The Omega 8500 Series of Calibres

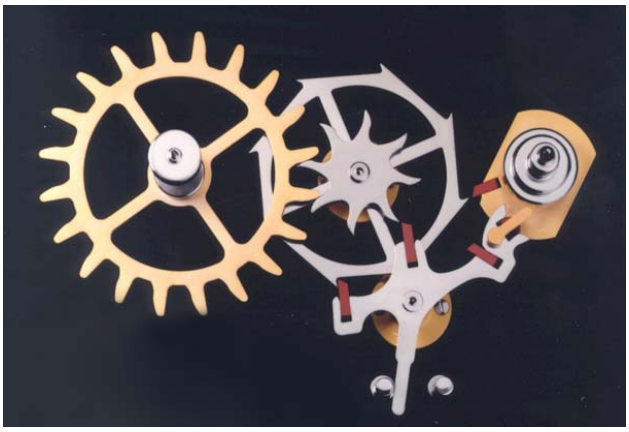
Background

The calibre 8500 family represents an important milestone towards the complete rehabilitation of the Omega brand to that of an in-house high-value watch movement producer. As the closest a watch brand can get to a household name (seven out of ten households in developed countries are said to know of the brand), the return of Omega's status to that of a true 'manufacture' brings closure to a long comeback beginning with the introduction of the Constellation Manhattan in 1982.

Prior to the Swiss Melt-Down in the mid to late nineteen-seventies, when high-value mechanical watch making was under serious threat by quartz technology, cheap Japanese watches and American disposable timepieces, Omega had enjoyed an unbroken history of more than one hundred years as a 'manufacture'. Contrast this with Rolex, which never became a true manufacture until the advent of the calibre 1500 family in the late 1950s and continued using ebauches in some of its watches until quite recently, and you may begin to appreciate the magnitude of the collapse of Omega's brand eminence.

Since the retirement of the 1000 family of in-house calibres in the later 1970s, Omega began to source its power plants from sister company ETA. A number of derivatives of the ETA calibres 2890/2892 - from the calibre 1100 in 1977 to the current and widely acclaimed 2500 – have been used under the dials of various Omega collections. The first of the co-axial escapement calibres, the 2500, was launched in 1999.

The Daniels ‘Fix’



The introduction of George Daniels’ co-axial technology was a major step in the restoration of Omega’s horological credentials. There has been much debate about the efficacy of the co-axial escapement (see picture), and often in such debates there has been confusion between the stating and solving of an horological ‘problem’ and the effects of the solution.

The co-axial escapement was designed to address the problem of “sliding friction” as the escape wheel and pallet jewels come into contact to provide power to the balance. In higher beat movements, sliding friction exacerbates the problem of escape teeth and pallet wear, particularly when lubrication fails. In the Daniels design, sliding friction is virtually eliminated and replaced with “radial” or “rolling” friction, which addresses a major weakness of lever escapements and, to a large degree, eliminates the need for consistent lubrication on the impulse surfaces. The infinitesimal amount of sliding friction that remains is unable to be eliminated owing to the impossibility of maintaining precise tangential geometry for the duration of an impulse. There is incontrovertible evidence that the Daniels ‘fix’ does indeed solve the stated problems of high-beat lever escapements, and, thus, can be considered as a significant advance in horology. So, contrary to the assertion that co-axial technology is “just a marketing tool for Omega”, it actually solves a long-term horological conundrum.

Where the debate also appears to run off the rails is when people confuse “service intervals”, a potential effect of the problem fix, with the original task of solving the sliding friction issue. Recommended service intervals are based not only on the escapement, but also on friction and lubrication regimes throughout the movement. While the Daniels invention may offer greater reliability or robustness of the escapement, one cannot expect a new escapement design to carry the can for reliability of an entire movement. A reasonable position to take would be that the ‘effect’ of the Daniels fix results in fewer repairs to the escapement over time and, thus, co-axial technology reduces service costs and extends serviceability over the life of the movement.

Interestingly, the above issues may well become redundant with the advent of deep reactive ion etching processes in the manufacture of silicon watch parts. Already Omega is cautiously introducing silicon balance springs, and with the physical properties, robustness and no lubrication requirement of the material, we are beginning to see escape wheels, levers and balance springs manufactured from silicon, as is the case with the Breguet calibre 519A. However, silicon has not yet proved itself in the reliability stakes, and it may well be in the post 8500 generation of Omega movements that silicon finds its place.

