Spark of inspiration

This apparatus, held in London's Science Museum, has some significant purpose — or curiosity value — in the history of physics. Can you guess what it is?

THESE TWO SIMPLE OBJECTS INDUCED THEIR OWNER TO MAKE FUNDAMENTAL DISCOVERIES. ANSWER NEXT MONTH.

Sir William Thomson, later Lord Kelvin, encouraged the use of harmonic analysis to predict tidal behaviour accurately. By breaking down the complicated pattern of the tide into measurable components — such as the lunar and solar semi-diurnals and the mean water level — and analysing each component in terms of simple fundamental frequencies, he reasoned it should be possible to predict tide behaviour for years to come.

Thomson had this instrument constructed in 1872–3 by A. Lège of London. It traces ten components. Each has a shaft with an overhead crank, which carries a pulley that can be adjusted according to the range of that component for a given port. The shafts are all geared together so that their periods are approximately proportional to the periods of the tidal constituents. The crank on each shaft can be clamped into a position corresponding to the epoch of whatever tide is required. Summing each component gives an overall tidal curve. A hanging weight, consisting of an inkbottle and glass pen, marks the tide level on a band of paper. The machine could draw a year's worth of tidal curves for a harbour in about four hours. At peak calculation speed, the smallest wheel in the gear train could be spinning at 1,600 revolutions per minute.

The original machine was not much used and Thomson deposited it with the South Kensington Museum in 1876. He developed more advanced models, and tide predictors became widely used in Indian ports. Over the years, engineers developed tide predictors that could handle more and more components; in 1928, German machines boasted 64 components. Tide-predicting machines were widely used until the 1960s, when digital computing rendered them obsolete.

Last month: Kelvin's first tide-predicting machine

Tidal analysis was just one aspect of Thomson's wide-ranging work. His work on signal transmission and submarine forces led to the laying of the first cable across the Atlantic, for which he was rewarded by being created Baron Kelvin of Largs in 1866. He was also a major figure in the development of thermodynamics: in 1848 he developed an absolute scale of heat, which, after some refinement by others, now forms the basis of the Kelvin temperature scale.

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