PATEK PHILIPPE
GENEVE

Press Release

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Patek Philippe "Advanced Research"
The manufacture presents a pioneering innovation for one of its most significant fields of competence – chiming watches.

The engineers at Patek Philippe "Advanced Research" have extended the horizon of its chiming watches by developing a totally new all-mechanical sound amplifying system. This *fortissimo "ff"* module consists of a flexibly suspended sound lever and an oscillating wafer made of transparent sapphire-crystal glass. In comparison with conventional minute repeaters and regardless of the case material, it delivers clearly amplified sound of excellent acoustic quality. Crowned by four patents, the pioneering technology is presented in the Ref. 5750 "Advanced Research" minute repeater, a special limited edition consisting of 15 watches cased in platinum and endowed with a unique dial design.

The spirit of innovation has been in Patek Philippe's DNA since the company was founded. True to this uninterrupted tradition, the manufacture has spared no effort to further push the limits of watchmaking artistry and move at the forefront of technical development. But Patek Philippe considers innovations to be meaningful only if they offer the user genuine added value in terms of quality, precision, and dependability in the long run.

Founded in 2005, the Patek Philippe "Advanced Research" department has meanwhile been integrated in the Research & Development division and vested with the task of pursuing high-end research in the fields of new materials, technologies, and conceptual fundamentals intended to open totally new perspectives in the domain of watchmaking.

To attain these objectives, the manufacture has established unique competencies, called together its best specialists, and provided them with the latest technical resources, including instruments required for computer simulation. The engineers at Patek Philippe "Advanced Research" also collaborate with independent external research facilities such as the Centre suisse d'électronique et de microtechnique de Neuchâtel (CSEM) or the Federal Institute of Technology Lausanne (EPFL).

Since 2005, Patek Philippe "Advanced Research" has stood out with pioneering work in the innovative field of Silinvar®, a derivative of silicon with phenomenal characteristics for watchmaking applications (temperature compensating, lightweight, lubricant-free, antimagnetic, etc.). Concurrently, the manufacture presented the first escape wheel in Silinvar® (2005), followed by the Spiromax® balance spring (2006), the Pulsomax® escapement (2008), the Oscillomax® ensemble (2011), and a further optimized version of the Spiromax® balance spring (2017). Each of these technology leaps was accompanied by the launch of a wristwatch in limited editions that were the first to be endowed with the innovative components. In the meantime, most of the movements for the current Patek Philippe watch collections are equipped with Spiromax® balance springs made of Silinvar®.

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In 2017, in a totally different field of research, Patek Philippe “Advanced Research” developed a compliant mechanism (system with flexible articulations) made of conventional horological steel that in Patek Philippe watches with two time zones is used to set the second time zone. This technical innovation was launched in the limited-edition watch that also first featured the optimized Spiromax® balance spring.

A sound amplification system with a sapphire-crystal oscillating wafer.

Today, the Patek Philippe “Advanced Research” department can present an important technical milestone in a domain that relates to the superb competencies of the manufacture: the chiming watches, or, more precisely, the minute repeaters. As regards these grand complications, Patek Philippe offers the largest portfolio of regularly produced models.

Departing from the famous self-winding caliber R 27, the movement with which Patek Philippe in 1989 ushered in the grand comeback of the minute repeater, the engineers and designers at Patek Philippe “Advanced Research” searched for a way to amplify the volume of the time strike in a purely mechanical manner while preserving the excellent acoustic quality as well as the smallest possible dimensions. After several technical forays in various directions, they decided to preserve the design of the base movement and then on the bridge side (the side facing the wrist) to add a module that works like a mechanical loudspeaker. But unlike normal loudspeakers, the amplification of the sound does not rely on a flexible diaphragm which like the skin of a drum is attached along its periphery. Instead of a membrane, the system for which Patek Philippe registered three patents has an oscillating wafer made of synthetic sapphire with a thickness of 0.2 mm. Thanks to its angular motion, this rigid and freely movable wafer provides clearly better sound propagation for the confined volume of a wristwatch. The transparency of the sapphire glass also preserves the unobstructed view of the movement through the case back. To implement this heavily miniaturized system, the developers had to master considerable challenges, both in design and in production.

