FLAMSTEED'S WELL

By P. S. Laurie

A recent paper by Alex G. Smith (see Note, p. 36) draws attention to the common belief, held since classical times, that stars can be seen in daytime from the bottom of a deep shaft. There has been a popular legend for many years that John Flamsteed, the first Astronomer Royal, sank a well at the Royal Observatory for this purpose. The truth however, is much more likely to be that he wished to use the well for obtaining the zenith distance of γ Draconis, being anxious to measure the "annual parallax of the Earth", as he called it, to prove the Copernican theory of the Earth's motion.

As the chances of making accurate observations were better in the case of γ Draconis, which passes close to the zenith at Greenwich, it appears that the well was an ingenious attempt to obtain the stability that a long-focus telescope was unable to give. If the objective were placed horizontally, then the eyepiece could be used in the place of a plumb-bob, and in this way Flamsteed no doubt hoped to measure the zenith distance with great accuracy.

The very existence of the well has long been a subject of controversy, in spite of two illustrations in the 1712 edition of *Historia Coelestis*, showing it fitted with a spiral staircase and a roofed entrance similar to the "pineapple" tops of the summer-houses in the North Terrace of the Observatory. That the well did, in fact, exist, seems certain from some facts additional to those mentioned by Maunder and Lynn in their correspondence[1] on the subject. As far back as 1862, Airy had collected a good deal of information about the site of the well, which he placed a short distance south-east of Flamsteed House, outside the original boundary of the grounds. A subsidence in 1881 strengthened this view.

In correspondence with his patron, Sir Jonas Moore, Flamsteed mentions the well in a letter[2] dated 1677 November 14:—"I shall also today examine whereabouts in the well the stones must be placed that we may order them the better". This and other remarks evidently refer to fixing an object glass and making allowance for its adjustment. Francis Baily was the only writer to notice an observation actually made in the well[3]: on 1679 July 30 Flamsteed noted "Ego in puteo subterraneo observavi transitum lucidae in capite Draconis", which seems definite enough, while further evidence, although not of an astronomical nature, is found on 1679 February 20. In a letter dealing with height determination by means of the barometer, he writes[2] ". . . (the barometer stood) on the House top at 29^{inc} 35^{c} and at the bottom of the well Thomas Smith noted it at 29^{inc} 57^{c} so that in about 61 yards ascent it subsided 2/10 of an inch". Allowing for the height of the building and the drop in the ground, these figures give a depth of some 130 feet, which is in reasonable agreement with the only others to be found, namely 100 and 120 feet.

The object glass for use in the well was in Flamsteed's hands as early as 1677 January. By November of that year he was testing it on terrestrial objects[4] and making experiments with stops to improve resolution; comparing it with one of Cox's lenses he found "the ffrench the better of the two". In 1676 September a note appeared in *Phil. Trans.* that

Borelli[5] was offering his objectives on the open market, and later Sir Jonas inserted a price-list in the same publication,[6] the inference being that he had purchased one for Flamsteed's use.

It is recorded in the *Journal of the Royal Society*[7] that on "November 3, 1737, Mr. Hodgson made a present of the object glass of a 90-foot tube, being that which Mr. Flamsteed designed to have used in the well at the Observatory at Greenwich, but was prevented by the damp of the place." This was the James Hodgson, assistant at Greenwich 1696–1702, who married Flamsteed's niece and inherited some of his property.

The object glass, some $9\frac{3}{4}$ inches diameter and rather badly scratched and chipped, is at present on view at the Science Museum.

Flamsteed's well was a failure, but although he doubtless hoped to use this lens to make observations of γ Draconis by day, there is nothing to show that he expected to do so by virtue of the depth of the shaft.

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References

(1) *The Observatory*, **26**, 102, 138, 179 (1903).
(2) Greenwich records, quoted here by permission of the Astronomer Royal.
(3) *Life of the Rev. John Flamsteed*, 1835.
(4) Flamsteed's account of these tests strongly indicates that the large telescope shown in *Historia Coelestis* 1712, and on a manuscript plan, was originally erected for this purpose. After the failure of the well, the pole-and-tube mounting may have been adapted for general use with a 60-foot object glass.
(5) *Phil. Trans.*, XI, 691, 1677. Pierre Borel (1620–1689), member of the Académie Royale des Sciences and author of *De vero telescopii inventore*, 1656, is often confused with Giovanni Borelli (1608–1679) owing to the identical latinizing of their names into "Borellus". Although in connection with these long-focus lenses the *Philosophical Transactions* and *Mémoires de l'Académie Royale des Sciences* both refer to "Borelli"; the Académie des Sciences confirms that the maker was Borel.
(6) *Phil. Trans.*, XII, 1005, 1678.
(7) C. R. Weld, *History of the Royal Society*, Vol. I, p. 255.

THE FLAMSTEED 90-FOOT LENS

By A. Hunter and E. G. Martin

Through the kindness of Dr. Calvert, the Science Museum, South Kensington, have recently allowed us to examine this lens, now the property of the Royal Society, to whom it was given by James Hodgson in 1737.

The lens is 9·75 inches in diameter, 0·36 inches thick and weighs $39\frac{1}{2}$ ounces. One surface is nearly plane, the other having a number of patches, each about a quarter of an inch square, which are no longer transparent. There are several considerable chips in the edge of the lens. Two main tests were made. First the lens was set up in the upper gallery of the Observatory, where it is possible to project a beam over a length of 100 feet. A sodium lamp illuminated an artificial star (pinhole) which was projected through the lens to a 16-inch flat mirror, thence reflected back through the lens to an eyepiece or knife-edge close to the artificial source.