
A CONSTANT FORCE ENSURING EVEN OSCILLATIONS

As the tension in the mainspring of a mechanical watch decreases, so too does the balance amplitude, which can negatively impact the watch's accuracy. IWC's patented constant-force mechanism ensures an absolutely even supply of power to the escapement and delivers unprecedented precision.

The movement of a mechanical watch consists of a driving force and a brake: at one end, the mainspring feeds energy into the system, while at the other end, the escapement divides this energy into evenly distributed small portions - similar to the way a turnstile at an entrance only allows a single person from a large crowd to pass through. The balance wheel, a ring-shaped pendulum, sets the pace in which the anchor stops and releases the wheel train. This way, the escapement ensures that the hands of the watch will move forward in simultaneous steps.

One specific challenge, however, has faced inventors and watchmakers for centuries. When a watch is fully wound, the mainspring generates its maximum torque, and that results in maximum amplitude. As the tension in the barrel decreases, less power is delivered through the wheel train to the escapement, and the oscillations of the balance become smaller. This phenomenon, a drop in amplitude, can harm the accuracy of the watch.

IN SEARCH OF A CONSTANT FORCE

For the balance oscillations to remain even at all times, the power transmitted through the wheel train and the escapement must likewise always be consistent. However, as long as the flow of power to the balance

is continuous, decreasing tension in the mainspring inevitably influences the amplitude. Various solutions have been designed to convert diminished energy from the mainspring into constant momentum with the help of an additional mechanism.

IWC's engineers have found an efficient and technically elegant solution to this problem. Their patented constant-force mechanism integrates an additional escapement between the escape wheel and the fourth wheel. Every second, this winds a balance spring that serves as a temporary storage space and keeps the escape wheel supplied with sufficient energy to keep the balance moving. The trick is simple: the angle by which the additional balance spring is wound every second remains the same, which in turn means that the energy supplied to the escapement also remains constant. Even when the tension in the mainspring decreases, the balance continues to oscillate with virtually the same amplitude.

Integrated into a tourbillon, the innovative constant-force mechanisms were first used in the Portugieser Sidérale Scafusia and later the Ingenieur Constant-Force Tourbillon. The frequency of the constant-force tourbillon has purposely been set at 2.5 Hz to enable the system to wind the balance spring once every second. Most recently, the constant-force tourbillon also appeared in the Portugieser and Pilot's Watches collections.

TEMPORARY ENERGY STORAGE

At the heart of the constant-force mechanism is a form of Swiss club-tooth lever escapement. A triangular cam is mounted on the escape wheel pinion. The cam engages with the fork-shaped constant-force lever, which grips the so-called stop wheel with its two pallets at the other end. When the escape wheel has advanced five steps, it releases the stop wheel. It revolves through 30 degrees before being locked again. The process is repeated after five beats of the balance. At 18,000 beats per hour, this sequence also determines the progress of the second hand mounted on the tourbillon cage. Every rotation of the cage also turns a pinion on the escape wheel staff, which meshes with the fixed fourth wheel. It winds the balance spring (situated below the escape wheel), which supplies a constant impulse of force to the balance.

The IWC-manufactured 94800 calibre with twin barrels drives the tourbillon and the constant-force mechanism. The two barrels supply enough power to keep the mechanism running reliably for about 48 hours. After two days, the available torque is no longer sufficient. At this point, the tourbillon automatically reverts to normal mode and advances at the rate of five steps a second, at the same speed as the beats in the balance.

A REAL CHALLENGE TO ASSEMBLE

Assembling a constant-force tourbillon is a severe test of patience for even the most experienced speciality watchmaker. It takes them a full two weeks to assemble the mechanism that weighs in at just 0.7 grams and consists of 104 individual parts. Exceptionally high demands are also placed on the manufacturing of the components. For example, the constant force lever and cam are manufactured using the LIGA process combined with X-ray exposure. This method allows the production of remarkably homogenous microstructures with a degree of precision of which conventional manufacturing technologies would not be even remotely capable.

TIMEPIECES WITH THIS COMPLICATION:

- Portugieser Sidérale Scafusia (Ref. 504101)
- Ingenieur Constant-Force Tourbillon (Ref. 590001)
- Portugieser Constant-Force Tourbillon Edition "150 Years" (Ref. 590203/02)
- Big Pilot's Watch Constant-Force Tourbillon Edition "Le Petit Prince" (Ref. 590303)
- Portugieser Constant-Force Tourbillon (Ref. 590110)
- Big Pilot's Watch Constant-Force Tourbillon Edition "IWC Racing" (Ref. 590501)

IWC SCHAFFHAUSEN

In 1868, the American watchmaker and entrepreneur Florentine Ariosto Jones travelled from Boston to Switzerland and founded the 'International Watch Company' in Schaffhausen. His visionary dream was to combine advanced American manufacturing methods with the craftsmanship of Swiss watchmakers to make the best pocket watches of his time. In doing so, he not only laid the foundation for IWC's unique engineering approach but also established the centralised production of mechanical watches in Switzerland.

Over its 150 year history, IWC Schaffhausen has developed a reputation for creating functional complications, especially chronographs and calendars, which are ingenious, robust, and easy for customers to use. A pioneer in the use of titanium and ceramics, IWC today specialises in highly engineered technical watch cases manufactured from advanced materials, such as titanium-aluminide and Ceratanium®. Preferring the principle of "form follows function" over decoration, the Swiss watch manufacturer's timeless creations embody their owners' dreams and ambitions as they journey through life.

IWC sources materials responsibly and takes action to minimise its impact on the environment, creating intrinsically sustainable timepieces that are built to last for generations. The company prides itself in training its own future watchmakers and engineers, as well as offering an excellent working environment for all employees. IWC also partners with organisations that work globally to support children and young people.

DOWNLOADS

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