N° 56

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RICHARD HORNBY (1810-1872)
Liverpool

SMALL-SIZE BRASS BOUND MAHOGANY TWO-DAY MARINE CHRONOMETER

Mid-19th century
Dimensions of the box: 5.9 x 5.9 x 5.9 in – Dial diameter: 3.5 in
Signed Richard Hornby, Liverpool N° 265

REFERENCE BIBLIOGRAPHY: Tony Mercer, *Chronometer Makers of the World*, 1991, revised 2004; and Jonathan Betts at the National Maritime Museum.

MID-19TH CENTURY SMALL-SIZE BRASS BOUND MAHOGANY TWO-DAY MARINE CHRONOMETER

Signed Richard Hornby, Liverpool, No 265.

Chain fusee movement with maintaining power, diamond endstones for the balance wheel, freesprung blued steel helical spring with terminal curve, Earnshaw type detent escapement, cut and compensated bimetallic balance wheel, signed and numbered silvered dial with two subsidiaries: state of wind in 3 hour divisions up to 54 hours; and running seconds. Heavy beveled convex glass, gimbaled bowl, mahogany case with brass mounted corners

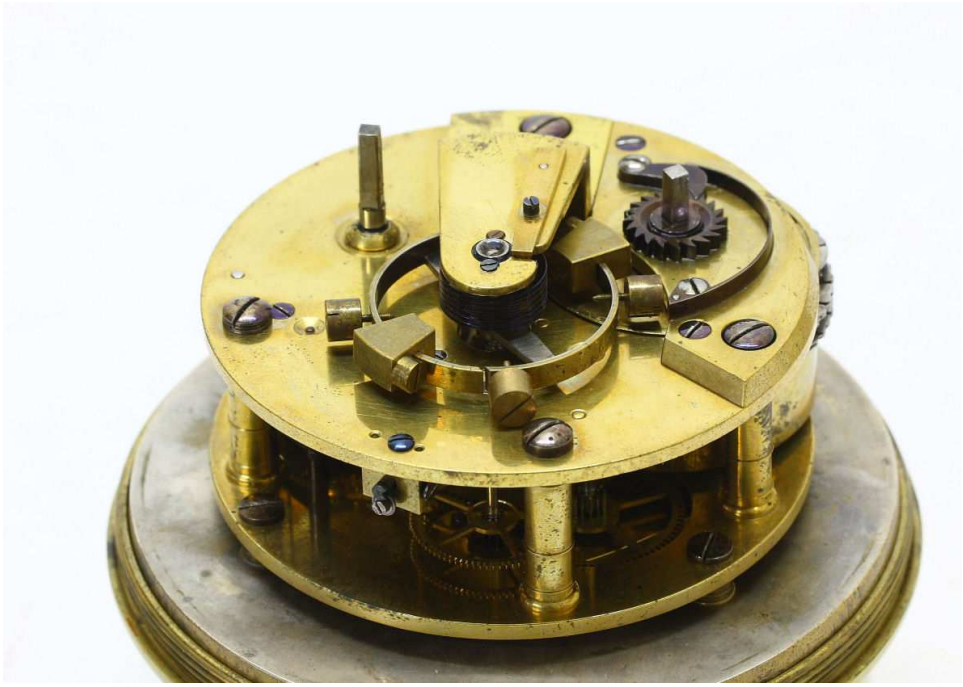
Dimensions of the box: 5.9 x 5.9 x 5.9 in – Dial diameter: 3.5 in.

The Ledger of Receipts and Issues of Chronometers reveals that this chronometer was one of a batch sold off to the Indian Government in 1894.

RICHARD HORNBY (1810-1872), established in New Scotland Rd, then 42 School Lane (1810-1834) the 36 South Castle St (1839-1872), Liverpool.

Used mostly steel balance and Guillaume balance springs with Pooles Auxilliary. He was making his own adjustable spring detent. One of a great clockmaking family, he was a watch and chronometer manufacturer, chronometer maker to the Lords of the Admiralty. From 1851, his title was Hornby, Richard and Sons.


Rich.d Hornby
Liverpool
Down
2 Days
60
30
10
20
40
50




RICH.HORNBY
LIVERPOOL

THE INVENTION OF THE MARINE CHRONOMETER IN THE 18th C.

Until the mid 1750s accurate navigation at sea out of sight of land was an unsolved problem due to the difficulty in calculating longitude. Navigators could determine their latitude by measuring the sun's angle at noon (i.e., when it reached its highest point in the sky, or culmination). To find their longitude, however, they needed a time standard that would work aboard a ship, and that would have to be a precision mechanical clock.

