

“...the much desired
longitude...”

1707 the Association disaster (though due to latitude error)

longitude problem

- reward promised: Spain (1567), Portugal, Venice, Holland
- 1675 The Royal Observatory at Greenwich is founded to 'find the much desired longitude of places for perfecting the art of navigation' (lunar distance method)
- 1714 Act of Parliament: 20 000£ for error <0.5 degrees

Solutions

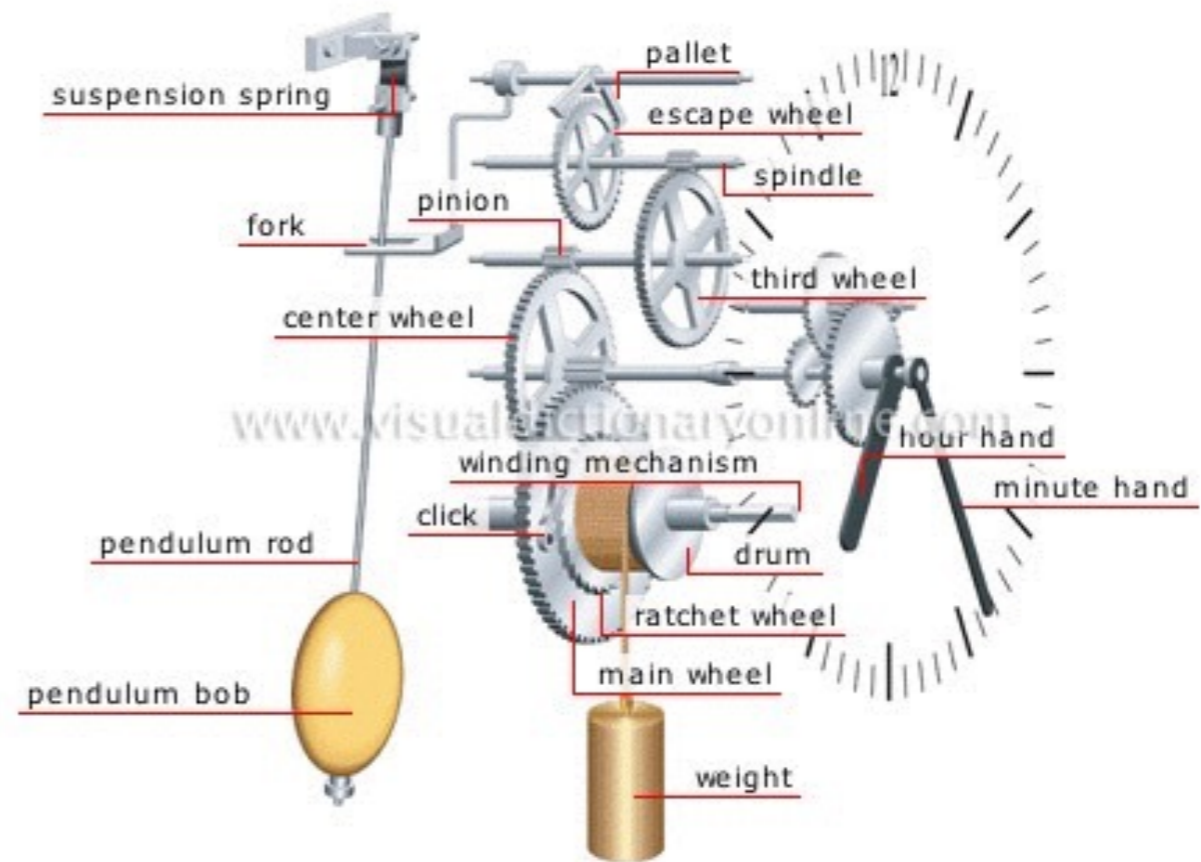
- 1688 Powder of sympathy (the wounded dog)
- 1713 Whiston & Ditton propose in “The Guardian” fixed barges with signalling rockets across the Atlantic
- lunar distance method: required detailed charts
- accurate portable timekeepers

