Power Up

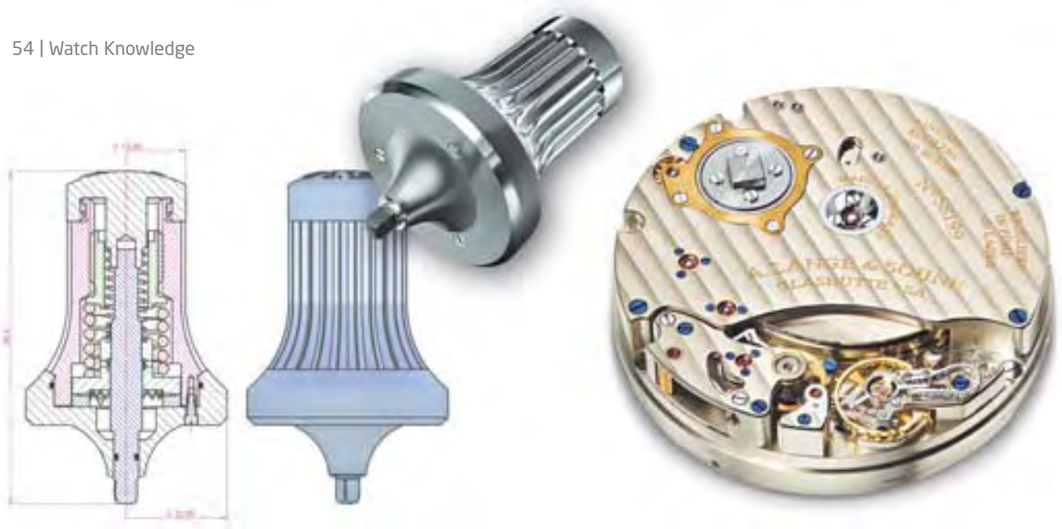
A Lange & Söhne's 'Lange 31' packs a full month's punch with typical elegance and cleverness

Timothy Treffry

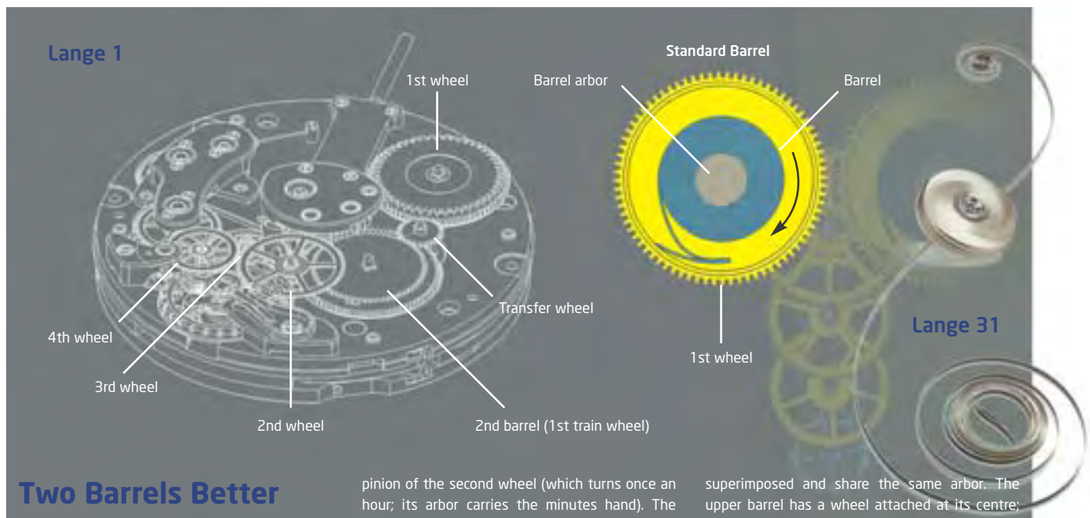
The watchmakers at A Lange & Söhne never come to a fair with a 'new' watch that simply restyles a previous model. Anything described as 'new' always has some genuine technical novelty. The Lange 31 presented at this year's Salon International de la Haute Horlogerie followed this now well-established tradition. Whereas the usual mechanical watch runs for about 40 hours and needs to be wound every day, the Lange 31 is only wound once a month.

