THE GODFREY SEXTANT

by

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The invention of the sextant two hundred years ago may be truly characterised as epoch-making in the annals of navigation. With this instrument the navigator was first given a means of measuring the altitudes of heavenly bodies above the sea horizon with accuracy and ease regardless of the motion of the ship. He was thus enabled to obtain an accurate fix from astronomical observations instead of being compelled to rely upon rough estimates based on observations obtained with the crude and cumbersome instruments in use prior to that time.

In addition the sextant permits the accurate measurement of horizontal angles which, before the invention of the sextant, had to be measured by compass with all the inaccuracies and inconveniences inherent in that method. Further, since the sextant can be used from any position aboard ship the observations are not confined to objects which are visible from the deck.

The sextant was so well adapted to the purpose of astronomical observations at sea that with the exception of a few slight modifications and improvements the original design has been retained for the past two hundred years,

As a result of the invention of this handy instrument and the perfection of the ship's chronometer, which followed a short time later, the science of navigation was given a new impetus with a consequent reaction on the associated science of hydrography. With the means at hand for obtaining greater accuracy in the astronomical fix at sea, the need for more accurate charts became apparent. Thus we may ascribe to the sextant the great advance which has since been made in the allied sciences of navigation and hydrography and the progress which has been made towards making navigation safer and easier on all the seas of the world.

Strangely enough this invention, of such vital importance to the seafaring world, was made almost simultaneously but quite independently, by two scientists in widely separate parts of the world, one, Thomas GODFREY of Philadelphia, in what was then a colony of Great Britain, and the other, Captain HADLEY of England.

The first instrument was constructed by GODFREY in 1730 and a description of the invention was laid before the Royal Society about two years later in 1732. In October, 1730, GODFREY wrote a letter to Mr. James LOGAN of Philadelphia, in which he set forth the full description of his invention. He wrote a similar letter to the Royal Society but decided not to send it pending a reply from LOGAN. LOGAN, however, did nothing about the matter for more than a year, but finally wrote to Mr. Edmund HALLEY of the Royal Society in May 1732, transmitting therewith a description of the invention, little

doubting but that it would be entirely new. The records show that the original papers of Thomas GODFREY were filed by Peter COLLINSON with the Royal Society, London.

GODFREY'S instrument was used in navigating the sloop *Truman* on a voyage to Jamaica in November 1730 and later on a voyage to Newfoundland in 1731.

The presentation of GODFREY'S papers to the Royal Society raised the question as to who was really the inventor of what is now known as the sextant. It appears that Captain HADLEY of England had, in May 1731, presented to Mr. Edmund HALLEY of the Royal Society, a description of his sextant. The Society, after a thorough investigation, decided that the idea was original to both GODFREY and HADLEY and awarded to each a prize of £200. GODFREY'S claim was particularly well supported in two affidavits sworn to by the Mayor of Philadelphia, in which were set forth the facts pertaining to the use of GODFREY'S invention on board the sloop *Truman* in 1730 and 1731.

Immediately after the presentation of Captain HADLEY'S papers to the Royal Society, Mr. Edmund HALLEY stated that NEWTON had made some progress towards the invention of a sextant, and had, in 1699, communicated an account to the Royal Society.

Pending the final decision, HALLEY looked up these papers and found nothing therein concerning any new principles of construction.

In fact, so far as can be learned, no instrument embodying NEWTON'S idea was ever constructed. NEWTON had eliminated some of the faults of the crude instruments that had been in use before the invention of HADLEY and GODFREY to measure the altitude of the sun, but NEWTON'S work, so far as the Royal Society was concerned, did not bring him recognition as the inventor of the sextant.

It may be desirable therefore to refer to *Philosophical Transactions* for the year 1733-4 in which Mr. LOGAN'S letter to the Society sets forth the description of GODFREY'S principles of construction.

The DAVIS Quadrant, the instrument then in use by navigators, sufficed only when the sun's altitude was low and in mild weather. There was great need for some other instrument which could be used with speed and accuracy in rough weather.

Of GODFREY'S instrument LOGAN says :—

"Bow had best be an arch of about 100 degrees, well graduated and numbered both ways ; a radius of 20 or 24 inches, the curve at the centre 1/20 of the radius on each side ; that is, 1/10 of it in the whole ; the radius of that curve 64/100 parts of the radius of the instrument ; that the glass for the Solar Vane should not be less, but rather longer, than a silver shilling, with its vertex most exactly set. And that the utmost care be taken to place the middle of the curve at the centre exactly perpendicular to the line or radius of 45 degrees. As the observer must also take care that the two vanes

on the limb be kept nearly equi-distant from that degree, to which I shall only add that it may be best to give the horizontal vane only one aperture and not two; the rest I suppose may be left to the workmen."

After his signature to the letter, dated at Philadelphia, 25th June, 1734, Mr. LOGAN adds this note :—

"That the Radius of the Quadrant being divided into 20 equal parts, the Centre of the Curvature of the Horizontal Vane (————) must be 12-8/10 of those Parts from the Centre (*c*) of the Quadrant. The Breadth (————) of that Vane should 1/10 of the whole Radius, that is 1/20 on each side of the Centre (*c*)."

This description is couched in the language of the day and is somewhat difficult to comprehend but it is the only original description found in all references consulted.

An exhaustive search through the various publications in the U. S. Observatory, the U. S. Congressional Library and the archives of the Royal Society in London, has failed to bring forth any plates, illustrations, etc., of the original GODFREY Sextant.

Almost immediately after the presentation and settlement of the claims of both HADLEY and GODFREY in 1734, HADLEY built an improved instrument from which the present day sextant has evolved and which differs little from it. It is this improved sextant and not the original GODFREY and HADLEY instrument which is described in the various scientific papers and encyclopaedias.

Thomas GODFREY, born in Philadelphia in 1704, was and is credited with being the inventor of a sextant, as is also Captain HADLEY of England. He was a glazier by trade and quite accidentally chanced to read a book on mathematics. This subject absorbed him to such an extent that he rarely attended to his trade.

GODFREY, his wife and children, lived in the house of Benjamin FRANKLIN, one of the greatest scientists the world has produced, and, as a matter of fact, maintained his glazier's shop in that house. FRANKLIN boarded with GODFREY and his family and spoke frequently of GODFREY in his writings.

As to his personal characteristics, FRANKLIN found him unpleasant and described him as "knowing little out of his way." He was a member of a mutual improvement club, the "Junto" and FRANKLIN, also a member, states: "He was a self-made mathematician, great in his way and afterwards (1730) inventor of what is now called the HADLEY'S Quadrant... Like most great mathematicians I have met with, he expects universal precision in everything said and was forever denying and distinguishing upon trifles to the disturbance of all conversations."

Incidentally this generalisation of FRANKLIN about "most great mathematicians" later caused much discussion and received wide quotation by those opponents of the mathematical sciences.

GODFREY'S passion for mathematics led him to a study of Latin in order that he might read and study NEWTON'S *Principia*. Although GODFREY'S

brother was a seafaring man, it is generally believed that GODFREY'S invention of the sextant resulted from his passion for the sciences of mathematics, astronomy and optics alone.

NOTE. — The valuable information which forms the basis of this article was kindly furnished by the Superintendent of the U. S. Naval Observatory to whom thanks are due.

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