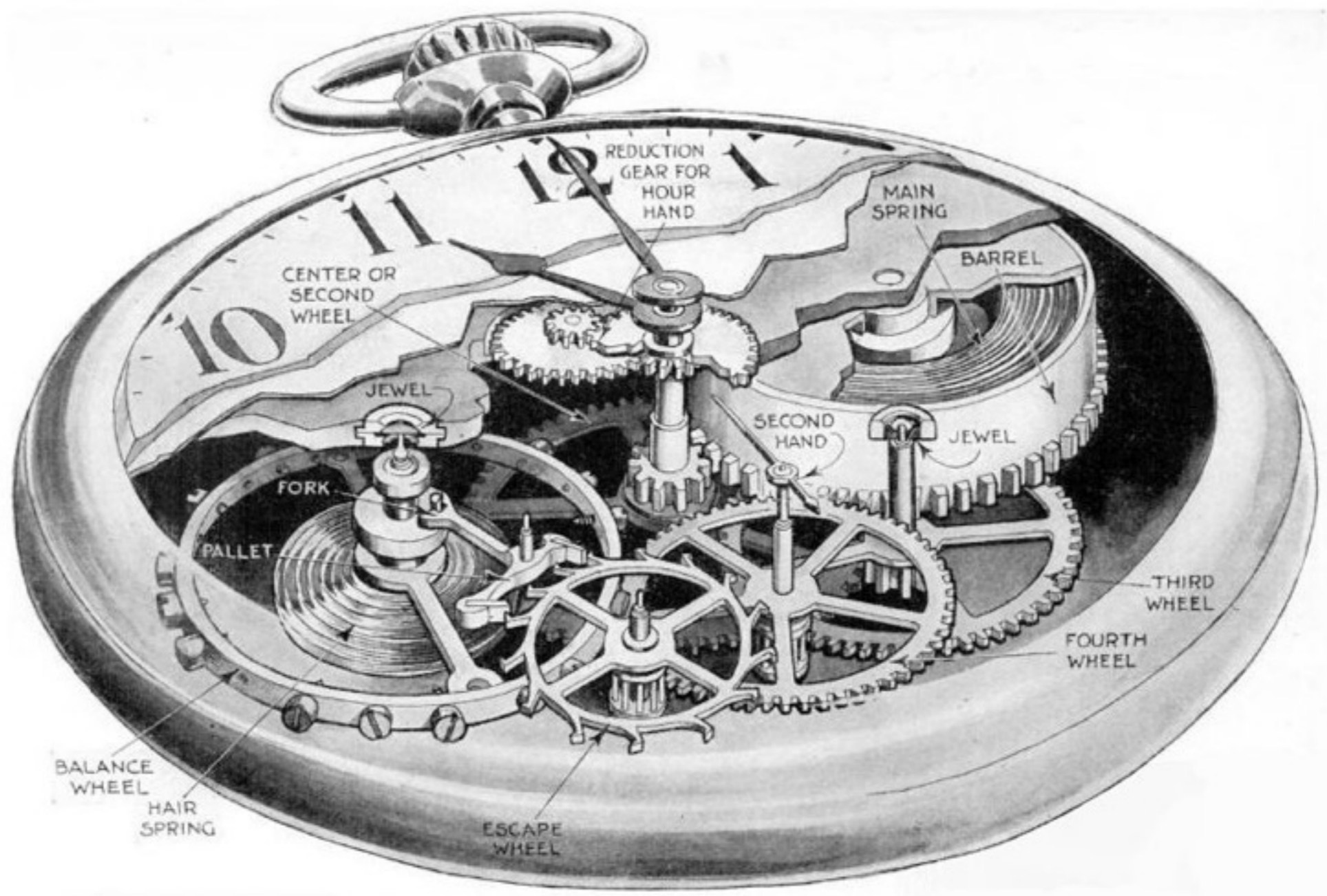
Solutions

- pendulum clocks: accurate, but not portable (ship movement + temperature variations)
- watches: portable(balance spring used as timekeeping element, rather than gravity), but not precise enough.