This was almost a first. Jacob & Co. showed a monster month-going wristwatch at Basel last year with seven barrels laid-out brazenly beneath a glazed 'hood', not unlike Parmigiani's Bugatti or Halter's Cabestan (see p.86). The Lange 31, on the other hand, carries that minimalist elegance so typical of Lange & Söhne. The plain silver dial has just subsidiary seconds and power-reserve indication. Only the words below the large date display, 'Monats-Werk', reveal (perhaps with the aid of a German/English dictionary) that the '31' on the power reserve dial actually refers to days rather than hours.

The month-going Lange 31 is a limited edition in a platinum case (€134,000). The solid silver dial is frosted and rhodium plated, as are the white-gold hands and hour markers.



(Left) The winding key for the Lange 31 is a complex piece of engineering in its own right. It can only be turned in one direction and has a torque-limiting clutch so that the watch cannot be over-wound. Unlike many more conventional watches, the mainsprings are fixed in their barrels and will not slip. Each watch is sold with two keys (one to use and one to lose?). (Right) The movement of the Lange 31 has the usual Lange & Söhne features: the plates are in striped German silver, most screws are blued, the jewels are set in gold chatons, the screwed 21,600 vph balance has swan-neck adjustment and the balance cock is engraved. Note the large winding square at the upper left. This engages the winding disc seen in the back of the watch case. Slightly above the centre of the movement, in a setting with three screws, is the barrel arbor and the edges of the two superimposed barrel arbors can be seen protruding below the three-quarter plate. These barrels occupy 75% of the movement's footprint, forcing most of the other components to the periphery. These include the remontoir (see box) located under the separate plate, lower left. Note that the fourth wheel/seconds arbor carries the remontoir spring. This movement is unusual in having two third wheels (the second cannot be seen in this view; it is hidden by the remontoir plate). This extra wheel also provides a longer running time.



Two Barrels Better

In the standard spring barrel, winding tightens the spring around the barrel arbor. The brace at the outer end of the spring pulls against the edge of the barrel to make it rotate and the toothed outer edge forms the first wheel in the train of gears leading to the escapement. Lange & Söhne has found two different ways of combining the power of two mainsprings.

In the Lange 1 model, winding turns the arbor of the first barrel. As tension builds in the spring the first barrel rotates, winding the arbor of the second barrel. Winding continues until both springs are fully wound. It is the teeth on the outer edge of the second barrel that drive the pinion of the second wheel (which turns once an hour; its arbor carries the minutes hand). The second drives the third and so on to the escape wheel. The fourth turns once a minute and carries the seconds hand. Both mainsprings run down together to drive the watch.

The new barrel assembly of the Lange 31 is shown with one of its 1.85 m springs in relaxed condition. Note that it is the upper end that attaches to the barrel arbor. As the spring is wound to place it in the barrel, most of the spring will have to reverse its curvature. This increases the tension in the spring. Once in the barrel, it will never be able to achieve its relaxed position but as it attempts to do so, it will drive the watch. In the Lange 31 the two spring barrels are superimposed and share the same arbor. The upper barrel has a wheel attached at its centre; this is engaged by the winding system. On winding, it is the upper barrel that turns, not its arbor. This winds its spring from its outer end, which grips the periphery of the barrel. As tension builds in this spring it will turn the arbor, which is common to both barrels, and start to wind the second spring in the lower barrel. This winds from the centre in the usual way.

Eventually, both springs are wound. The lower barrel has an outer ring of teeth forming the first wheel driving the train. As the watch runs, power is withdrawn from both springs. The two springs' common barrel arbor means they act as a single long spring.