The 8500 Series

The new co-axial 8500 family of calibres has been built around the Daniels fix rather than built into an existing platform as is the case of the ETA-based calibres. The size of the movement has been increased to 13 lignes to accommodate major changes in layout. The bridges are very sturdy, the functional finish is high-grade, the cosmetics are eye-catching, the design allows for easy maintenance and a new non-beryllium alloy variable inertia free sprung balance system has been created for the series, which, in some models, features the Si14 silicon balance spring.

Released in 2007, the movement series does not have enough universal wrist time yet to have earned a reputation either way, but so far it appears to be shaping up very well. There have been no systemic problems reported with the movement as there were after the introduction of the Piguet calibre 3000 series, and in conversations with Omega service agents in Australia I gain the impression that no fundamental materials failure or design faults have surfaced, and most certainly no urgent rewriting of the service regime for the calibre has occurred.

About the Beat Rate

Ever since the modification of the beat rate of the Omega calibre 2500C from 28,800 bph to 25,200 bph, there has been widespread speculation as to the reason for the change. Some of the most common speculations are:

1. The original rate was too fast for the co-axial escapement;
2. There were some instances of jamming pallet forks leading to the reduction of beat rate as a fix;
3. The beat rate was lowered to support the claims of greater service intervals;
4. 28,800 bph did not allow the co-axial escapement to perform at peak.

There were reports on various watch forums some years ago of the co-axial escapement jamming in 2500 As and Bs and the use of a 'natural' remedy of giving the movement a good shaking to free the pallet jewels from their predicament. If there was enough feedback to the above effect from Omega service centres, this may well have led to problem-solving by the Omega technical team and a decision to lower the beat rate.

When I put the question of jamming to Omega Headquarters, I was informed that "Omega does not communicate technical details of its products and production processes." to which was added the rather cryptic comment "You will understand that the geometry and functioning of the Co-Axial escapement cannot be compared to those of a conventional Swiss lever escapement." It appeared, reading between the lines, to be a rather ambiguous response to say the least.

In other communications of a technical nature, I was advised, "We can say generally that the transition to a frequency of 25,200 bph for this type of calibre allows the optimum functioning of our Co-Axial escapement, whether for performance, reliability or long-term accuracy."

It can be extrapolated the 28,800 bph was not "optimal" for achievement of the standards mentioned above, and that while speculations two and four are probably on the money, speculation one is too woolly.

Speculation three is not correct as, again, it introduces into the discussion of an horological 'problem' (such as jamming escapements, performance, reliability and precision) the effects of problem-solving and not the problem itself. Even it a technical team was told "make the watch more robust and increase service intervals", any horological specialist would interpret such a demand as an horological trouble-shooting exercise and explore engineering, materials, manufacturing or designs problems that were impacting on reliability.

25,200 bph in the Calibre 8500

One opinion expressed about the reduction of beat rate is that the centre sweep appears more jerky in the slower beat version than in a 28,800 bph movement. The same argument could be used when comparing a 28,800 bph movement with a 36,600 bph movement such as a Zenith el Primero, but essentially the above observation is simply the expression of personal preferences, and it is perfectly reasonable to express such preferences. Fortunately, most of us do not care to become absorbed in the hypnotic effects of watching a second sweep making its way around a chapter ring, as there are other more entrancing aspects to dwell on.

Perhaps the most relevant question to ask about the lowering of beat rates centres on whether or not there has been a negative impact on amplitude. That is, has the change to 25,200 bph resulted in any noticeable loss of recovery of oscillating performance of the balance wheel as a result of disturbances or shocks? I put that question to Omega and received the following general reply, “This calibre has been designed and produced around our Co-Axial escapement "ideal" which targets reliability, performance and long-term high precision.” This is code for “No, not really.” It was further pointed out to me that calibre 8500 series movements leave the factory for COSC testing having achieved a maximum range of 4 seconds variation in all 6 positions in terms of daily accuracy, and that is a significant improvement over the previous standard of ten seconds.

Generally, it can be concluded that many of the discussions about high beat versus slower beat movements that have taken place on watch fora and other platforms are irrelevant sideshows to the main event. It can be said, however, that the reduction in beat rate by half a hertz may indeed have an impact on long-term reliability - in a very positive way. Consider the current jewels in the horological crown of Omega - the mid-500 series of movements manufactured in the nineteen-fifties and sixties that purred along at 19,800 bps. This family of movements has over time built a reputation of being some of the finest production movements ever made, and the reasons for their durability and precision are that the slower beat rate combined with thick plates, excellent engineering and robust materials placed less stress and friction on the movement. A well looked-after calibre 551, serviced regularly, can still meet COSC standards more than 40 years after it was manufactured!