Basic clock mechanism

- power source(weight or spring)
- wheel train
- escapement
- control(pendulum or balance wheel)
- indicator





John Harrison

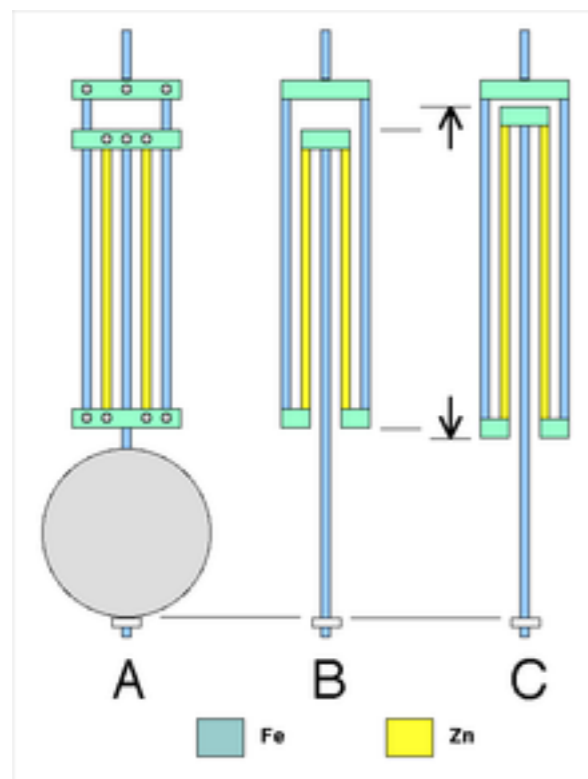
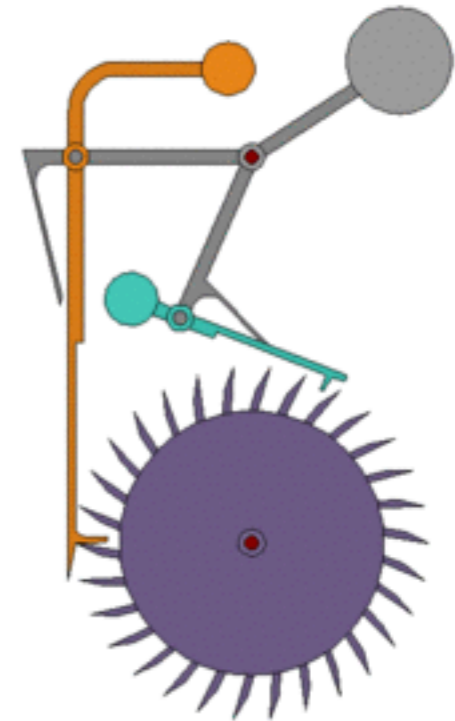
1693-1776

- obscure carpenter from Lincolnshire
- self-taught
- interested in music
- lived in Red Lion Square



