



# A History of Time

Continuing our series of iconic timepieces that have shaped the way we live our lives today, Jonathan Betts, Senior Specialist in Horology at the Royal Observatory (NMM) Greenwich states the case for what he call 'the horologist's Mona Lisa'.



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## John Harrison's H4

The story of John Harrison's pioneering development of the marine timekeeper, between 1730 and 1760, is one of the most famous of horology's heroic tales. Over the years it is a story that has been told many times, most notably by Lieutenant Commander Rupert Gould in 1923 and Colonel Humphrey Quill in 1966 and more recently by Dava Sobel in her 1994 best-seller *Longitude* - the book credited with bringing Harrison almost universal fame. Published in many different language versions, the work also spawned a major documentary and a two-part TV dramatisation in both the UK and USA. But despite his new-found global fame, one of Harrison's greatest achievements - the design of his prize-winning longitude watch, known today as 'H4' - is still not fully understood or appreciated by the majority of his new fans and is all too often relegated in stature by those who should know better.

Ironically, it is one of Harrison's most dedicated champions, the previously mentioned Gould, who inadvertently damned him - albeit with faint praise - when he compared Harrison's creation with that of the French pioneer, Pierre Le Roy, stating: "Harrison took the escapement, balance and general arrangement of the ordinary watch of his day and... compelled it to become an efficient timekeeper." Then came Gould's dangerous summary: "Harrison built a wonderful house on the sand; but Le Roy dug down to the rock." Adding of Pierre Le Roy: "He stands alone, the father of the chronometer as we know it."

There is actually a fundamental misunderstanding in Gould's assessment, but unfortunately, as in so many

cases, mud sticks and this view has been adopted and repeated by writers and scholars ever since.

### The right balance

According to Gould, it is accepted that the successful marine timekeeper (and indeed all precision watches) must incorporate three essential elements: namely a detached escapement, a balance spring designed to ensure isochronism and a method of temperature compensation incorporated in the balance. Yet H4 succeeded magnificently without any of these elements and those that follow the accepted rule have never explained how the piece managed this.

The fact is that there is a fourth element - the most important of all - common to H4 and all subsequent watches enabling them to perform well as portable timekeepers. This element, created by Harrison, is a high energy, high frequency balance and today forms the central feature of any successful marine chronometer. In essence, it is the ultimate solution to the Longitude Problem.

Before Harrison's creation, the pioneers (including Pierre Le Roy) had been working on large marine timekeeper designs with heavy, low frequency oscillators, based on attempts to convert a seconds beating pendulum clock into a 'portable' timepiece. This was because good pendulum clocks, when fixed, were excellent timekeepers (capable of accuracy up to a few seconds a week), but even the best wristwatches were hopeless (gaining or losing a minute a day at best). Harrison too had followed this course with the large 'sea-clocks' H1 to H3, but it was he who finally

realised that, if a timekeeper was to be subjected to large external movements, a 'portable clock' was the wrong course and what was needed was quite a different type of oscillator.

The definitive proof was H4, which, with its high-energy, high frequency balance (beating 18,000 times per hour - five times a second), performed magnificently on both of its official British Government trials in the early 1760s. Harrison went further in his published description of the watch in 1767, when he stated that if smaller watches were made then they should have a balance beating at six times a second (a '21,600 train'). Eventually, this 200-year-old idea was introduced in 1950s wristwatches - and claimed as a brand new idea.

### Improving on perfection

In fairness, it is true that H4's design was improved upon by the subsequent generation of clockmakers, incorporating the three other elements as mentioned by Gould; elements that enabled the timekeeper to be much simplified and consequently made more affordable and easier to reproduce.

Indeed, Harrison himself had already stated the need for the compensation balance (H1 originally had such a refinement) and implied the advantages of a detached escapement when he published his statement that, "the less the wheels have to do with the balance, the better". Had he lived longer there is no doubt he would have developed something similar to the timekeepers that came after him.

But there is no denying that Harrison got his priorities right and H4, with that most essential element, the right kind of oscillator, is the father of all chronometers as well as the precision watches that followed. It must surely rank as one of our greatest timekeeping 'celebrities', which is why to me it will always be 'horology's Mona Lisa'. 🕒