Winding up

Turning over this fashionably large (46 mm diameter, 16 mm thick) watch reveals a unique rear view that provides a key to the mystery of the new movement's lengthy running time. For a start, the sapphire window is not round. Rather, it is kidney-shaped to accommodate an acentric socket; for, like an 18th-century pocket watch, the Lange 31 is wound by a key rather than through the crown. A closer look at the movement shows that the striped back plate is almost featureless; the usual train jewels are off to one side near the balance. We then realise that a great deal of the movement – three-quarters of its footprint in fact – is occupied by a spring barrel, the edge of which peeps from below the back plate.

Most mechanical watches are driven by single mainspring and the size of its barrel is usually less than half the diameter of the movement. This allows the centre arbor, which turns once an hour and carries the minute hand, to be in the middle of the dial. The Lange 1, the first model produced after the recreation of the company in 1990, has an extra spring barrel called a 'doppelfedderhaus' (see box). The extra spring increases the running time to 72 hours. The Lange 31 also has two spring barrels, but they are stacked one on top of the other rather than side by side. The mainsprings are much longer (nigh on 6 feet) and stronger than normal, and the barrels are Siamese twins, linked by a single barrel arbor – all of which combines to produce an extraordinary power supply of 744 hours. Lange & Söhne helpfully explains that the two springs' combined energy could lift a 100-gram bar of "Swiss" chocolate to a height of 320 cm!

Controlling this energy obviously needs a robust movement, but more importantly, a movement that can compensate for the substantial drop in torque as the springs run down over the course of the month. As we all know. the watch balance requires a uniform power supply to achieve the stable amplitude required for good timekeeping. Horologists have known about this for centuries. The fusée-and-chain mechanism, attributed to Leonardo da Vinci, tackles the problem by evening-out the power delivered by the spring. This device was once common in pocket watches and Lange & Söhne used it in the Pour le Mérite Tourbillon – one of the debut wristwatch models introduced as a limited edition in 1994 – and last year's Tourbograph (see Issue 17). A more sophisticated approach, however, is the remontoir.

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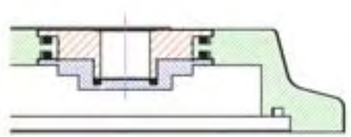
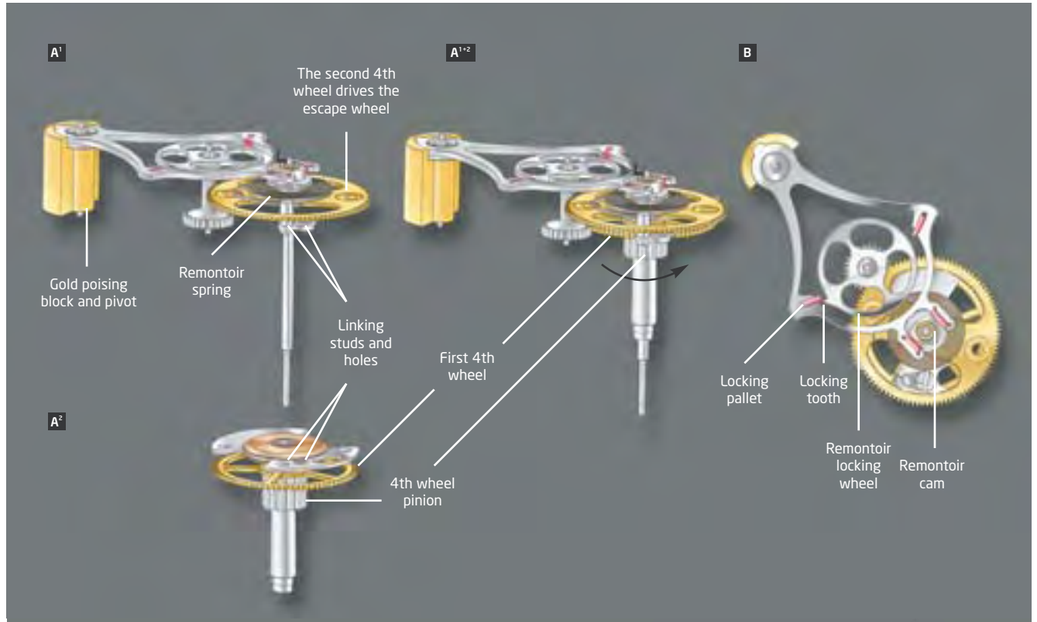


