THE BUILDINGS AND OLD INSTRUMENTS OF THE ROYAL OBSERVATORY, GREENWICH

By P. S. Laurie

"Whereas, in order to the finding out of the longitude of places, for perfecting navigation and astronomy, we have resolved to build a small observatory within our Park at Greenwich, upon the highest ground."

So reads the beginning of the Royal Warrant for building the Royal Observatory, dated 1675 June 22. On Friday August 10 of the same year, the newly-appointed John Flamsteed (1646–1719) laid the foundation stone at 3.14 p.m., as he duly noted. Wren's building, designed "for the Observator's habitation and a little for pompe", was ready for occupation by 1676 July 10.

The original building consisted of little more than the dwelling-apartments and, above them, what is now known as the Octagon Room, a term apparently first used by G. B. Airy (1801–92) in 1835; the older name was always the Great Room. This room, 34 feet across and 18 feet high, is now restored to practically the same condition as when Flamsteed worked there. It was the *camera stellata*, from which a considerable proportion of the observations were to be made, the interior of which is shown in the well-known print from Flamsteed's *Historia Coelestis*. The four windows were glazed with small panes but capable of being opened to give uninterrupted views. Over the door hung two large paintings, one of the Observatory's founder, Charles II, and the other probably of his brother, James II. Three clock dials are shown, two being the work of Thomas Tompion (1639–1713) and the third perhaps being one of Flamsteed's own. An interesting point about these Tompion timekeepers is that they had 13-foot pendulums, beating two seconds, suspended above them. Three people are shown in the illustration, one engaged in noting down the observations, while the others are using a quadrant and a refractor from the north and east windows.

The plaque over the external door, commemorating the foundation of the Observatory, bears the name, in addition to that of Charles II, of Sir Jonas Moore (1617–79) Surveyor-General of Ordnance. When, in the course of repairs, the lettering was restored in 1876, the Astronomer Royal wrote in his report: "I scarcely need to add that I shall be careful to avoid interference with the venerable Tablet, whose noble and simple enunciations of the purpose of the Observatory has, I am persuaded, been most beneficial to its constant conduct."

The additional building and meridian wall were in the south-eastern corner of the grounds, which were then no more than a rectangle extending from the "summer houses" on the North Terrace to the southern wall of the upper lawn. The main entrance was only a few yards to the east of the present front door of the dwelling-house. A deep well for observations of γ Draconis was dug to the south-east, just outside the Observatory grounds.[1] It was unsuccessful and soon fell into disuse.

Entirely unprovided with instruments by the Government, the new Astronomer Royal was hard pressed to obtain the bare essentials for observing.

Sir Jonas Moore, who was Flamsteed's patron, provided a large sextant and two astronomical clocks "with charge", as the recipient carefully noted, "to dispose of them by my will". The sextant was designed by Flamsteed when staying with Moore at the Tower before taking up his appointment. The frame was of iron, and the brass limb, of radius 6 feet 9 inches, was fixed on by Tompion, who also contructed the index telescope and revolution-counter. The whole was supported on a stout iron polar axis. With this first instrument the Astronomer Royal "began to measure distances in ye Heavens" on 1676 September 19, but by December of the following year the sextant was altered, diagonal divisions being cut on the limb as the revolution-counter was already wearing.

Moore had also lent a small quadrant (probably of 18-inch radius) and Flamsteed had himself provided a similar instrument "of about 3 feet radius" for checking the clocks. These proved unsatisfactory, as did yet another quadrant made by Robert Hooke (1635–1703). The small sums spent on maintenance, however, indicate the difficulties of the financial position.

1677 Jan 10.	For the object glass of the wall quadrant	3s. 0d.
	For the eye glass	4s. 6d.
1678 Sept.	Repairing the tube of the sextant	2s. 6d.

Between 1680 and 1683 Flamsteed made a "Voluble" quadrant and a meridian arc, but both failed through instability and it was not until his father's death in 1688 that he was in a position to procure a reliable instrument.

Abraham Sharp (1651–1742) constructed the 140° mural arc of 79½ inches radius and "strengthened the rim with screws, and carved divisions upon it, affixed an index, and made all and each of its parts so skilfully that it was a source of admiration to every experienced person who beheld it". The counterbalanced index telescope had convex lenses and cross-threads; the frame was of much greater strength and better design than its predecessors, the whole instrument taking 14 months to complete and costing over £100. From 1676 to 1689 Flamsteed made 20,000 observations with the sextant and by 1703 had brought the total up to 30,000 by means of the mural arc.

