



Both the astrolabe and cross-staff required that the observer look directly into the sun. On bright days, the glare was blinding. To solve this problem, the English sea captain and navigator John Davis invented the back-staff. It consisted of a staff with a sliding half-cross or transom. The observer began by turning his back to the sun. Then he slid the transom along the staff until it cast a shadow on a small plate at the front. Through this, the observer could sight the horizon.

John Davis also invented the quadrant, with the help of Edward Wright, a mathematician from Cambridge. This device had an eye piece on a transom through which the observer sighted the horizon and the reflected sun.

Pierre Bouguer, a professor of *hydrography* at Croissic, made further improvements to the quadrant, including a transom to bring down the reflected sun to the horizon.

The octant was developed in England by John Hadley and first tested in 1732. It included a reflecting telescope and spirit level, and was much more accurate than any other instrument previously used at sea.

TRAVERSE BOARDS

By 1600 navigators were using traverse boards for reckoning the position of a ship on its course. At the top of the board was a compass rose with eight holes for pegs drilled in each of the thirty-two points. Pegs were hung from cords in the centre. Each half hour, as the ship sailed along its course, the helmsman on watch would place a peg in the point of sail — north, north-east, east, etc. — travelled. Time was kept with a sand glass.

The rows of holes along the bottom of the board were for calculating the speed of the ship in nautical miles or knots and tenths of a knot. Once each