In Summary

From the time Nicholas Hayek approved the calibre 8500 project in 2000, the Omega team headed by Chef de Project, Michael Bourqin, dug deep into Omega’s DNA and created a movement series that mirrors many of the markers of quality present in its famous in-house predecessors. The mid-500 series of calibres was the last series that was built to standards of robustness, quality and precision rather than to a price. With the upward price movement of the Omega brand, those who perfected the calibre 8500 concept have had the latitude and indulgence to work to a set of performance criteria absent from Omega for nearly half a century.

The Omega brand has come full cycle with the successful release of the 8500 series of calibres. Two years have passed since their introduction and no technical issues of any substance have emerged. Given time, this series of calibres may well be seen as the series that fully rehabilitated Omega’s horological status to that of scion of the production watch houses.

There have been few serious technical reviews of the 8500 series, and the following review appearing in WatchTime in October 2007 under the unfortunate title ‘Omega’s Alpha Dog’ is one of the better ones.

Advantages

+ Attractive design
+ The movement's construction is technically interesting
+ Beautifully decorated movement
+ Meticulously crafted details
+ Impeccable rate results

Disadvantages

– The crown moves stiffly

OMEGA'S ALPHA DOG

Omega's in-house base movement, Caliber 8500, makes its debut in the new De Ville Hour Vision. We see if the watch and movement live up to the company's high expectations.

BY ALEXANDER LINZ

PHOTOS BY NIK SCHÖLZEL

Nicolas G. Hayek, Sr., chairman of the Swatch Group, announced in 2000 the development of a new base caliber that would significantly shape the near future of the Omega brand. A work group under the direction of Omega, augmented by some of the best minds at ébauche makers ETA and Frédéric Piguet (both owned by the Swatch Group) and including specialists from component manufacturer Nivarox-FAR, began working toward that goal. Their mandate was to create a base movement that was more than another derivative of the familiar ETA 2892, an entirely new family of self-winding movements that could eventually replace all of the movements Omega had been using from suppliers within the Swatch Group. The fruit of their labor is Caliber 8500, a 13-ligne caliber with date display inside a window at the 3. In the next few years, it will be joined by other versions, including one with an annual calendar; another with a second time zone, big date, day and date displays; and a version intended for ladies' watches. The series is scheduled to conclude three years from now with the debut of the 14-ligne chronograph Caliber 9300: this item is slated to appear simultaneously with the start of the Olympic Games in Vancouver, where Omega will serve as official timekeeper.

The starting point for the new movement was Omega's co-axial escapement. For once, it didn't need to be adapted for installation inside an existing movement. In this case, the process ran in the opposite direction: the new caliber was designed around the escapement and in accord with its needs. In the past, when the co-axial escapement had been installed in place of a classical Swiss lever escapement on the plates of calibers in the 2500 series, the space available on the plate determined the caliber's dimensions. Caliber 8500, on the other hand, was free to occupy

The color of the date ring matches the shimmering brown of the dial.

No more little earthquakes on the wrist: the rotor winds the mainspring quietly and efficiently.

The case's sapphire middle piece offers unobstructed views of the movement from all angles.

The inner case is made of sapphire crystal and is screwed to the lower and upper parts.

as much space as it required: 13 percent more, to be exact. This was made possible by increasing the distances between the centers of the escape wheel and the balance and between the co-axial wheel and the watch pallets. The greater height also made room for an escape wheel with three levels: the driving wheel, its accompanying pinion, and the escape wheel itself. The escape wheel that had been used in Caliber 2500 served two functions: it created the connection between itself and the intermediate wheel and also provided the propelling impulse for the balance. In the new design for the co-axial escapement, the eight-toothed driving wheel serves only the latter function; the connection to the gear train is made with a low level of friction by a 14-toothed wheel. As a general rule, the greater the number of teeth in a pair of wheels, the less energy is lost when power is transferred from one wheel to the other. The developers' goal was to minimize the energy lost throughout the entire gear train, while ensuring that torque remains nearly unchanged and that energy is transferred as smoothly as possible. The balance's deviation of amplitude was reduced to a mere 5.4 percent. An average value of 10 percent would have put it among the front-runners in this area, so this is a masterful horological achievement. The balance, which is now crafted from a beryllium-free alloy, has a moment of inertia of 21 mg x cm^2 (compared to just 9.4 mg x cm^2 for the one in Caliber 2500), which further improves the stability of the rate. The innovative alloy, used only for Omega and Breguet (the high-end luxury brand also owned by the Swatch Group), guarantees ideal temperature coefficients. To fix its active length precisely, one end of the Nivarox-Anachron balance spring is affixed using a patented 90° bend. In this way, Omega avoids potential errors in pinning or gluing this spring to the balance-spring stud because the spring's inactive end no longer exerts an influence on its active portion.