The Board of Visitors, making their first report on 1713/4 February 18, stated "that in the garden there is a shed with a sextant and wall quadrant and a clock therein" adding, with a touch of reproof, that "the sextant is grown rusty and should be cleaned".

Although none of the original instruments survives there is a representative quadrant by Sharp on view at Greenwich. This was presented to the Royal Observatory in 1865, after its rescue from being melted down by a tinman. It has three understrutted iron radii to which the brass arc is fixed; this consists of four pieces of thin sheet metal, 10 inches wide at the middle and a little more at the edges. The outer radius is 5 feet and the arc extends three degrees beyond the quadrant at one end and fourteen degrees at the other. The divisions, of fine workmanship, can be read by eye to 36 seconds, but the whole is very weak and has evidently never had the movable index attached. Early plans and illustrations also show an 80-foot mast, with a 60-foot telescope suspended from it, fixed in the middle of the upper lawn, around the edges of which were arranged several flower-beds.

Flamsteed himself gives us a very brief glimpse of the interior of the dwelling-house in an account of a fireball on 1719 April 19. "Being set by

the fire in my chamber, a Table before me with Candle upon it blazing, the flash on my window made the light of the candle disappear and the Maps of the World and all things in the room much plainer than in the bright day. My spouse, who sat by me, rose hastily and ran to see what was the matter." Margaret, Flamsteed's wife, is rarely mentioned in her husband's correspondence, although one of the odd facts concerning her which does emerge is that she was an enthusiastic user of the microscope! Although the Astronomer Royal did not marry until 1692, after he had inherited his father's money, the domestic economy of his house must have been in capable hands and more may be due to the ailing Flamsteed's wife than is ever thought. Her very real devotion to him is shown in her letters after his death, and one can only hope that she realized the South Seas stock he left her before the crash came.

Of the famous men who visited the Observatory in the first few decades, Isaac Newton was the most illustrious; there are several references to his visits from 1694 onwards, although latterly his presence was more than distasteful to the Astronomer Royal. Others were more welcome. Moore used to stay occasionally and was allotted his own particular apartment as the following note shows. "For washing ye window curtains of Sir Jonas's room. 00–00–06." Ole Römer (1644–1710), the celebrated Danish astronomer and engineer, visited Greenwich in 1679 May and again in 1688, and was thus probably the first of a long succession of distinguished foreign visitors. In the spring of 1698 "the Czar of Muscovy visited the Observatory and was four times in it, and was sometimes present at my observations". Peter the Great (1672–1725) returned to Russia in June to deal with rebellion, but not before he had made an observation of Venus. He was accompanied on that occasion by one "Bruceus, parentibus Scotis, Moscoviae natus, legatus militaris". On 1716 June 9 the Princess of Wales was the first member of the Royal Family to visit the actual Observatory; as Queen Caroline she was once more a visitor in 1727.

Flamsteed had several assistants over the years, amongst the best-known being Sharp and Joseph Crosthwait, who completed the *Historia Coelestis* in in 1725, and James Hodgson (1672–1755), who married the Astronomer Royal's niece and inherited part of his property. More than 130 pupils (a guinea a week for board, lodging and tuition) contributed to eke out the miserable £100 salary, and they included many interesting people; in 1691, Richard Hyde, nephew by marriage to the exiled James II, and in the next year a grandson of Charles II, cautiously described as "Mr. Henry Crofts, n.s. to the D. of M." (Monmouth's execution had taken place only half a dozen years before). The only lady in the list stayed for five months and is briefly mentioned as "Madame Astell; she went hence Monday, Feb. 14, 1697/8".

Crosthwait, Flamsteed's last assistant, paid a visit shortly after Edmond Halley (1656–1742) had become Astronomer Royal, and found the first signs of the new transit room, "a little boarded shed between the study and the (western) summer house". By this time (1721) the sextant house, stripped of its instruments by Flamsteed's executors, had been converted into a pigeon-loft and so, apart from the new transit room, the Great Room remained the main feature of the Observatory. Halley obtained a grant of £500 to refit the establishment and from this time the instruments could no longer be considered the Astronomer Royal's private property; for this reason it is advisable to consider each instrument separately.

