

Chronometer History

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In 1707 a squadron of British men of war, being unsure of its position, ran aground and sank with the loss of 2,000 souls. This catastrophic event brought home the need of a timekeeper that would keep accurate time for navigation in a moving ship. The British Parliament initiated the development of this technology with a reward of 2,000 pounds for a timekeeper that would do this. A man named John Harrison came up with an instrument that worked in 1759. This design was produced and in use by 1772.

Over the years the chronometer was refined and improved but the basic design has remained unchanged. A chronometer repairman who was familiar with chronometers made for W.W.II would recognize and understand the function of everything in a 200-year-old chronometer. By the beginning of W.W.II, the ship's chronometer was a distinctive instrument, being unlike a clock or a watch. The clocks in observatories could use a pendulum in a vacuum, be mounted on a solid surface, and protected from temperature change. A watch had to be resistant to shocks, sudden movement, and different positions while running. The chronometer had to occupy an environment in between. The main spring was connected to a fusee device that delivered the driving power at a constant rate as the spring ran down. The escapement, the device that unlocks the drive train to the balance wheel, was a detent type escapement. This was different than the watch's lever escapement in that it was more precise but would not tolerate sudden rotational movement, which might stop it. The chronometer was mounted in a gimbal that allowed it to remain horizontal as the ship pitched. This was housed in a three piece box that allowed the chronometer to be observed through a pane of glass with the lid lifted while the bottom two sections remained closed to protect the works from sudden temperature changes. The chronometer's balance wheel was designed to be adjusted to run at the same rate at temperatures ranging from 40° F to 95° F.

Two weaknesses were common to chronometers that plagued chronometer makes up until W.W. II. These were acceleration, the tendency to gain in rate as the chronometer aged, and the middle temperature error. That is the tendency for the rate to be correct at the high and low temperature extremes but slightly fast at the mid temperature. These problems were not solved completely until W.W.II when the Hamilton Watch Company made chronometers with modern materials and an uncut balance wheel that could still adjust for temperature change.

Article Questions

1. When was the first marine chronometer designed?
2. Why was a chronometer needed?
3. How is a chronometer different than a clock or watch?
4. What were the two weaknesses of early chronometers?
5. How were these weaknesses overcome?