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# Memberline 01636 817617

## Covers



### Front

David Walter Double Pendulum clock. The left dial with mean/apparent solar time, perpetual calendar and sunrise sunset, the right dial is sidereal time and the lunar indication with a spherical moon.

### Back

Wall mounted Double Pendulum clock of mahogany with extensive raised ebony inlays.

Special thanks to Bill Taylor ASC, Hon FBHI for the photographs.

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# Double Pendulum Clock with Perpetual Calendar

# David Walter reveals his latest timepiece.

This is my latest double pendulum clock which continues the development based on Breguet No 3671, (*HJ October 2010*). This new clock has all the features of the double pendulum clock described in this issue, with the addition of a perpetual calendar and sunrise/sunset indications, all of which are fitted to the left had mean/apparent solar time movement.

The perpetual calendar mechanism was designed and patented by Dr George Daniels (see *Watchmaking* by George Daniels, 1985 revised edition, plate XXII and Plate XX for the watch it is fitted to). To my knowledge only George Daniels and I have used this excellent perpetual mechanism.



1. Mean/apparent solar time movement with perpetual calendar and sunrise/sunset indications.

### Features

Height 85¼in 217cm Width 27in 69cm Depth 14¼in 36cm Full 4-year perpetual calendar Instant change at midnight

Retrograde date function

Retrograde date hand has a square aperture framing the date. Indications for day, date, month, and leap year

Sunrise and sunset sectors in the arch

Equation annual calendar aperture under the date hand. Sunrise/sunset annual calendar aperture above the minute hand

Equation hand and the sunrise hand are made in 18k gold Riefler style solid brass pendulum bobs



2. Mean/apparent solar time movement showing the triple plate design.



3. The perpetual mechanism plate.

#### Evolution

At the time of delivering and installing a double pendulum clock and, after fully describing the complications devised by Breguet, plus the improvements and complications which I have added to the Double Pendulum clock, I was asked by the client if there were any further complications I could add to another clock. While I was considering this possibility, I was asked if I could design and fit a perpetual calendar to a double pendulum clock. After a few moments thought reflecting on several previous clocks I had created in the 1990s using the George Daniels perpetual mechanism, I replied, that I believed I could.

A short time later another client asked if a sunrise/sunset indication could be added to the perpetual movement and dial. These features are now displayed on the mean/apparent solar dial of the current clock. A further request was to have Riefler style pendulum bobs fitted rather than the Janvier type bobs I had previously used. Each bob is turned from a solid piece of brass 230mm (9 in) in diameter x 45mm (1<sup>3</sup>/<sub>4</sub>in) thick; the V shape of the bob plus a rounded periphery creates a very



4. Sunrise/sunset with annual calendar.



5. Retrograde date hand, with equation date.

aerodynamic pendulum bob. The cross hole for the pendulum rod is drilled before turning to shape.

### The Movement

Of particular importance in a clock with two separate dials is maintaining their symmetry. With the addition of the perpetual calendar, the total height of two movements and dials must remain the same. This meant a redesign of the left hand



6. Perpetual parts.



8. Weight & jeweled pulley with unique DW hook & eye.

movement as the center wheel and barrel arbors had to be repositioned to accommodate the new complications.

The movement is constructed in layers using three plates. The perpetual calendar and sunrise/sunset work are on the plate immediately under the dial, while the equation work is mounted on the central plate. A benefit is providing easy access to each of the complications without having to interfere with or disassemble the perpetual work. The perpetual plate simply lifts off the movement after the four extended pillars are unscrewed; these pillars double as the dial feet.

The perpetual calendar changes instantly at midnight. This is triggered by a hard steel cam mounted on a 24-hour wheel within the equation mechanism. A pivoted control lever mounted on the perpetual plate is fitted with an extended foot that rests against the 24-hour cam. When the foot falls off the cam tip, it simultaneously advances the date, the day, and (if it is the last day of the month), changes the month, the leap year



7. Perpetual discs assembled.



9. Top case mouldings.

indication, and the retrograde mechanism for the date, which returns the square aperture date hand to 1.

### The Daniels perpetual mechanism

This is located at the lower left of the perpetual plate. While at first glance this system looks simple, it is quite complex but very reliable in operation. The photos below show the separate and assembled components. Screwed to the long shaft is one of the 12-tooth star wheels and the 12-month disc, which has a cutout for February. A hollow shaft slides over the longer shaft. Attached to the hollow shaft is the four-year disc, a portion of which is stepped for the leap years, and a wheel driven by the pinion attached to the second star wheel. This assembly provides the 4-year rotation necessary for the leap year disc.

#### Sunrise-sunset mechanism

A wheel with pointed teeth is moved forward by a pin on the hour wheel which meshes with two more wheels and a pinion to turn the attached annual disc with the sunrise and sunset cams once per year. Two hardened steel followers mounted on shafts are held against the cams with light spring tension and the hands are fitted to these shafts.

The cams are marked with the latitude they were designed for. David Walter