Described by the Board of Visitors as "a Curious Telescopick Instrument", Halley's transit (soon to be on view in a new gallery) was the first to be used regularly in this country. Of 5 feet focal length and $1\frac{3}{4}$-inch aperture, the telescope had a power of about 40; of off-centre construction, the tube was placed $26\frac{1}{2}$ inches nearer to one end of the axis than to the other; the axis rested in brass notches let into separate stone piers. Transits of stars were taken across a single wire (to the nearest second of time) although, as the instrument was too heavy at the eye end, the tube had to be supported during observations. Situated at the western side of the house, the mounting was sufficiently far forward to allow the telescope to be depressed enough to use the window frame of a garret in Greenwich as a north meridian mark, a line or a brick in the Park wall serving as the other. Observations were begun on 1721 October 21 and Halley used the transit solely until 1725 October (when the Iron Quadrant was ready), after which he only employed it occasionally.

When James Bradley (1693–1762) succeeded Halley he had the instrument overhauled by Jonathan Sisson (1694?–1749). It was balanced and had two more vertical wires added, 15 minutes of arc away from the existing central wire. The first observation with the repaired transit was made by Bradley on 1742 July 25, although the regular programme did not begin until 1743 January 1. A system for illuminating the wires was added between this date and 1750 August 31 when the instrument went out of use. It remained *in situ*, however, until 1774, when it was recorded that "Dr. Halley's old transit, and its level, being wholly useless, may be disposed of". Fortunately, it was removed to the Great Room and preserved.

By 1726 a further extension had been made by Halley; a room, designed to hold two large quadrants, was erected north of Flamsteed's old Sextant House. The pier, which cost £42 17s. 0d., was "a firm stone wall lying North and South, being 11 feet high, 9 feet long, and 2 feet wide, consisting of 9 large stones, cemented". This can still be seen, although not easily recognized, as the bottom of a much more recent pier.

Halley had equipped the Great Room with "a plain Month Clock giving the time of such observations as must be made there and for which he has also provided three very good telescopes of 24, 16, and 9 feet, in square tubes, with two microscopes of different sorts which he has made with great care and adapted to them."

The other important instrument of Halley's time was the Iron Mural Quadrant, constructed by Sisson under the supervision of George Graham (1673–1751) for £204, a considerable sum for those days. Of 8 feet radius, the frame was of iron and the limb of brass, divided into 90 degrees on the inner edge and 96 equal parts (to facilitate dividing) on the outer; the vernier read to one second of arc. The counterbalanced movable index, of overall length 8 feet 8 inches, had an aperture of 1·4 inches, which gave a power of 51 and a field of 43 minutes. The arc was set by means of a plumb-line. Delivered by 1725, the quadrant was erected on the eastern face of the wall, pointing south, and used by Halley until his death in 1742, by which time the telescope had been allowed to become jammed against the roof timbers and the whole instrument required much attention. When Bradley assumed office in 1742 he had it examined and repaired by Graham; a collimator was purchased from Sisson (who later added a micrometer showing seconds), and illumination for the wires provided. On 1753 July 31 the quadrant's

position was changed to the western face of the pier (on the arrival of Bradley's Brass Quadrant). During the same year new divisions were cut on the brass rim by John Bird (1727–76), and the instrument generally overhauled. Minor alterations were made under Nevil Maskelyne (1732–1811) and an achromatic object glass was fitted in 1789, but, after this, little was done to the Iron Quadrant until it was superseded by the Mural Circle in 1812 when it was said to still be "in a very perfect state".

Under Bradley the "New Observatory" was built and furnished with instruments from the grant of £1,000 made by George II in 1749. This extension consisted of a new wing to the south-east of the original building; the Quadrant House was enlarged and two further rooms added, running east-west, facing onto the enlarged courtyard; the central room, or principal office, had a second storey over it for the assistant, and the eastern end, or Transit Room, matched the reconstructed Quadrant House, the whole being symmetrical.

The first new instrument to be added by Bradley was the Brass Mural Quadrant, made for £300 by John Bird to the same design as the Iron Quadrant and divided in the same manner. Set up on 1750 February 16, the new quadrant was used on the western face of the wall, pointing north, from 1750 August 10 to 1753 July 31 when it was changed over with its twin and placed on the eastern face, where it still hangs. The dimensions were very close to those of the Halley instrument and the two quadrants were used together for over 60 years. No major alteration was made to the Brass Quadrant until 1772, when Peter Dollond (1730–1820) put in an achromatic object glass and eyepiece, giving the slightly higher power of 62. New micrometers were fitted in 1801 but little else was done to the instrument before it went out of general use on the introduction of the Mural Circle. The last observations seem to have been made in 1824 when some declinations were taken.