The rear view shows the square socket for the key required for the monthly winding. The diagram illustrates the water-tight seals connecting the socket to the movement.



The Remontoir

The power supply in the Lange 31 can be represented by large (the mainspring) and small (the remontoir spring) water tanks. The action of the remontoir is to open and close valve A so as to keep the smaller tank full. The turbine (representing the seconds arbor) controls the flow from the smaller tank. The power available to drive the turbine remains constant.

Components of the remontoir assembly (see movement photograph) are illustrated above. The mainspring, via the wheel train, drives the fourth wheel pinion as shown. This is mounted on a collar concentric with the seconds arbor and linked (as shown in A1+2) to a stud fixed to the outer end of the remontoir spring. The inner end of this spring is fixed to the seconds arbor. The remontoir spring is pre-tensioned and applies a continuous torque to the seconds arbor. A triangular cam is fixed to the end of the seconds arbor B and oscillates the remontoir pallet frame. This will unlock the remontoir locking wheel allowing it to turn 180° before re-locking. This happens every 10 seconds. Note that the remontoir locking wheel is turned by the first fourth wheel.

The seconds arbor turns continuously (at 3 Hz). Every 10 seconds, when the remontoir unlocks, the first fourth wheel rotates and adds torque to the remontoir spring before the remontoir re-locks. The remontoir spring turns the seconds arbor, driving the escape wheel via the second fourth wheel.

The under-dial view of the movement shows the large date display (indicating 25). The seconds arbor is at 6 o'clock and the power reserve mechanism towards 3. Note that the arbor for the minutes hand in the centre of the movement is not the centre arbor; this has been displaced by the large spring barrels. Extra gears are required to transfer the action of the centre arbor to the centre of the watch.

Torque talk

Although the following analogy may not be attractive when dealing with *haute horlogerie*, it is the only one that comes to mind: a remontoir is rather like a toilet cistern. Although the water supply in the mains may vary, the flow of water available for the flush remains constant. In the common watch, power is delivered from the mainspring to the escape wheel by a gear train. A remontoir breaks this train at, or near, the escape wheel and reconnects it via a small spring, which is rather like a balance spring (see box). It is the fixed amount of energy alternately stored and released every 10 seconds by this small remontoir spring that drives the escapement with constant force from day 1 through day 31.

Apart from the watch's mammoth proportions, only one small criticism has arisen since the Lange 31's launch in April: whether it actually belongs in that special place reserved in collectors' hearts for the manually wound mechanical watch. When asked about his favourite watch, proprietor of Antiquorum Osvaldo Patrizzi named a simple mechanical watch from the 1960s. He said that winding it each night was a bedtime ceremony: he takes the watch off, looks at it, checks it against the bedside radio-controlled alarm, congratulates it, or commiserates with it, winds it, admires it once more... and so to bed. The Lange 31 is an undoubted technical achievement but does it overdo deferred gratification? Will giving the key its 31 full turns be just too much excitement? Jacob & Co.'s presentation box, it's worth noting, winds the Quenttin while you sleep.

Further information: A Lange & Söhne watches are available at Wempe (020 7493 2299), Watches of Switzerland (020 7493 5916), Cottrills (01625 443 150), Hamilton & Inches (0131 225 4898) and George Pragnell (01789 267072). www.lange-soehne.com