A History of Time

In the latest of our iconic timepieces series, Stephen Forsey, Master Watchmaker and one half of Greubel Forsey, explains how Thomas Earnshaw's 18th-century detached escapement has impacted on the way we live our lives today.

Stephen Forsey FBHI

Thomas Earnshaw's Spring Detent Chronometer Escapement

Throughout history it has often been the case that time clouds over breakthroughs, their significance revealed only once they have been truly proven over time or – as in this case – by chance. The timepiece I've selected is signed Jessop (the retailer) and appears to contain a relatively obscure movement by Thomas Earnshaw (though it does not bear his name); however, it represents an important evolutionary step in precision timekeeping. In fact, Earnshaw's inventions and solutions were so advanced and refined that, with only minor modifications, they were universally adopted for the vast majority of mechanical marine chronometers produced from the end of the 18th century until today. This specific timepiece is particularly significant as it is one of very few known examples of Earnshaw's first series of spring detent chronometer escapement movements.

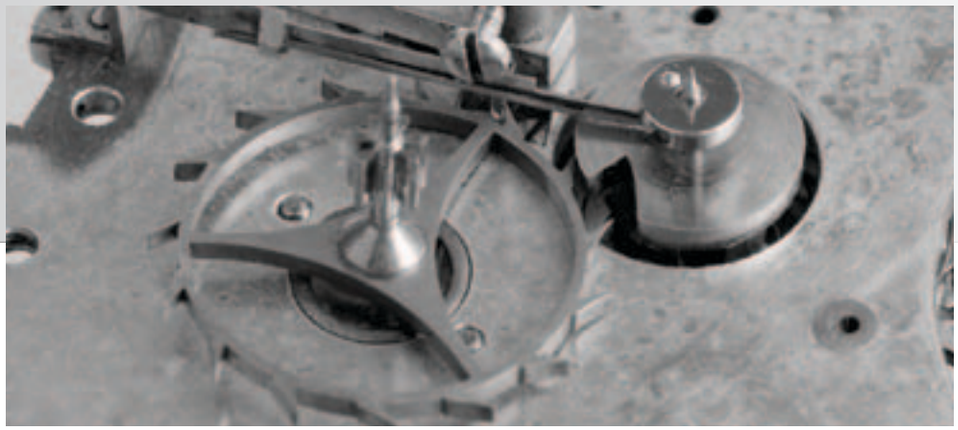
Ever since the very first spring-driven portable timekeeper appeared over five centuries ago, horologists have striven to perfect their art and science. Hindered by available technology and often relatively crude materials, they needed to be highly creative in their quest for high-performance mechanical timekeepers. Great advances were sporadically made – for example the spiral balance spring around 1675 – and these were usually followed by a period of refinement of the new mechanism to allow the technology to either prove itself or be abandoned.

The 18th century was a particularly spectacular period in the history of precision timekeeping because finding a solution for determining a ship's longitudinal position became of the highest national and international importance. Frequent shipwrecks due to navigational errors resulted in significant loss of life and resources at a time when countries were vying for dominance of the seas for trade and military might.

The beginning

Thomas Earnshaw was born in Lancashire in 1749 and apprenticed to a local watchmaker at the age of 14. By the time he reached 20 he was working in London and already recognised as a very reputable watch finisher and a specialist in ruby cylinder escapements with steel escape wheels, a very delicate and exacting process. From what he later states, after having fabricated a few detached escapements with pivoted detent, Earnshaw focused on the shortcoming he found in the oiling of the detent's pivots. His solution to this problem revolutionised precision timekeepers.

Lacking the funds himself to develop his idea for a new mechanism, Earnshaw tried in vain to obtain funding before approaching London watchmaker Thomas Wright. Wright agreed to finance the patent in return for a royalty on movements containing Earnshaw's new escapement and, around 1780, Earnshaw began work on a timepiece equipped with what he called a



Left: Earnshaw's 'detached' spring detent chronometer escapement, underside of the movement's top plate from the "Jessop" pocket chronometer.

Below: The pocket chronometer retailed by Jessop with movement by Thomas Earnshaw (private collection).

Bottom: Balance wheel visible and regulating plate removed, Wright's patent punch mark stamp is now revealed.