Bradley had made his discovery of aberration as far back as 1729, thirteen years before he became Astronomer Royal, but his other great discovery, nutation, was announced in 1749. The instrument which contributed to both of these was the 12½-foot Zenith Sector. Constructed by Graham in 1727, the sector was first erected at Wanstead in the house of Bradley's aunt, the widow of James Pound (1669–1724), an observer of great ability and successor to Flamsteed's living at Burstow, in Surrey. The tube of the telescope, which constitutes the radius, was made of riveted iron plates, tinned over. The whole was originally suspended from the top of two horizontal cylinders placed opposite each other on contrary sides of the object glass of 12 feet 6·8 inches focal length and 2·85 inches aperture; the power was about 68. The 12 degree arc was made of brass, divided to 5 minutes, and fitted to the tube exactly against the cross-wires in the common focus of the O.G. and eyepiece. Of very light construction, the tube and fittings weighed only a little over 15 lb., but were made with great care. Bradley estimated that, set by plumb-line, the instrument could be rectified to ¼ second of arc. The sector was moved to Greenwich in 1749 July (when the Astronomer Royal received £45 for it) and re-hung on the quadrant pier where it was used to observe absolute zenith distances for correcting the collimation of the quadrants. Maskelyne had the suspension altered to that from which the instrument still hangs, and in 1777 replaced the brass arc by an iron one with gold studs set at the divisions. This in turn was replaced by a

steel arc (again with gold studs) in 1785, and the addition of an achromatic O.G. in 1801 ended the modifications to the instrument. In constant use until 1813, the zenith sector remained in the Quadrant Room until 1837, when on August 4 it was dismounted and sent to the Cape of Good Hope to assist in the survey of the colony; it was returned to the Observatory in about 1851.

Bradley had made provision for a new transit at the eastern end of his "New Observatory" and on 1750 September 2 the first regular observations were begun with the instrument. Made by Bird for £73 13s. 6d., the telescope had an overall length of 8 feet 6 inches; the focal length was 8 feet and the maximum working aperture 1·6 inches with a power of 50. Supported in steel Y's on stone piers, the transit had counterpoises applied to the ends of the axis to reduce the weight on the bearings to about 3 lb. The eyepiece was fitted with 5 vertical wires although Bradley, like Halley, usually only used the meridional wire and at first only recorded his times to the nearest second. On the introduction of a compound eyepiece in 1752 he timed to the nearest $\frac{1}{4}$ second, and later still, used a system of signs to indicate the nearest $\frac{1}{8}$ second. The illumination was provided by a reflector near the O.G. but by 1767, under Maskelyne, an improved method through the axis had been devised. In 1772 Dollond put in an achromatic O.G. of 2·7 inches aperture giving nearly three times the light of the old aperture. Maskelyne introduced several refinements and estimated his times to $\frac{1}{10}$ second. In 1787 he proposed that the level should be taken by the reflection method, as later employed in the Airy Transit Circle, using a mercury trough. Considerable trouble was experienced during the next decade through the effect of expansion of the axis and by Pond's time the transit was showing distinct signs of wear and tear; the last observation was made on 1816 July 5 when the instrument was dismounted. In 1798 a north meridian mark was erected 78 feet from the instrument and an additional lens of the same focal length provided. The stone base is still there, between the Small Transit Pavilion and the courtyard railings, having carried the night sky camera for many years.

Among the survivors of the instruments bought with the 1749 grant is part of Bradley's Equatorial Sector. This, the first of its kind, was constructed by Graham in 1750 and consisted of a 2 foot 6 inch telescope fixed to a polar axis and capable of being moved into any meridian. Intended for measuring the distance of comets from fixed stars, the arc along which the tube could be moved was only 6 degrees long; divisions were cut every 15 minutes and read to 1 minute by vernier. The sector was kept in the Great Room where, as Maskelyne wrote, "standing on the wooden floor it wants that stability proper to an instrument of this sort, and requires removing frequently from one window to another. Add that when a comet is very high, and in some other positions, it would be impossible to observe it at all from the Great Room". Nothing was done to improve the instrument or its position and it was finally put into store in 1811.