A flexibly suspended sound lever

To achieve sound transmission from the gongs of the minute repeater to the sapphire-glass oscillating wafer, the engineers developed a system with a steel sound lever that is attached in the middle of the oscillating wafer. The other end of this sound lever that resembles a tuning fork features a flexible attachment with a thickness of 0.08 mm. When the hammers strike the gongs, their oscillations are transmitted to the sound lever which in a first phase amplifies them and transmits them to the rigid oscillating wafer where they are further amplified. The angular motion of the oscillating wafer excites the air layers above and beneath the sapphire glass, producing a noticeably louder sound.

A new type of sound propagation

Parallel to the integration of the *fortissimo “ff”* amplifier module, the team also developed a totally new sound propagation system. In a classic minute repeater, the strikes of the hammers on the gongs create oscillations of the entire watch. The sound is propagated on all sides by the case, the back, and the crystal glass. Therefore, the case material has a significant influence on the sound, whereby rose gold is considered the best precious metal for sound propagation while platinum, with its higher material density, presents the greatest acoustic challenge. In the minute repeater with the *fortissimo* module, an insulation rim made of a high-tech composite material acoustically uncouples the amplifier from the movement. The sound is first routed to the sound lever and then to the oscillating wafer and

subsequently propagated through four openings at 12, 3, 6, and 9 o'clock in a titanium ring. The sound waves exit through a narrow slot between the case back and the case band. A dust filter protects the movement without affecting the sound. So the case material does not influence the sound and its propagation. It is always of the same quality, regardless of whether the case material is rose, yellow, or white gold or platinum.

A distinctly louder and totally harmonious sound

The *fortissimo* module attached in the case back allows the sound to be heard at a six-fold larger distance. So a classic minute repeater on the wrist, at a distance of 10 m, sounds as loud and clear as an amplified minute repeater at a distance of 60 m. The manufacture also leveraged its rich experience in the domain of chiming watches to create a reverberating sound that also pleases the ear; this requires considerable dexterity and acute hearing. Even though the sound amplified by the *fortissimo* module differs slightly from that of other minute repeaters, it offers the harmonic quality and acoustic richness that underpin the unique reputation of Patek Philippe minute repeaters and arouse enthusiasm with a long resonant fade out relative to the “attack” (hardness). Additionally, the maximum duration of the time strike (32 strikes at 12:59) – it usually lasts 17 to 18 seconds – was extended to 20 to 21 seconds, allowing the gongs to fade somewhat longer.

Platinum components

Apart from the additional *fortissimo* module, the caliber R 27 PS benefits from further technical enhancements with respect to materials and design factors. The minute repeater hammers, originally in steel, were replaced with platinum hammers, a patented solution that in this specific case improves the quality of the strike in line with the directives of the Patek Philippe Seal and produces a softer strike as well without reducing its sonority. A minirotor in platinum replaces the eccentrically recessed minirotor in 22K gold; thanks to the greater material density, it delivers the same winding power with a thinner design. With it, the thickness of the *fortissimo* module can at least be partially offset.

A limited edition of 15 watches

To present the exclusive system of sound amplification and propagation, Patek Philippe is launching a limited special edition of the watch as was the case previously with the “Advanced Research” innovations. The Ref. 5750P Patek Philippe “Advanced Research” minute repeater comes in a sleek case with a slightly domed bezel. It is inspired by the Ref. 5178 minute repeater with cathedral gongs, has the same diameter of 40 mm. However, with a height of 11.1 mm, it is 0.57 mm thicker. To demonstrate the efficiency of the *fortissimo* system, the manufacture opted for the material that poses the greatest acoustic challenges – 950 platinum.

In its center, the five-part elaborately constructed dial features an openworked motif inspired by the spoked wheels of vintage automobiles. It stands out against the black background with snailed spiraling lines. The subsidiary seconds at 6 o'clock consists of a rotating disc with the same openworked motif against a black snailed background and a small marker that serves as a hand – a movable element which creates a unique, dynamic effect. The time is indicated by flat Dauphine hands in white gold and applied kite-type hour markers in blackened white gold.