The creation of a timepiece which would work reliably at sea was difficult. Until the 18th Century the best timekeepers were pendulum clocks, but both the rolling of a ship at sea and the up to 0.2% variations in the gravity of Earth made a simple gravity-based pendulum useless both in theory and in practice.

The first true chronometer was the life work of one man, John Harrison (1693-1776) (fig.1), spanning 31 years of persistent experimentation and test that revolutionized naval navigation enabling the Age of Discovery and Colonialism to accelerate (fig.2).

Fig.1. P.L. Tassaert's half-tone print of Thomas King's original 1767 portrait of John Harrison, located at the Science and Society Picture Library, London

Fig.2. Harrison's « Sea Watch » finished in 1761

The purpose of a chronometer is to measure accurately the time of a known fixed location, for example Greenwich Mean Time (GMT). This is particularly important for navigation. Knowing GMT at local noon allows a navigator to use the time difference between the ship's position and the Greenwich Meridian to determine the ship's longitude. As the Earth rotates at a regular rate, the time difference between the chronometer and the ship's local time can be used to calculate the longitude of the ship relative to the Greenwich Meridian (defined as 0°) using spherical trigonometry. In practice, an error of one second equals 600 yards and a minute equals 6 nautical miles. In practical terms, a nautical almanac and trigonometric sight-reduction tables permitted navigators to measure the Sun, Moon, visible planets, or any of 57 navigational stars at any time that the horizon is visible.

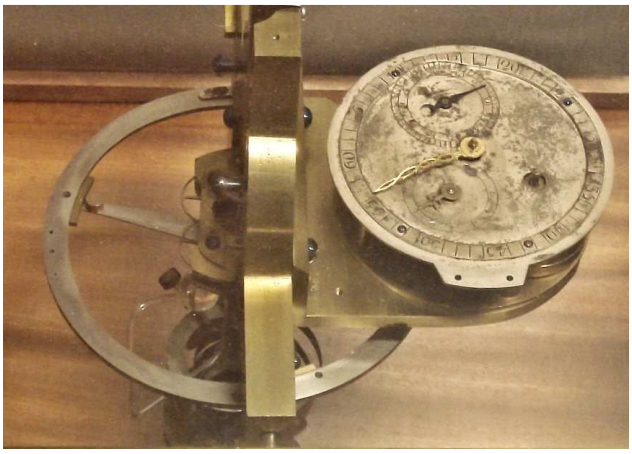


Fig. 3. Pierre Le Roy' marine chronometer, 1766

About the same time in France, Pierre Le Roy (1717-1785) invented in 1748 the detent escapement characteristic of modern chronometers. In 1766, Pierre Le Roy created a revolutionary chronometer that incorporated a detent escapement, the temperature-compensated balance and the isochronous balance spring: Harrison showed the possibility of having a reliable chronometer at sea, but these developments by Le Roy are considered to be the foundation of the modern chronometer. The innovations of Le Roy made the chronometer a much more accurate piece than had been anticipated. (fig.3).

Fig.4. Ferdinand Berthoud, Chronometer N° 24, 1782

Ferdinand Berthoud (1727-1807) in France, as well as Thomas Mudge in Britain also successfully produced marine timekeepers. Although none was simple, they proved that Harrison's design was not the only answer to the problem (fig 4).

The greatest strides toward practicality came at the hands of Thomas Earnshaw and John Arnold, who in 1780 developed and patented simplified, detached, "spring detent" escapements, moved the temperature compensation to the balance, and improved the design and manufacturing of balance springs. This combination of innovations served as the basis of marine chronometers until the electronic era.

Although industrial production methods began revolutionizing watchmaking in the middle of the 19th century, chronometer manufacture remained craft-based much longer. Around the turn of the 19th to 20th century, Swiss makers such as Ulysse Nardin made great strides toward incorporating modern production methods and using fully interchangeable parts, but it was only with the onset of World War II that the Hamilton Watch Company in the United States perfected the process of mass production, which enabled them to produce thousands of their superb Hamilton Model 21 & Hamilton Model 22 chronometers of World War Two for the United States Navy & Army and other Allied navies. Despite Hamilton's success, chronometers made in the old way never disappeared from the marketplace during the era of mechanical timekeepers. Mercer of St. Albans in Britain, for instance, continued to produce high-quality chronometers by traditional production methods well into the 1970s.

Without their accuracy and the accuracy of the feats of navigation that marine chronometers enabled, it is quite likely the ascendancy of the Royal Navy, and by extension that of the British Empire, would not have occurred; the formation of the empire by wars and conquests of colonies abroad took place in a period in which British vessels had reliable navigation due to the chronometer, while their Portuguese, Dutch, and French opponents did not. For example: the French were well established in India and other places before Britain, but were defeated by naval forces in the Seven Years' War.