At some unspecified date in Bradley's time an alteration was made to the dwelling-house and a large chimney erected over a new kitchen to the south of the Great Room, which was fast becoming more of a storehouse than an observatory; by 1762 it contained a considerable number of instruments, including a 40-inch quadrant, a 6-foot Newtonian reflector, two levels, two refractors, a clock, and several obsolete items.

In 1770 October Maskelyne decided to alter the Summer houses on the North Terrace to take new equatorial sectors; the pineapple roofs were accordingly removed, a storey added to each building, which were topped by movable domes. Shutters were fitted to the windows of the Great Room in 1779, when the nearly derelict Sextant House was also altered into a useful room for occasional instruments, such as the 40-inch quadrant. The building was heightened and a sloping roof with sliding shutters put on; it then became known as the Advanced Building.

An improved equatorial sector was bought from the younger Sisson in 1780 and placed in the East Terrace Observatory. This instrument was of 5 feet focal length, had an achromatic O.G., declination and hour angle circles, and was mounted on a long polar axis. Although unfavourably situated, it remained the sole effective equatorial instrument in the Observatory for over 35 years. In 1816 it was overhauled and placed in the West Terrace Observatory where it remained until 1846 when the telescope was taken off and the axis and mounting presented to the Cape Observatory.

Maskelyne carried out extensive alterations to the dwelling-house, removing the room and chimney on the southern side and building three new apartments. A larger space was added to the courtyard and railings erected, bringing it up to its present dimensions. The last addition made by Maskelyne was the Circle Room; this was built on to the eastern end of the Transit Room in 1808–09 although the mural circle itself, designed by the Astronomer Royal, was not completed until after his death in 1811.

Shortly after John Pond (1767–1836) assumed office a telescope was presented to the Royal Observatory by the executors of Sir George Shuckburgh Evelyn, who had died in 1804. The Shuckburgh Equatorial, as it became known, was the work of Jene Ramsden (1735–1800) who built it in 1791, and it was later described as the most perfect instrument of its kind then in existence. Mounted in the "English" style, the telescope was held in a cradle of four brass tubes, $3\frac{1}{2}$-inches in diameter and 5 feet 10 inches long, fixed at the top to a bell-metal circle and at the bottom to a truncated cone. This principal axis was 8 feet 4 inches in length, the lower end supported on an iron frame fixed to the floor and its upper end held by an iron support rising 10 feet above the floor. The circles were 4 feet in diameter and divided to 10 minutes of arc, being read to minutes and seconds by a micrometer screw and moving wire. The 5 foot 6 inch telescope of 4 inches aperture was illuminated through the declination axis, a filter being incorporated into the train so that "the stars are seen upon a beautiful pale green field, the wires appearing black". The instrument was delivered in 1812 August and set up on a new pier erected to the east of the newly-built Circle Room. This pier, consisting of four cast iron pillars with a cross on top, proved so unstable that the Shuckburgh remained out of action until 1816 June when it was mounted in the East Terrace Observatory by Berge, Ramsden's successor. This telescope remained the Royal Observatory's principal equatorial instrument until 1838, after which it was used less regularly, mainly for occultations and eclipses. Still in its dome as late as 1929, it was then presented to the Science Museum, South Kensington.

The next instrument to be installed at Greenwich was the Mural Circle. As early as 1792 Maskelyne had recommended the use of such an instrument for taking transits as well as zenith distances, antedating the Airy Transit Circle by over half a century, but the idea was shelved until 1807 when

sanction was given for its construction. The room and granite pier were were already built by the time Pond came to the Royal Observatory but the actual instrument, which represented the most revolutionary change in observing since Bradley's day, was not ready until 1812 May 23. Made by Edward Troughton (1753–1835), the circle cost £735. Of 6 feet diameter, it was divided into degrees on a platinum band on the circumference. The telescope, of 4 inches aperture, could be rotated separately and was fitted with clamps at both ends. The eyepiece contained 5 fixed vertical wires and one movable horizontal wire. Used latterly with six micrometers, the effects of expansion were rendered negligible. It was soon evident that the circle was unsuitable as a transit instrument owing to the motion of the centre of rotation and it was used thereafter solely as a differential instrument. A south meridian mark was put up, but was dogged by the ill-luck that always seemed associated with these adjuncts to meridional instruments. It was noticed on 1815 August 1 that "the meridian mark of the circle was taken away by mistake. All searched in vain for it." In 1821 the telescope was permanently fixed to the rim of the circle, following some recent discrepancies, and from then the instrument gave excellent results.