The escapement, which requires no index, can be finely adjusted using two diametrically opposed square-headed screws. The conical balance-staff pivot measures just 0.07 mm at its tip; this component is manufactured to a tolerance of 3/1,000s of a millimeter. The new Nivachoc shock absorber is an improvement over the previously used Incabloc shock absorber; developed and manufactured by Nivarox, it also makes it possible to more accurately center the balance pivot. All of these factors contribute to the quality factor of the escapement by minimizing the friction, especially in horizontal positions. The quality factor, defined as the amount of energy the balance needs to keep its amplitude steady between two subsequent oscillations, is measured without using watch pallets. In a test, the balance swings to around 330 degrees and then a laser measures

The co-axial escapement served as the starting point for the new movement; the caliber was designed around it.

the angular loss from one oscillation to the next until the balance's amplitude declines to 180 degrees. The poorer the balance spring, or the poorer the ratio between mass and moment of inertia (or air resistance), the worse (lower) the quality factor. Omega claims that Caliber 8500 has an average quality factor of 317 in the horizontal positions and 231 in the vertical ones. We cannot compare these to the quality factors of other common calibers because Caliber 8500 oscillates at the unusual pace of 25,200 semi-oscillations per hour (3.5 hertz) rather than 28,800 vph (4 hertz).

Quiet Revolution

An automatic winding mechanism gathers energy for the mainspring from the motions of the wearer's forearm. This system winds the mainspring in both directions of rotation by means of a newly designed reverser. The rotor's axle turns in a sliding bearing equipped with zirconium-oxide jewels. This ensures that the wearer neither hears the rotor nor feels any vibrations — two factors that Omega's technicians prioritized. Considering the noise that certain other automatic winding mechanisms make, and the miniature earthquakes their wearers feel on their wrists (the Valjoux 7750 comes to mind), this newfound peace and quiet is truly a leap forward. The efficiency of the self-winding system also represents progress: it requires only the slightest wrist motions to supply the barrels with sufficient energy. The gears' special teeth and their use of Moebius lubricants minimize friction from the oscillating weight all the way through to the fourth wheel.

Omega designed a new decorative pattern to adorn Caliber 8500.

DATA

OMEGA DE VILLE HOUR VISION CO-AXIAL CHRONOMETER

Manufacturer: Omega SA, Rue Stämpfli 96, CH-2500 Biel 4, Switzerland

Model: De Ville Hour Vision Co-Axial Chronometer

Reference number: 431.63.41.21.13.001

Functions: Hours, minutes, central seconds and window date

Movement: Caliber 8500 (stainless steel; Caliber 8501 has a gold balance bridge and gold rotor); diameter = 29 mm (13 lignes); height of Caliber 8500 = 5.5 mm; height of Caliber 8501 = 5.6 mm; 39 jewels; co-axial escapement with freely oscillating balance spring without index; Nivarox-Anachron balance spring; moment of inertia = 21 mg x cm^2; angle of lift = 38°; 25,200 vph (3.5 hertz); Nivachoc shock absorption; Caliber 8500 has a heavy metal rotor, Caliber 8501 has a solid gold rotor; each rotor winds in both directions of rotation; two barrels; approx. 60 hour power reserve; rapid adjustment for the date display; stop-seconds function; COSC chronometer certification.

Case: Massive tripartite case made of sapphire crystal and rose gold; back has pane of sapphire crystal and is affixed by four screws; crown isn't screwed; sapphire crystal above dial is nonreflective on both its surfaces; water-resistant to 100 meters.

Strap and clasp: Crocodile-skin strap (20 mm x 18 mm) with rose-gold folding clasp.

Results of rate test:
(When fully wound / after 24 hours / after 39 hours)
(Deviations in seconds per 24 hours)

Dial up:	+1	+2	+2
Dial down:	+3	+5	+4
Crown down:	0	+1	+2
Crown left:	+3	+5	+2
Crown up:	+1	+3	+3
Crown right:	0	+1	+2
Greatest deviation of rate:	3	4	2
Mean deviation:	+1.3	+2.8	+2.5
Mean amplitude			
flat positions:	292°	259°	245°
hanging positions:	276°	244°	223°
Maximum difference between the vertical positions:	4°	3°	5°

Dimensions: Diameter = 41 mm, height = 12.2 mm; weight = 112 grams

Price: $5,780 (steel with leather strap), $6,380 (steel with steel bracelet), $13,600 (rose gold with leather strap), $23,000 (rose gold with rose-gold bracelet)

Before and after: the escape wheel of the new co-axial escapement (left) beside its predecessor.