'detached escapement' (now known as a spring detent chronometer escapement). Wright finally filed the patent as No. 1354 in February 1783, at a cost of the princely sum of 100 Guineas (equivalent to a year's income for a skilled man).

Earnshaw's groundbreaking spring detent chronometer escapement consisted of an escape wheel (with one single set of ratchet teeth, generally 15 in number) locked and released by a 'spring detent'. This new type of detent was usually crafted from solid steel, hardened, tempered and then polished to form an exquisite showcase of the horologist's mastery of his craft. The foot of the detent was fixed by a single screw, with the spring section reduced (in pocket chronometers) to 0.03mm in thickness, about half that of a human hair.

Located approximately two thirds of the way along the detent, a shaped jewel locks the escape wheel, thus keeping the balance wheel 'detached' from it. At the extremity of the detent, the passing spring, usually in gold and 0.02-0.03mm thick, protrudes fractionally beyond the end of the detent, enabling the oscillator to unlock the escape wheel in one direction so triggering a direct impulse from the escape wheel tooth onto the impulse pallet carried by the oscillator. On the return vibration of the oscillator, the unlocking pallet brushes aside the very light passing spring, limiting the effect on its oscillations.

To reimburse the patent, Earnshaw and Wright's agreement stipulated a payment to Wright of one Guinea for each movement equipped with the new escapement that Earnshaw produced for sale by other makers. Many of the movements Earnshaw created at this time went to famous watchmakers and retailers, including "Vulliamy, Barraud, Hughes, Frodsham, Rigby, Best, Bates, Margetts and others", as stated by Earnshaw when he petitioned the Board of Longitude for a substantial reward for his advances in precision marine chronometers. Among the few survivors today is this piece marked "Jessop", who we assume to be one of the "others".

A survivor

Re-cased early in its life, the silver cases and dust cover have protected the movement from the ravages of time; however, initially there is no obvious sign of Thomas Earnshaw due to Jessop's signature and fine engraving adorning and masking the technicality of the mechanism within. Tilting the movement very slightly reveals the full story, a fusee and chain with maintaining power, invented by none other than John Harrison. Following the gear train, which was at this time already beautifully executed between the two full plates of the frame, we arrive at the escapement in all its splendour, with a polished one-piece detent; 15 tooth escape wheel; double rollers for impulse and unlocking; and above the top plate, a large diameter balance

Top left: Close-up of the punch stamp with the number 19.

Top right: The going train from fusee to escape wheel, with top plate, barrel and fusee chain removed.

Above: The complete movement with dust cover removed, Fine engraving and Jessop's signature conceal Earnshaw's groundbreaking technicality within.

wheel (as yet uncompensated for temperature) with its flat spring.

The evidence unmasking the truth behind this historic movement is concealed under the engraved balance cock. The words: "WRIGHT'S PATENT" are surmounted by a crown insignia and a number 19 is punch-stamped into the top plate. This provides concrete evidence of how the agreement between Earnshaw and Wright worked in practice and, from the scarcity of examples existing today, it leaves no doubt that this originates from the very early series of movements Earnshaw made to repay Wright - even examples from as early as 1784 no longer bear Wright's stamp mark.

If we are to be critical today it may appear that, compared to the work of some of his talented contemporaries, Earnshaw's spring detent escapement is more like fine-tuning. However, thanks to his new concept and refined construction, Earnshaw's invention was a turning point in precision timekeeping that has resolutely stood the test of time and this sets it apart from many other mechanisms then and since. Thomas Earnshaw was clearly an important figure of his time, one that created a truly practical, rational and workable solution contributing to more precise time measurement, something many had eagerly sought since the famous Queen Anne act of 1714 that awarded prizes – including £3,000 to Earnshaw – for solutions to the 'longitude problem'. Even today, over 200 years later, Thomas Earnshaw's work can be seen in modern mechanical marine and pocket chronometers the world over.

With thanks to Mr AG Randall FBHI for his kind assistance.

Further information: www.greubelforsey.com
Catalogue of Watches in the British Museum VI Anthony G Randall and Richard Good;
Earnshaw's Appeal to the Public republished by the BHI; *The Time Museum Catalogue of Chronometers* Anthony G Randall.

Photos courtesy AG Randall