John Harrison innovations

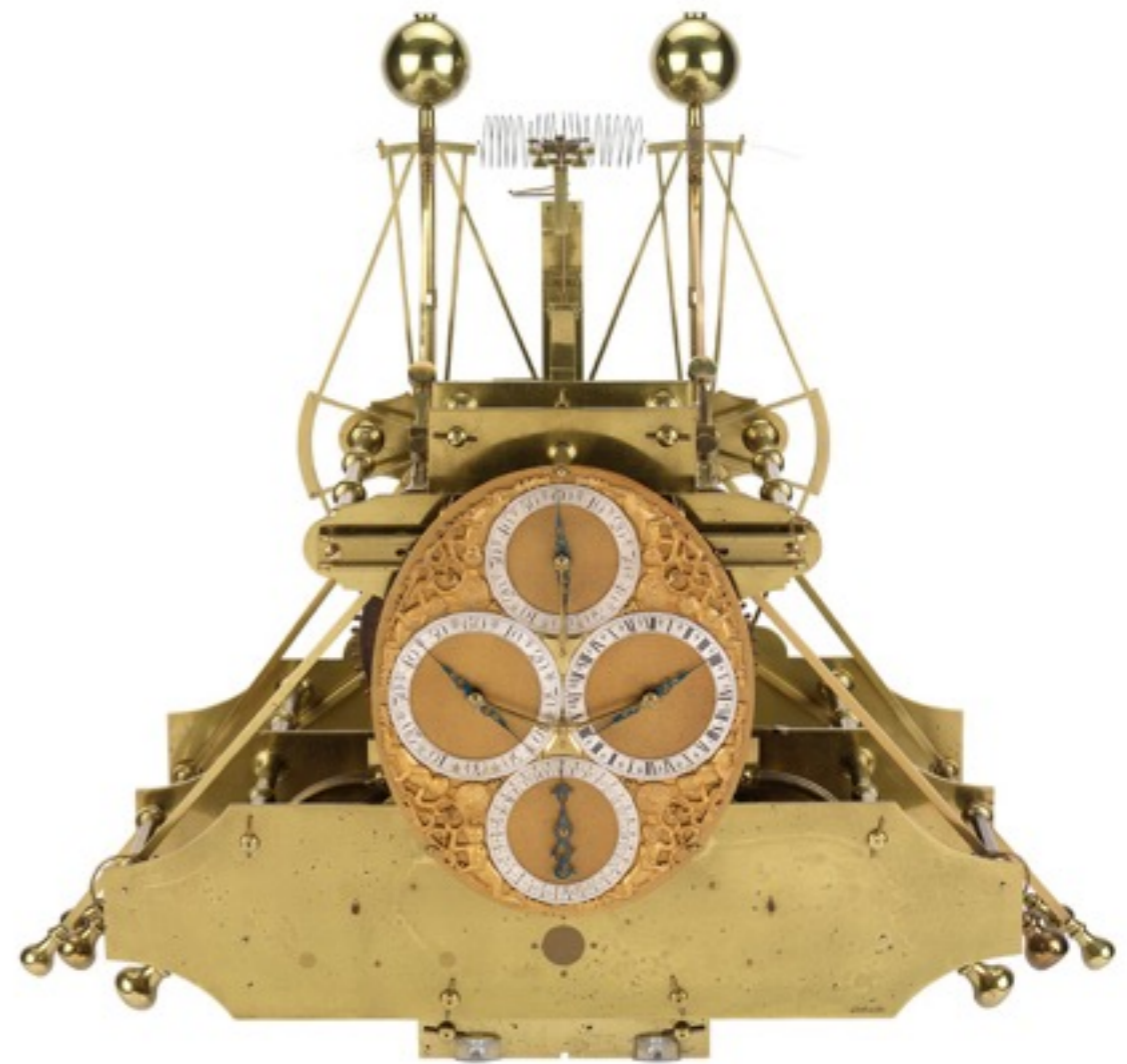
- no oil required: combination of material and design: lignum vitae and grasshopper escapement

