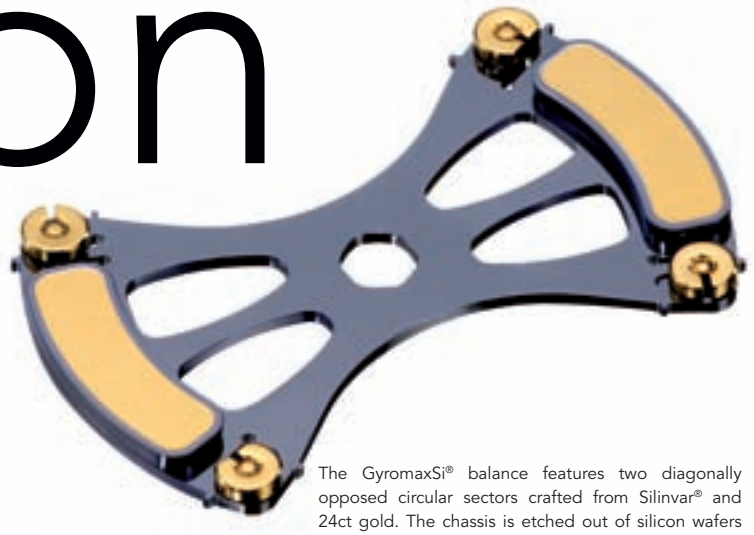
A limited-edition timepiece has been dedicated to each Patek Philippe Advanced Research innovation to date. The new GyromaxSi® balance is housed in the Advanced Research ref. 5550P, where the new components will be tested and prepared for implementation in the Patek Philippe collection.

Silicon

Since the idea of a balance spring was conceived by Hooke and Huygens in the 17th century, the principle developments have been the introduction of alloys with better isothermic properties, improved geometry for the spring (the Breguet overcoil), the escapement (such as the Daniels Co-axial) and for the balance (through adjustable weights such as Patek's own Gyromax). Despite these improvements, watch escapements are prone to lose precision through exposure to magnetic fields, extremes of temperature, shocks and degradation of the lubricants over time. Silicon promises a cure for all these evils and more.

QP has run several articles on the various techniques such as LIGA for micro-forming components in silicon and similar materials. The technique Patek Philippe relies on is known as DRIE (Deep Reactive Ion Etching) and has the advantage of producing components of the best precision across three dimensions. Although silicon comes with excellent properties in terms of stability across a wider range of environmental conditions than conventional materials, it is the precision offered by processes such as DRIE that makes silicon worth pursuing as it allows movement designers to precisely control the components behaviour under different stresses. It is the development and use of this property that both makes Oscillomax so newsworthy and accounts for the long period of reticence from Patek's Advanced Research team.

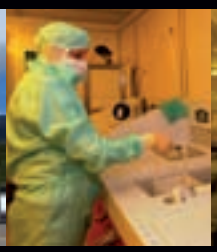
The Spiromax balance spring has been around since 2006 but is a good example of the value silicon brings to these components. It is a flat spiral with a geometry designed to improve isochronism, it is amagnetic and temperature compensated. The stud and self-centring collet are also integrated, formed in the same process, so avoiding a source of error.



The GyromaxSi® balance features two diagonally opposed circular sectors crafted from Silinvar® and 24ct gold. The chassis is etched out of silicon wafers using the DRIE process and converted into a Silinvar® component by way of oxidation. The centrifugal masses are gold inlays integrated into the chassis with a technique patented by Patek Philippe. Additionally, the GyromaxSi® balance features four small slotted poising weights that can be precision-adjusted.

Thanks to the superior material properties of Silinvar® – which allows the balance spring to be three times flatter than a Breguet spring – the terminal curve and the integrated collet and stud attachment, the Spiromax® balance spring makes a decisive contribution to the isochronism of the movement. It is antimagnetic, corrosion-resistant, shock-resistant and insusceptible to temperature fluctuations.

In the new Pulsomax® escapement, which requires no lubrication, the pallet ends feature a locking notch that nudges the lever into the ideal position of departure just before the next impulse occurs. The escape wheel has elastic spokes that automatically snap it into the correct functional position when it is pressed onto its hub. The ample distance between the escape wheel teeth reduces the risk of unintentional contacts between a tooth and a pallet when a jolt occurs and the guard pin holds the lever in the locked position if the watch receives a blow.



CSEM, Centre Suisse d' Electronique et de Microtechnique (Swiss Center for Electronics and Microtechnology), founded in 1984, is a private research and development centre specialising in microtechnology, nanotechnology, microelectronics, system engineering and communications technologies. Having founded several start-ups, it contributes to developing Switzerland as an industrial location with approximately 400 specialised employees from scientific and technical disciplines based around the country.

Lower in mass than a conventional spring, it is less prone to positional error, requires less energy and takes up less space. So clear are the advantages, Patek announced that Spiromax would be rolled out as standard on all escapements in the coming years.

Also seen before was a silicon escape wheel and anchor – the Pulsomax. Even in conventional form, the silicon version carried several advantages, not least that the low-friction values meant that jewelled pallets no longer needed to be inserted into the anchor and adjusted. More importantly the reduced weight of the components means that transfer of each impulse across the system is more efficient. In the 2011 version, a radical new geometry has been introduced that more precisely controls the way the wheel absorbs and transmits the energy, saving both energy (15 per cent or more apparently) and precision in the process. The geometry also helps absorb external shocks and has even been tweaked to be easier to put in place in the movement.

Part works

The centrepiece of the new system, however, is the GyromaxSi balance. As with some other novel balances such as that developed for the Jaeger-LeCoultre Extreme Lab concept watch, the GyromaxSi uses an aerodynamically efficient bar shape, which Patek's engineers say saves a potential 60 per cent loss of energy. At each end of the silicon bar are gold inlays, set between adjustable gold poising weights – a feature of the original 1951 Gyromax balance.

All together the Oscillomax system demonstrates clearly how silicon and its associated technologies should be used – not just as a better performing material, but as an opportunity to re-examine every stage of the system these parts serve. Is the end result worth so much effort? It has taken a decade and considerable resources (Patek Philippe was, unsurprisingly, silent on this question, but it must be assumed to be millions of Francs) to achieve this point.

The official Patek line is clearly stated: "It is legitimate to ask whether the silicon technology in Patek Philippe's latest developments will be a long-lasting involvement and whether it is compatible with watchmaking traditions. But it is also justifiable to recall that the craft of watchmaking has constantly evolved since the first clocks were made of wood. By definition, the tradition of watchmaking is in itself a process of ongoing evolution. Historic examples include the synthetic rubies that replaced the original metal bearings, the self-compensating balance springs in place of compensation balances, the temperature-compensating Invar alloy instead of steel, the automatic winding mechanisms that superseded manually wound movements, and many more."

In terms of pure performance, there is no doubt. Tested in a calibre 240 movement, the Oscillomax saves so much energy that while a conventional movement would have stopped after 48 hours, the new version would still have another 22 hours of running left, having lost only 10 per cent of its torque. In short, silicon technology allows for smaller, more efficient and more robust movements that need less maintenance.

Anyone present at the press conference still worrying about whether this all fits with Patek Philippe's traditionalist ethos would have been at least partly relieved by the active part taken in proceedings by Philippe Stern who oversaw the genesis of this project long before handing over the reins of the company to his son Thierry. And, in reassuringly traditional manner, Patek Philippe is not just using this technology but has adopted it completely, to the point where the company has endowed a chair in the application of Micro-nano-technology at the CSEM.

Further information:
www.patek.com www.csem.ch

Strictly Silicon