Coated with black chrome, the balance matches the black screws and the DLC-coated barrels.

TEST RESULTS	
OMEGA DE VILLE HOUR VISION CO-AXIAL CHRONOMETER	
Strap and clasp: (max. 10 points): Top-quality crocodile-skin strap with technically and visually perfect folding clasp.	**10**
Operation (5): The crown is large and easily grasped, but due to its construction it offers a bit of resistance; the date display can be quickly reset via the separately adjustable hour hand.	**4**
Case (10): The look and feel of the craftsmanship are very appealing; the case is made of sapphire crystal and rose gold; the back has a pane of sapphire crystal and is affixed by four screws.	**10**
Design (15): Stylish and elegant; Omega's new "face" is an attractive one.	**15**
Legibility (5): Easy to read under normal conditions; no luminous material, so the dial remains dark when the lights are out.	**4**
Wearing comfort (10): The 41-mm-diameter case feels comfortable on the wrist.	**10**
Movement (20): Omega's Caliber 8500 is a new movement with interesting and sturdy construction and elaborate surface decorations.	**18**
Rate results (10): Perfectly adjusted! Nothing but "plus" values in all positions, and scarcely any deviation of amplitude, neither when fully wound nor after 39 hours.	**10**
Overall value (15): A comparatively low price for a top-quality luxury wristwatch; aficionados will no doubt crave this watch's exquisite technology and exciting design.	**13**
TOTAL:	**94 points**

The two barrels are wound sequentially. The barrel without the slip-spring (the so-called "hand-winding barrel") is wound first. As soon as it's full, winding energy is conveyed only to the barrel with a slip-spring (the "self-winding barrel"). In the opposite direction, the self-winding barrel first discharges its store of energy directly to the center wheel. If the stockpile of energy is equal in both barrels, then the two barrels discharge their reservoirs of energy at the same time.

Omega claims a 60-hour power reserve for this movement, and our test confirmed that this is no exaggeration. The barrels are coated with DLC (diamond-like carbon), which means that they function with little loss of energy and practically no wear-and-tear. There is enough power available in the barrels for a long power reserve, but none of the energy stored there is squandered to compensate for any shortcomings in the construction. The way that energy is budgeted in Caliber 8500 guarantees that the pressure exerted on the individual pivots is always less than 300 N/mm^2. That's a sensible level that significantly extends the lifespan and simplifies servicing.

The superlative quality of all components in the movement is borne out by the excellent rate results. We discovered "plus" values (gain) in all six tested positions, and only minimal differences in amplitude, not only when fully wound, but also after 24 and 39 hours.

Our test of Omega's Caliber 8500 yielded superlative rate results and a stable amplitude.

Faceted and polished indices plus finely made hands create a high-quality appearance.

The 8500 will be the cornerstone of a new series of calibers.

Caliber 8500 also performed well in the obligatory wrist test, where we measured a gain of just two seconds per week. Marc-André Miche, upon whose desk at Omega the passing buck stops where technical developments are involved, told this writer that he would have been satisfied with a "plus" value of two seconds per day or one minute per month. Miche can rest easy, because this caliber can do even better.

Movement Under Glass

The case of the De Ville Hour Vision is nearly as noteworthy as the fine new caliber that ticks inside it. Transparency is the watchword here. The middle portion of the tripartite case is made by Comadur in Le Locle from a solid block of sapphire crystal, through which a hole is drilled to accept the stem of the crown. Four screws affix the inner case to the back and top. The upper piece consists of the bezel and the lugs. In this unusual design, the wearer of this wristwatch can view the caliber from every angle, almost as though it were afloat inside an aquarium. The tableau inside the case changes with the incident lighting and angle of view.

The dial also testifies to the attention that Omega's specialists have lavished on the details throughout the entire conception of the watch. Applied, faceted and polished indices; faceted and partly matte-finished hands of perfect lengths; and three distinct structural levels: Omega put them all together to give the De Ville's dial a truly first-rate appearance. The fine quality continues in the crocodile strap and the elegant, easy-to-use, rose-gold folding clasp.

The Hour Vision is the new "alpha dog" of the Omega family. As befits the leader of a timekeeping pack, it combines the company´s own top-quality technology, horological innovation and meticulousness with an unprecedented case technology and a relatively attractive price for such an excellent product. The entry-level version retails for just $5,780 in a steel case with a leather strap. ■

The crocodile-skin strap and the golden folding clasp are both top-quality.