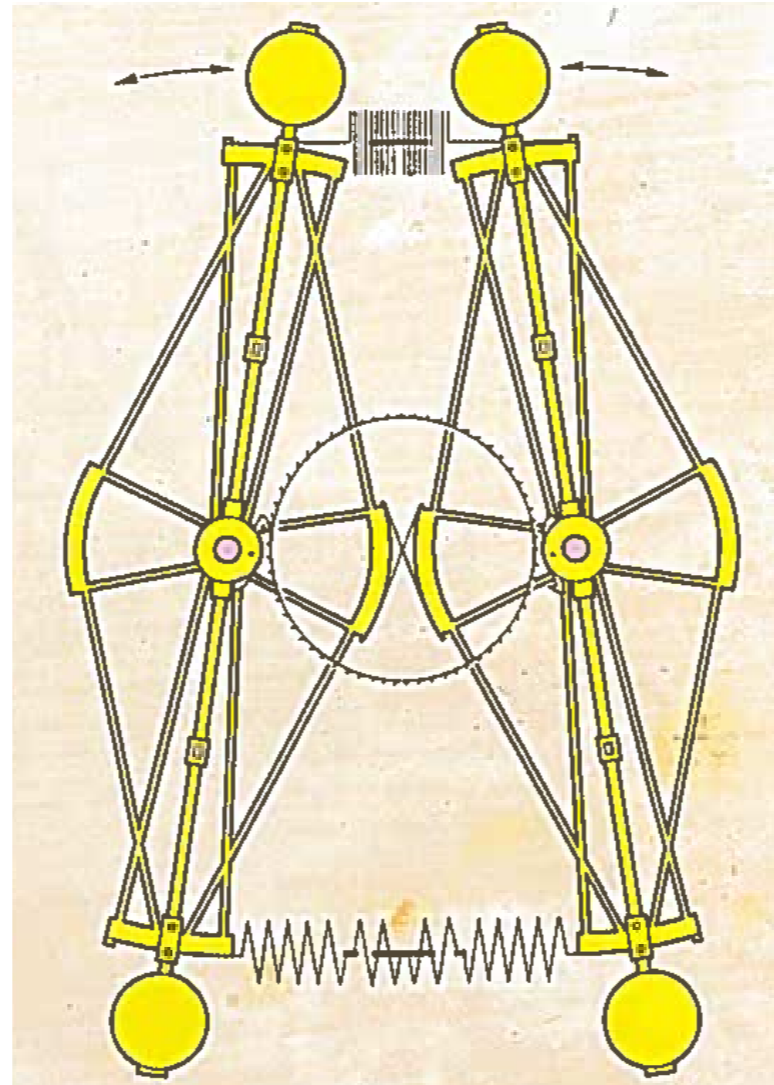


- temperature changes: the gridiron

H1

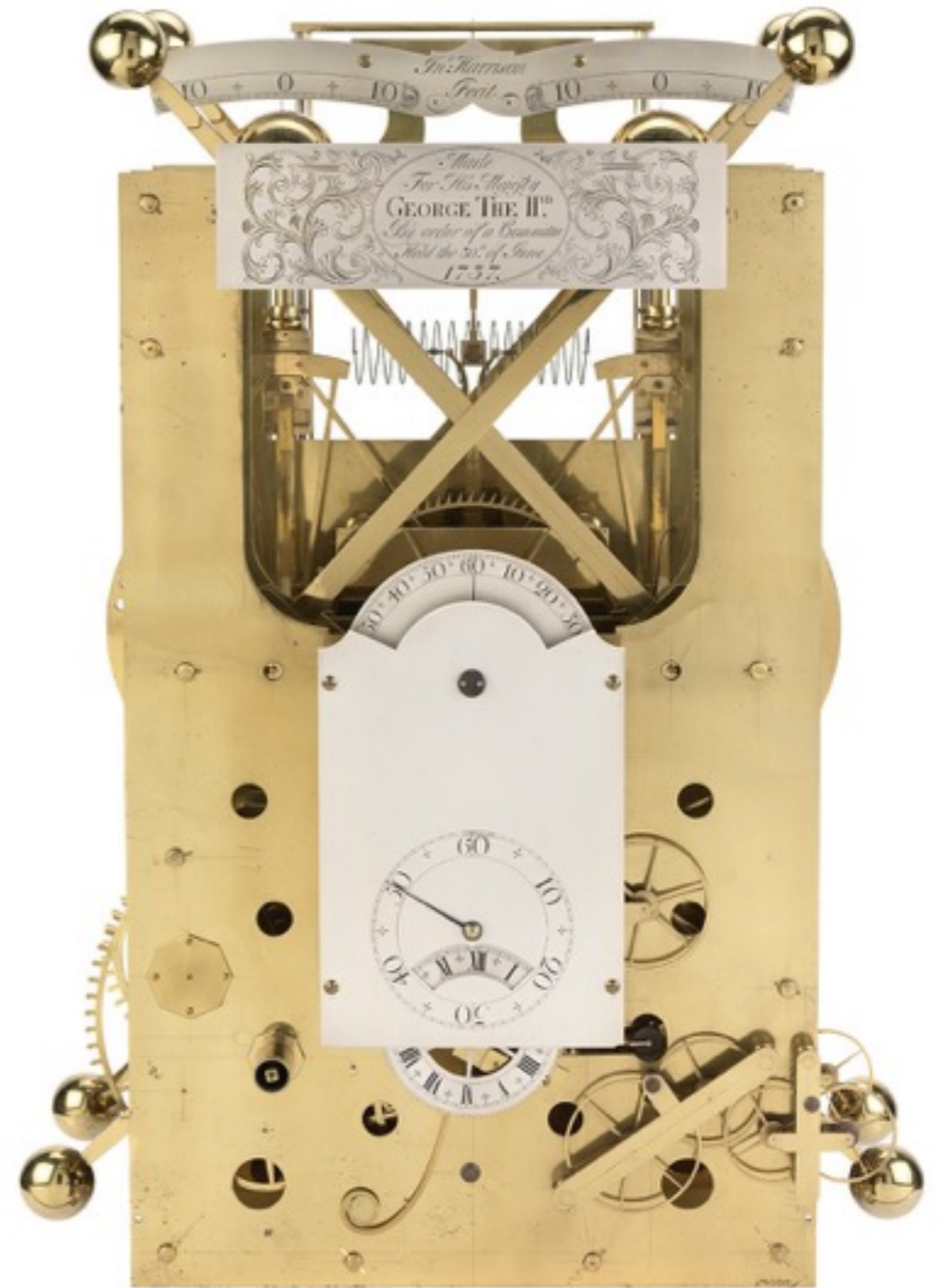
- artificial gravity: springs
- timekeeping element: a pair of bar balances
- automatic maintaining power while winding





