Punctuality is the politeness of kings.

King Louis XVIII of France
# Content

## DEVELOPMENT

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## PRODUCTION

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THE LOGIC OF THE “WHIRLWIND”

With its Tourbillon, the young Armin Strom Manufacture, draws on the previous achievements of two masters. Motivated by the ambition to produce as nearly a perfect timepiece as possible, Armin Strom has naturally looked to Abraham Louis Breguet for inspiration. It was in 1801 that Breguet patented his invention, the “Tourbillon regulator”, known as the “Whirlwind”, which compensated for the movement inaccuracies in a watch. However, the Tourbillon is also a homage to Armin Strom, the master skeleton watchmaker and founder of the company. He has perfected the art of skeletonizing watch movements.

Armin Strom is now making watches that reinterpret the art of skeletonizing, bringing it into line with modern design, according to the manufacturer’s own tradition. The observer sees how the parts of the movement engage with each other three dimensionally, as the function is transparent. What could be better to show off the beauty of the mechanism than a Tourbillon, this “Whirlwind”, whose filigree cage turns around its own axis in a minute?

For the Armin Strom Manufacture, the own ATC11 Tourbillon movement is therefore a logical further stage in a development, which began in 2009 with the first movement, the ARM09. Armin Strom has not reinvented the Tourbillon, but has combined it with a unique concept for watch architecture and watch design. As far as the young innovative team surrounding Owner Serge Michel and Director Claude Greisler is concerned, a Tourbillon is not simply a watchmaker’s toy, but clearly a mechanism with the task of improving a watch’s accuracy. Much has been invested in this objective - much time for more accurate timekeeping.

With the Tourbillon, Armin Strom has consolidated its skills as a small exclusive Manufacture, still bearing the stamp of its founder’s values: a love for the smallest detail, the search for technical and aesthetic perfection, and the conviction that the watchmaker’s art should not lie hidden behind the dial and a steel case back, and most emphatically not, if the movement is a “Whirlwind”. 
DEVELOPMENT
Armin Strom
Tourbillon.
Investing in time.
The earth's gravity acts on the balance wheel and spiral that form the regulator of any mechanical timepiece. The centre of gravity is never precisely in the centre of the balance wheel, on the rotating axis. This results in positional errors in the so-called hanging positions. The movement of the watch runs at different speeds according to whether it is held with the crown to the left, to the right, pointing upwards or pointing downwards. To achieve high accuracy, positional errors must therefore be regulated by the watchmaker.

The idea of the tourbillon is that the regulating device (balance wheel and spiral) can rotate about its own axis, such that the effect of gravity is compensated and the centre of gravity and positional errors neutralise each other.

The tourbillon consists of an angled arrangement of escapement wheel, pallet and balance wheel. This so-called escapement assembly is mounted in a carriage – also called a cage. The cage itself is anchored at both ends. In a period of 60 seconds, it is rotated once about its own axis. The cage is driven by a 3rd wheel or by an idler wheel. The resultant power is transferred by the cage to the escapement wheel.

Inside the cage, the escapement wheel engages the fixed 4th wheel and circles it in a planetary motion.
The ATC11 Tourbillon Calibre by Armin Strom is driven by two going barrels connected in series. The lengths of the two winding springs are housed in two going barrels in series. This produces a power reserve twice as long as with a single going barrel. In the ATC11 Calibre, this amounts to ten days. More specifically, the Armin Strom design works in this way: The two going barrels A and B are arranged separately, one behind the other. The drive wheel C rests on the barrel arbor b and drives the movement. When turning the winding crown D, the crown wheel F is driven via the winding wheel E. This then engages with the ratchet wheel, which rests on the barrel arbor a.

The ratchet wheel thus winds the barrel arbor a, which then tensions the winding spring a'. Because the going barrel A does not have a fixed resistance, it automatically sets the going barrel B in motion, because both going barrels are connected via a gear train. The going barrel B now winds the spring b', which encircles the barrel arbor b, because this is blocked by the drive wheel C. The combined power of both tensioned springs is the force, which is distributed by the drive wheel to the movement.
THE DRIVE MECHANISMS

In the Armin Strom ATC11 Tourbillon Calibre, a distinction is made between three different drive mechanisms.

Winding
The winding assembly comprises four different wheels, as described in detail on this page. The winding wheel, which rests on the winding stem, engages the crown wheel at an angle of 90°. In turn, it then drives both ratchet wheels.

Clockwork
Armin Strom’s Tourbillon clockwork differs from that of a conventional time-piece in that the 4th wheel is mounted in a fixed position on the gear bridge. However, as the first wheel, the drive wheel engages the central wheel, also known as the minute wheel. This again engages the 3rd wheel, which drives the seconds hand gear.