The sapphire-crystal case back reveals the hammers and the classic gongs of the minute repeater as well as the sound lever in the shape of a tuning fork that carries the transparent oscillating wafer of the *fortissimo* amplifier system. A pierced Calatrava cross decorates the cover of the centrifugal governor that assures the regular rhythm of the time strikes. The spectacular outlook also shows the Gyromax® balance spring in Silinvar® launched in 2006 by Patek Philippe “Advanced Research” as well as the large bridge with Geneva striping and carefully chamfered and polished edges. The platinum minirotor sports a ray pattern in the style of the dial; it was created with a laser-based light-absorbing surface texturing technique that allows certain segments to appear black. This limited special edition is worn on a shiny orange alligator strap with black contrast seams and a platinum fold-over clasp.

With its unique *fortissimo “ff”* system for sound amplification and propagation, Patek Philippe “Advanced Research” presents an innovation that will seduce all enthusiasts of minute repeaters and technical debuts. It opens up totally new horizons for chiming watches.

Patents

Loudspeaker with freely oscillating wafer:
PCT/EP2021/066501 – TIMEPIECE COMPONENT COMPRISING A SOUND AMPLIFICATION DEVICE

Sound amplification mechanism:
EP3812844 A1 – TIMEPIECE COMPONENT COMPRISING A SOUND AMPLIFICATION DEVICE

Platinum hammers:
CH00153/21 – STRIKEWORK MECHANISM COMPRISING A STRIKEWORK HAMMER AND A STRIKEWORK GONG, IN REFERENCE TO SAID STRIKEWORK HAMMER AND IN REFERENCE TO SAID STRIKEWORK GONG

Helical gongs with a coplanar attachment assure the balanced amplification of the hour and minute strikes
EP21203307.0 – BOSSED GONG ASSEMBLY FOR THE STRIKING MECHANISM OF A MOVEMENT

Patek Philippe "Advanced Research": key achievements

2005: Silinvar®
Silinvar® is a novel, patented material based on monocrystalline silicon. It was developed in collaboration with Rolex, the Swatch Group, and CSEM in Neuchâtel, and is suitable for applications in watchmaking. Thanks to a patented oxidation process that causes molecular changes in the outmost layers, it has temperature-compensating characteristics. In the temperature range from -10°C to +60°C, components made of Silinvar® are highly stable – or invariable as suggested by its name (Silinvar® = silicon + invariable).

This advantage is one of several positive characteristics that make Silinvar® a true super material for horology.
• Silinvar® is very lightweight and has merely a third of the mass of steel. Silinvar® watch components can therefore be moved with less energy and react less sensitively to the earth's gravitation.
• Silinvar® is twice as hard as steel and thus more wear-resistant.
• Silinvar® cannot be magnetized and is thus insensitive to magnetic fields.
• Silinvar® is corrosion-resistant.
• In microstructures, Silinvar® is very flexible but does not deform permanently. It is therefore very shock-resistant and dimensionally stable.
• Silinvar® components are manufactured with the DRIE process. *Deep Reactive Ion Etching* produces components of consistently identical shape and quality.
• Thanks to the DRIE process and the know-how accrued in this domain, Silinvar® components can be manufactured with tolerances of less than 1/1000 mm.

2005: First escape wheel in Silinvar®
This new part improves dependability because it requires no lubricants. It also reduces the mass to be moved (better efficiency), is corrosion-resistant, and remains perfectly concentric.
Launch of the Ref. 5250 Annual Calendar Patek Philippe "Advanced Research" with a Silinvar® escape wheel in a limited edition of 100 watches.

2006: Spiromax® balance spring in Silinvar®
• Optimized rate accuracy by improved isochronism thanks to concentric breathing (expansion and contraction) of the balance spring.
• Lighter balance spring, less sensitive to external factors such as shocks and gravity.
• Flat design, three times thinner than a Breguet hairspring.
• Patented geometry (Patek Philippe boss at the outer end, integrated stud attachment, self-centering integrated collet) for attachment to the balance staff.
Launch of the Ref. 5350 Annual Calendar Patek Philippe "Advanced Research" with a Spiromax® balance spring and an escape wheel made of Silinvar® in a limited edition of 300 watches.

Meanwhile, the internally produced Spiromax® balance spring has been integrated in most Patek Philippe movement families, especially in calibers 300 (Grandmaster Chime), 301 (Grande Sonnerie), R 27 (except the R TO 27), 240, 28-520, 324, 26-330, 31-260, 25-21, 215 and 30-255.