H2

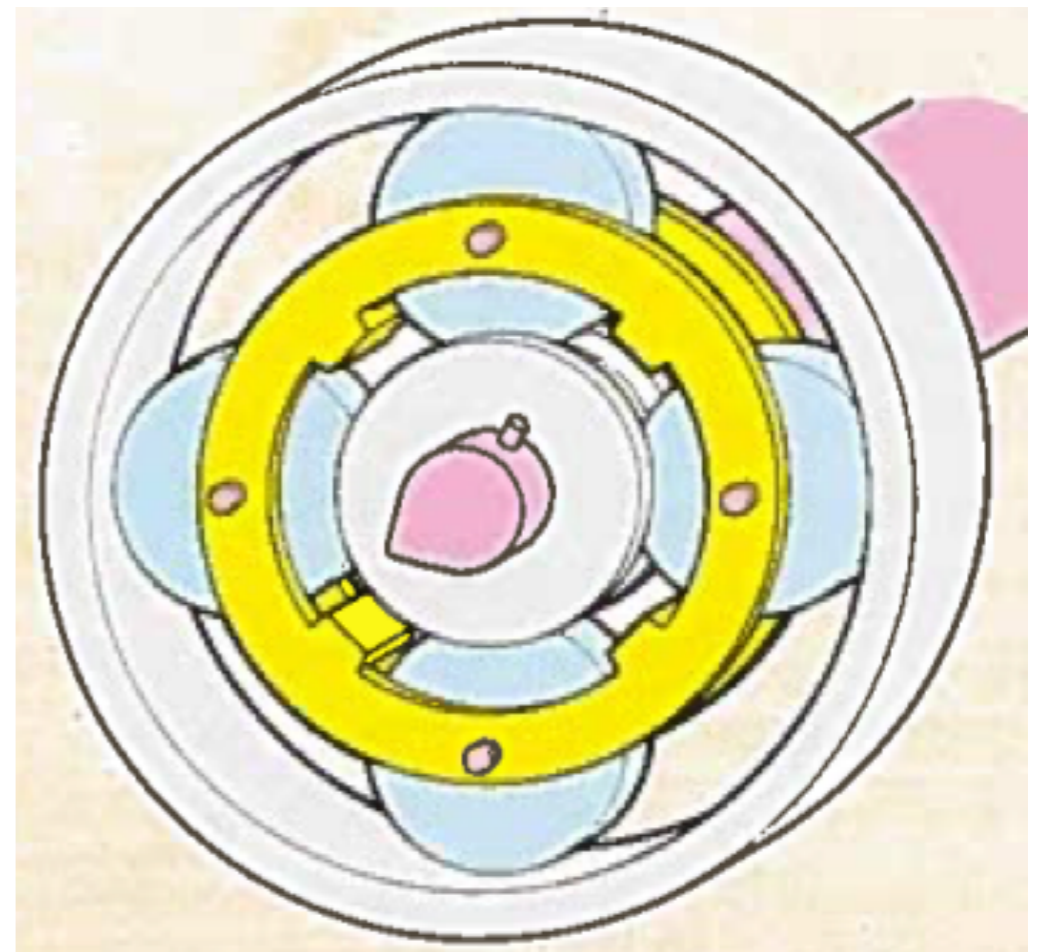
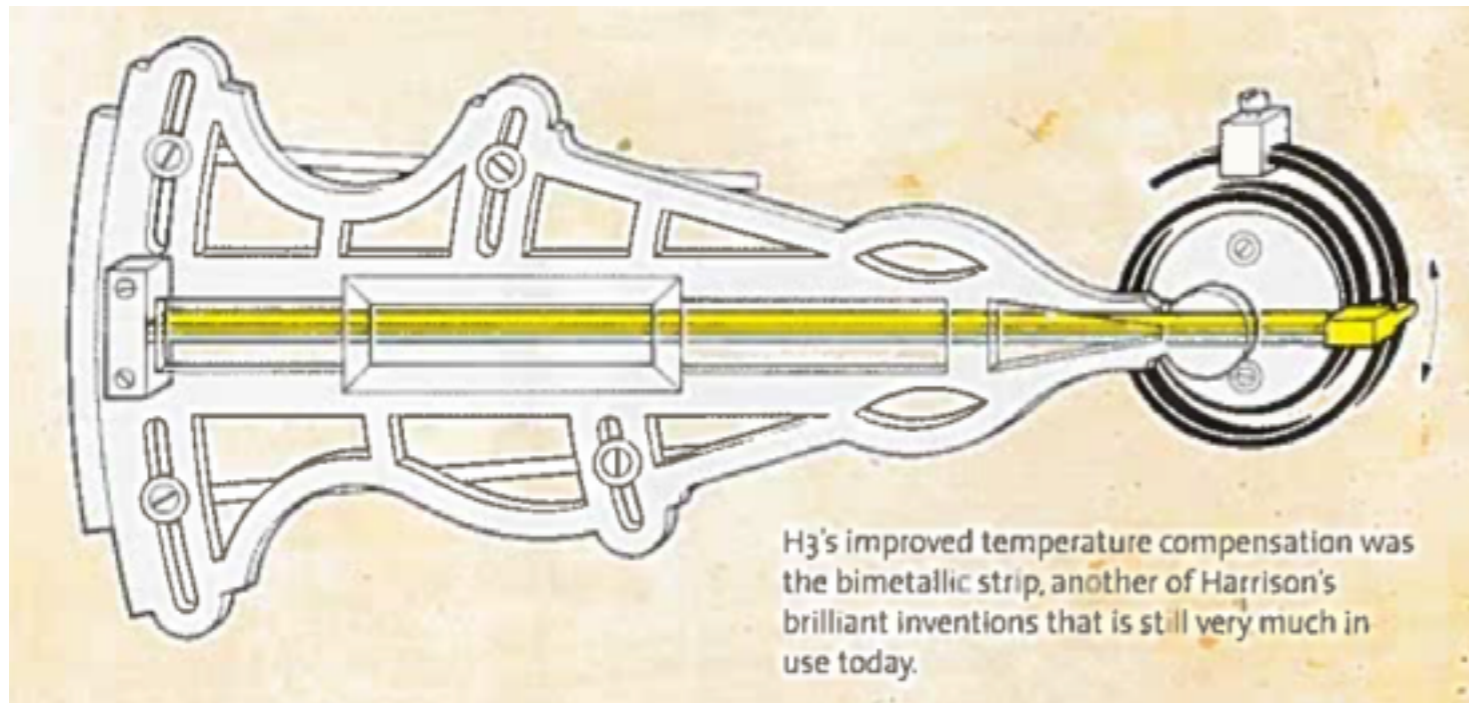
- remontoire (provides constant driving force to the escapement)
- but: sensitive to movement



H3

- balance bars replaced by wheels
- bimetallic strip
- caged roller bearing
- failure





H4

- improved watch:
higher energy
balance
- remontoir
- temperature
compensation
(bimetallic strip)
- isochronous verge
escapement
- accurate to within
5.1 seconds from
London to Jamaica