Solidly attached to the tourbillon cage, the seconds pin now turns the cage. This motion turns the escapement wheel drive around the fixed seconds wheel, which ensures that the power flows to the escapement wheel.
Hand setting

To change the time display, a movement is needed that can be operated by the user of the watch via the crown. The arrangement in the Armin Strom ATC11 Calibre is classic and identical to familiar hands mechanisms. Uniquely, the arrangement of the ratchet wheels on the numbers side requires minimal adjustment.

If the crown, which sits firmly on the winding shaft, is turned to the hands position, the movement drive is already engaging with the idler wheel and forwards power to the latter. The idler wheel, engages with a second idler wheel, in order to bridge the distance to the minute wheel. This then engages first of all with the minute tube and then with the firmly rivetted drive engaging with the hour tube.
THE CAGE

The design of the tourbillon cage was chosen so that the regulator is on the same axis as both pivot housings. To achieve as accurate a movement as possible, the mounted tourbillon must be balanced perfectly. As the greatest weight – the regulator – is arranged centrally, only the pallet and pallet wheel weight need to be compensated. This objective is achieved by the shape of the cage, which is minimally heavier on the opposite side of the escapement portion.
THE REGULATOR

Difference of the expansion between a flat and a Breguet spiral.

The regulator, comprising balance wheel and spiral, is responsible for accuracy. It must guarantee that the watch runs as precisely as possible, despite external influences. According to the basic idea of the tourbillon, which is to improve the accuracy of the timepiece, the regulator must be of the highest possible quality. This is why Armin Strom decided on a screw balance wheel with white gold balancing screws. The high moment of inertia makes this balance wheel more resistant to external factors, such as unintentional knocks.

The overcoil spring has a so-called Breguet end curve and has the advantage that the expansion is patently more concentric than with a conventional flat spiral.
Calibre ATC11

PRODUCTION
**Design**

From idea to project

An idea takes concrete form
The tourbillon can be clearly seen on the computer drawing.

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**The Tourbillon, the logical continuation of the manufacturing story**

In 2011, the AMW11 Calibre followed Armin Strom’s first proprietary timepiece, the ARM09. By this time, the proprietary ATC11 Tourbillon Calibre had already been born. For the ambitious watchmaker, it was the logical continuation in the development of high quality timepieces. The design and production of a tourbillon movement requires mastery of the most skilful techniques of the watchmaker’s craft. Modern and yet richly traditional artistic decoration also makes every Armin Strom an individual work of art.

The movement architecture employed in other calibres also makes it possible to look into the depths of the watch’s tourbillon and reveals the beauty of the technology, when reading the time. Hand winding, a power reserve of 10 days and the off-centre arrangement of the hands were also required of the technology and design of the tourbillon.
The design of a watch movement is a long process of trial and error leading to a defined objective. ‘The movement is alive in your head and is actually finished’, says constructing-engineer Claude Greisler. But first you have to design the individual parts. Greisler sketches his ideas by hand on paper and then transforms the data into a computer image. The elements of the movement thus take on three-dimensional form for the first time on the display screen.

Their interdependence and their interaction can be appreciated, and possible problems become apparent. Initial prints of the computer drawings are revised by hand, and the modifications are again displayed on-screen – a process which is then repeated several times over.

The assembly drawing
The assembly drawing is used to show fit and function and to verify how the tourbillon is put together.
With only a few exceptions, such as the escapement or the winding springs, every part of the watch movement is manufactured in-house at Armin Strom – screws, wheels, pinions, levers, springs, plates. This is a decision in favour of quality. Anyone who controls the manufacturing process from the raw material all the way to the end product is able to take responsibility for his watch without any ‘ifs’ or ‘buts’. Quality is also the paramount consideration behind the fundamental renunciation of movement parts produced by stamping. Armin Strom uses drilling, milling, turning and wire erosion techniques, but never stamping. This is a more costly approach, but it is gentler on the material. Stamping of any kind changes the material structure of the machined metal. And this can lead to minute, but undesirable deviations from the dimensional tolerances.

‘Manu factum’, made exclusively by hand, does not accurately describe the parts of the in-house movement from Armin Strom, although they are meticulously polished and decorated by hand in subsequent operations. Computer-controlled machine tools are used, however, for the production of these parts from brass and steel raw materials. The machine pool is small, yet flexible, and is geared towards the production of small series. It comprises an automatic lathe, a wire erosion station, a gear cutting machine and a machining station, which is highly versatile and can be quickly changed over. The latter may thus be set up to mill and bore large plates in the morning and to machine small levers the same afternoon.

The Manufacture has access to a machine pool adapted to its individual needs. This includes a machining station with 64 different drills and milling cutters for the machining of plates, bridges and levers.