2008: Pulsomax® escapement in Silinvar®
• Optimized geometry of escape wheel and lever
• Increase of energy efficiency by 15%

Launch of the Ref. 5450 Annual Calendar Patek Philippe “Advanced Research” with a Pulsomax® escapement and a Spiromax® balance spring in a limited edition of 300 watches.

2011: Oscillomax® ensemble (Pulsomax® escapement with GyromaxSi balance and Spiromax® balance spring)

With respect to precision adjustment, the GyromaxSi® balance preserves all of the advantages of the Gyromax® balance that was patented in 1951 (adjustment by changing the moment of inertia of the balance, no impact on the active length of the balance spring.

- Optimization of the advantages of the Gyromax® principle by a mass reduction near the balance staff thanks to a lightweight Silinvar® chassis.
- Concentration of the active mass on the outside edge thanks to pure gold inlays.
- Aerodynamic optimization of the balance with a 15% power gain.
- Change of the moment of inertia with four asymmetric poising weights
- All proven advantages of the Spiromax® balance spring and of the Pulsomax® escapement.

Launch of the Ref. 5550 Perpetual Calendar Patek Philippe “Advanced Research” with the Oscillomax® ensemble in a limited edition of 300 watches.

2017: Optimized Spiromax® balance spring

New Spiromax® balance spring thanks to an inner boss (thicker part at the inner end) to improve isochronism of the balance in the vertical positions. This progress is the subject of several patents, allowing a rate accuracy of -1 to +2 seconds per day in comparison with a Patek Philippe Tourbillon watch.

Launch of Ref. 5650 Aquanaut Travel Time Patek Philippe “Advanced Research” with a compliant mechanism for setting the time zone and optimized Spiromax® balance spring in a limited edition of 500 watches.

Since then, the optimized Spiromax® balance spring has been integrated in most Patek Philippe movements, especially in calibers 240, 215, 28-520 and 324.

2017: Correctors with compliant mechanism in steel

Compliant mechanism for correcting the time zones. It utilizes the elasticity of materials in microstructures and replaces articulations with pivots and leaf springs. This technical development offers numerous advantages: simplified assembly (12 parts as opposed to 37 previously), flatter design, no mechanical play, no friction, no arbor wear, which results in totally lubricant-free functionality and excellent energy efficiency.

Launch of Ref. 5650 Aquanaut Travel Time Patek Philippe “Advanced Research” with a compliant mechanism for setting the time zone and optimized Spiromax® balance spring in a limited edition of 500 watches.

Technical data

Ref. 5750 Patek Philippe "Advanced Research" Minute Repeater
Limited edition of 15 pieces

Movement:	Caliber R 27 PS Self-winding mechanical movement. Minute repeater with classic gongs and small seconds Patented *fortissimo "ff"* system for sound amplification and propagation consisting of a flexibly suspended sound lever, a transparent sapphire-glass oscillating wafer, a composite insulating rim and four sound openings in a titanium ring.
Diameter:	28 mm
Height:	6.05 mm
Number of parts:	342
Number of jewels:	39
Power reserve:	Min. 43 hours, max. 48 hours
Winding rotor:	Minirotor in 950 platinum with laser texture, unidirectional winding
Frequency:	21,600 semi-oscillations per hour (3 Hz)
Balance:	Gyromax®
Balance spring:	Spiromax® (in Silinvar®)
Balance spring stud:	Adjustable
Displays:	With hands: • Center hours and minutes With disk: • Subsidiary seconds at 6 o'clock
Functions:	Two-position crown: • Pushed home: To wind the watch • Pulled out: To set the time
Hallmark:	Patek Philippe Seal

Features

Case:	950 platinum Sapphire-crystal case back Minute-repeater slide in left-hand case flank Not water-resistant, protected against moisture and dust Diamond at 6 o'clock
Case dimensions:	Diameter: 40 mm Height: 11.1 mm Width between lugs: 21 mm

Dial:	White gold, black nickel-plated snailed base, openworked ray motif, hand-guilloched edging, hour circle with circular satin finish Applied kite-type hour markers in blackened 18K white gold Flat Dauphine hour and minute hands in 18K white gold, black transfer-printed Subsidiary seconds disk with marker at 6 o'clock
Strap:	Hand-stitched alligator leather with large square scales, shiny orange with black contrast stitching, 950 platinum foldover clasp