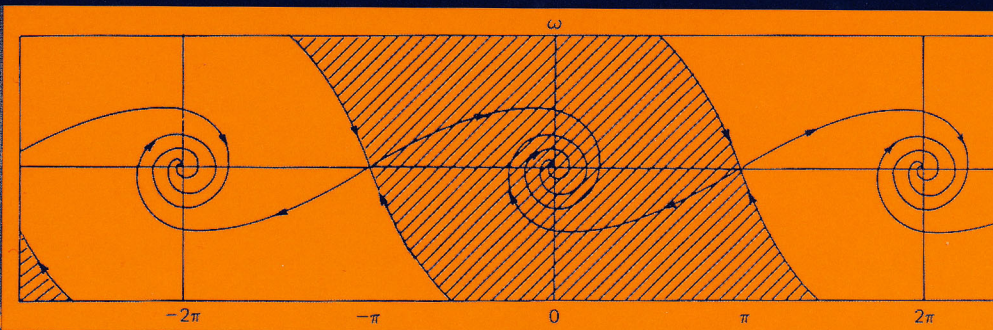
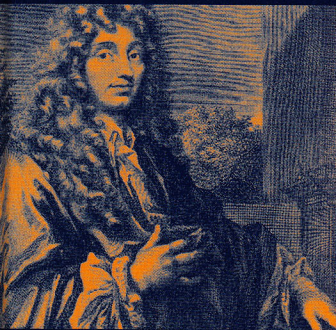


# The Pendulum

*a case study in physics*

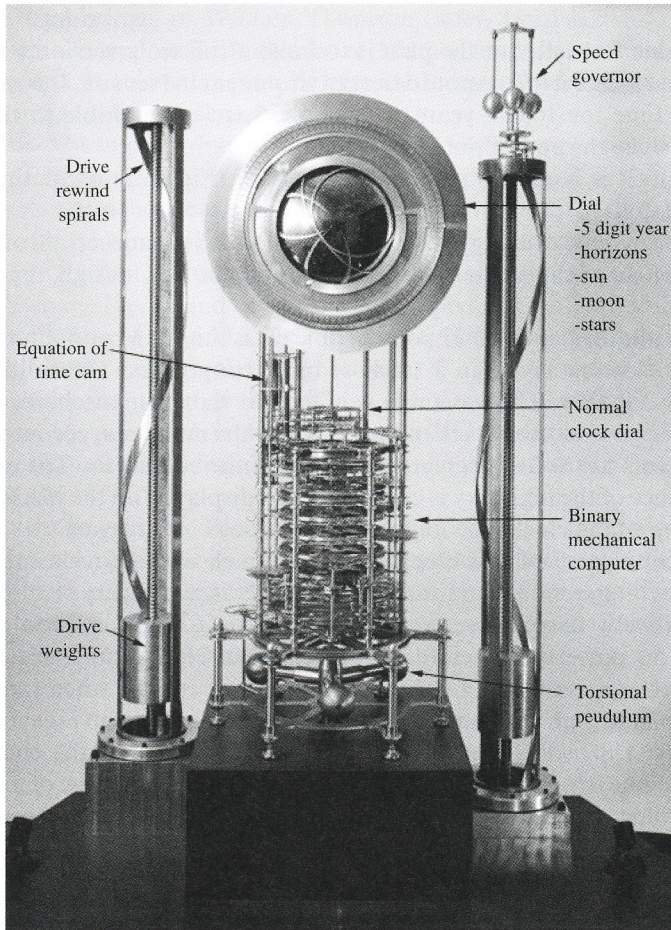


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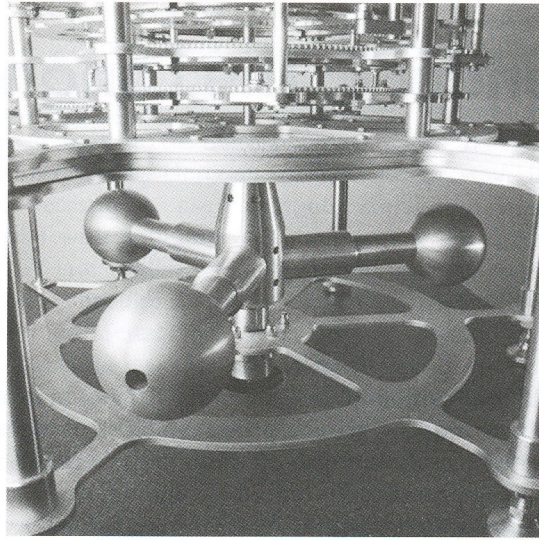
# Appendix E: The Longnow clock

In the April 2, 2000 edition of the New York Times, an article appeared describing an extraordinary torsion pendulum clock, designed by Danny Hillis and funded by The Long Now Foundation ([www.longnow.org](http://www.longnow.org)). The accompanying photograph, reproduced here (Fig. E.1) depicted the prototype of this startling design.



**Fig. E.1**

Overall view of the Longnow clock.  
(Photo credit Rolfe Horn, courtesy of  
the Long Now Foundation.)

**Fig. E.2**

Close up view of the triple mass torsion pendulum that is the heart of the Longnow clock. (Photo credit Rolfe Horn, courtesy of the Long Now Foundation.)

It is nine feet tall, but the plan is to build a full scale version ten times larger and locate it in a remote desert environment in Nevada. It is intended to keep time for 10,000 years, a symbolic span comparable to the time elapsed since the end of the last ice age.

The clock is based on a torsion pendulum (Fig. E.2) oscillating once every 30 s.

As in any clock, energy loss in the oscillator is made up through the action of an escapement which is powered, in this design, by falling weights.

In the photo, above the 22 pound triple mass tungsten pendulum, can be seen the first few layers in a stack of interacting gears. The full stack is visible in Fig. E.1. This assembly is in fact an elaborate mechanical computer, designed to keep track of time through the millennia, accounting for such factors as the 26,000 year precession of the equinoxes. The evolving appearance of the night sky is calculated and displayed on the black sphere at the top of the clock.

The conception of this clock is not so much about timekeeping, but about the intersection of art and technology. Nowadays very precise clocks are relatively inexpensive and very precise. Computers are equally cheap and powerful. Therefore, a mechanical clock and a mechanical computer are seemingly a throwback to earlier epochs when individual invention and high craftsmanship were hallmarks of human ingenuity and creativity. Harrison's clocks and marine chronometer of the eighteenth century come to mind. The Long Now clock reasserts the value of mankind in technology and looks to the future in a wonderfully anachronistic way.