Close cooperation
Short paths between Design and Fabrication make a small manufacture efficient and promote quality.
If you want time, you must make it.
**TURNING**

Screws, axles and pivots are turned from the solid rod.

**Long brass rods**
The raw material used in the production of movement parts is brass rods in various diameters and up to two metres in length.

**Feeding the automatic lathe**
A production worker loads a brass rod into the automatic lathe, which will then produce screws.
MILLING

Bridges and plates are produced to an accuracy of one part per thousand
GEAR CUTTING

Wheels and drives are given their teeth.

Clamped
For tooth cutting, the workpiece is clamped between two spindles rotating at a constant speed.

Cooled
Oil is used as a coolant, when the profile cutter mills the teeth in the workpiece.

After tooth cutting
The finger makes the minute dimensions of the pinion clear.

Permanent inspection
All parts are inspected with a loupe, a micrometer and under the microscope before they leave manufacturing.
EROSION

The outer shapes of bridges, levers and springs are cut out by wire erosion, protecting the material.
Lost time is never found again.

Benjamin Franklin
The process of mirror polishing is wearing down the metal with progressively finer grains, then polishing it to a mirror finish.
Refining all of the parts of the movement makes the Armin Strom Tourbillon a handcrafted masterpiece. Working bare brass or steel by hand is a time-consuming process. These procedures call for a trained eye, considerable flair and lots of patience and perseverance. A watchmaker can easily invest half an hour or even more of precision work in a single pallet bridge, a comparatively small movement part.

**Fine**

The first process in working the bridge of the tourbillon cage involves the use of fine steel files.

**Finer**

The final polishing of the tourbillon bridge bevels is achieved with a series of increasingly fine emery-papers.
Mechanical aids are also used at Armin Strom for part of the watch movement finishing process. The parallel "Côtes de Genève" are produced by an abrasive wheel, which is guided along the workpiece by hand in perfectly straight lines. To achieve circular graining, the watchmaker uses a rotating abrasive point, which is brought briefly into light contact with the workpiece. The finish is resembling clouds applied to plates, for example. This produces the characteristic overlapping circular graining effect. Finally, all the rotating parts of the watch movement are provided with a circular ground pattern.
ELECTROPLATING
Gold, rhodium and ruthenium

Exquisite brilliance from the plating bath

After polishing and decorating with ground patterns and engravings, bridges, plates, wheels and levers are ready for electrochemical finishing. All steel and brass components are coated first with pregold and then with a layer of nickel by immersion in an electroplating bath. Nickel not only protects against corrosion, but also hardens the surfaces. The thickness of the coating can be controlled with the duration of immersion and the current flow between the two poles in the electroplating bath. Depending on the particular version of the watch, the parts are immersed in a further electroplating tank after the nickel-plating process and a cleaning bath. From this point on, it is all about aesthetics. The wheels of the Tourbillon Water model are provided with a surface of yellow gold, while the bridges receive a shining white coating of the precious metal rhodium. For the Tourbillon Earth model, on the other hand, rhodium is used for the wheels and dark grey ruthenium for the bridges. The Tourbillon Air model has only rhodium-plated parts, and the Tourbillon Fire model combines rose gold and ruthenium.
Independent and flexible
The manufacture has its own multi-tank facility and is not reliant on third parties for the electroplate finishing of its parts.
ASSEMBLY
The whole consists of many parts

The Watch comes to life

Until now, everything was in the form of individual parts – turned, milled, polished, decorated and gold plated. The watch movement now begins to take shape in several stages. The watchmaker uses a jewelling tool to insert the jewel bearings for the spindles of the toothed wheels into the plate and bridges. This is a crucial operation, and the manner in which the jewels are pressed into place influences the correct vertical play of the wheel train. Are the toothed wheels and pinions in correct alignment with one another? Or does their height need to be corrected by a few hundredths of a millimetre? Once the wheel train has been adjusted and the bridges and plates have been screwed down, the winding springs are tensioned with a special tool and assembled in the mainspring barrels.

The installation of the tourbillon mechanism finally brings the watch movement to life. The Armin Strom Tourbillon is still not ready for final assembly, however. The movement must first be completely dismantled once again. All the parts are washed in cleaning baths and dried before being reassembled and lubricated. After timing, the watchmaker sets the hands, fits the movement into the case and screws on the back. The finished Armin Strom Tourbillon is subjected to an accuracy test on a watch winder over a period of several days. Its water resistance is also tested. Only when the watch has passed all the quality inspections is it ready for the customer.

Almost there
Setting the tourbillon is one of the final operations before encasing the movement.
Swiss watchmaking expertise in perfection.
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