A second circle, constructed by Thomas Jones, a pupil of Ramsden's, was intended for use at the Cape but Pond obtained permission to retain it at Greenwich and this was accordingly mounted on a new pier alongside that of the Troughton instrument. By the autumn of 1824 the new circle had been divided on its own pier and in 1825 February Pond started his reciprocal method of observation. This meant the addition of mercury troughs to both circles and then observing direct with one and by reflection with the other.

When George Biddell Airy succeeded Pond in 1835 he introduced observations, direct and by reflection, with one instrument and was thus able to send Jones' Circle to the Cape in 1839 to replace another (also by Jones), which had proved very faulty. The Cape Circle was eventually mounted at Greenwich, although very rarely used, and in 1849 was sent to Queen's College, Belfast. Troughton's was dismounted in 1848, when the Circle Room was reconstructed to take the Transit Circle, but continued to do service on a temporary pier until 1851 January when it went out of use.

In 1813 Pond added four more rooms on the ground floor at the eastern end of the Circle Room; these were an office, bedroom and sitting room of the First Assistant, and a small kitchen. A second storey at the western end of this extension housed the library. Two years later a camera obscura was put up in the western turret of the Great Room roof and towards the end of 1819 a new room, 20 feet high, was begun between the Great Room and the West Terrace Observatory, on the site of Halley's Transit Room. A wall was also built at the eastern end of the house for the sake of uniformity. This new room, known as the Zenith Sector Apartment, was the first to be specially designed for such an instrument. Pond had already erected a zenith sector by Troughton on the pier of the Mural Circle but it had proved unsatisfactory and its use was therefore discontinued. The new building had the sector installed by 1822, but this one also proved disappointing and so Pond had one final attempt in 1834 when he installed the Great Zenith Sector. This was 25 feet in length and had an aperture of 5 inches; it turned horizontally in a strong iron tube which was supported on four legs and very well braced. The plumb line, by which the instrument was set, was read by two micrometers, at the top and bottom. In spite of many alterations by Airy, the

zenith sector was never really satisfactory and was eventually dismantled in 1848.

Two other instruments, designed by Pond, which are still on view are the α Aquilae and α Cygni telescopes. These were used between 1816 and 1818 to disprove the large parallaxes of these stars given by John Brinkley, Andrews Professor of Astronomy in the University of Dublin. The telescopes, 10 feet in length and about 4 inches in aperture, were fixed to the west side of the Troughton Circle pier (α Aquilae) and on the quadrant pier (α Cygni).

On 1816 July 16, when Bradley's transit was removed from its piers, its place was taken by a new instrument with an axis of the same length. The new transit was made by Troughton, apart from the optical parts which were by Dollond, and had a focal length of 9 feet 8 inches and an aperture of 5 inches. The pivots were of bell-metal and rested in semi-circular Y's which were adjustable for level and collimation. Counterpoises took most of the weight (nearly 200 lb.) off the bearings. Although provided with a 2-ft. setting circle at one end of the axis, the operation was usually performed by means of two small circles, fitted with spirit levels, at the eye end. The construction was an innovation, the telescope and axis both being formed of conical tubes based on a central sphere. In 1825 the original pivots were replaced by new ones made of hard steel; little else needed doing to the instrument during its time of service and it was in constant use until superseded by the Transit Circle in 1851.

Two north meridian marks were used at various times, one at Blackwall, a distance of just over two miles, and the other at Chingford, 11 miles away. The Blackwall mark was "unfortunately rendered invisible for a week or a fortnight and occasionally for a longer period, either by ships moored near the place in the direct line of vision, or by vapours arising from the River Thames and London smoke, especially during westerly winds". The Chingford mark, erected in 1824, was "only seen when the atmosphere was particularly favourable". Finally, it was mentioned in the 1834 Greenwich Volume that "It was noted on 4th October last, that the engine house in which the meridian mark had been fixed, was taken down, and that a temporary one had been painted on the iron wharf". A tavern, however, was ultimately erected on the site and a new mark triumphantly fixed onto one of its walls. The last introduction of note under Pond was the Time Ball Service[2] instituted in 1833.

When Airy came to the Observatory he embarked on the customary improvements undertaken by successive Astronomers Royal and in his first year of office added more rooms to the western side of the dwelling-house. By now the Great Room was usually known as the Octagon Room, by which name it has been generally known since, and contained a mass of astronomical bric-à-brac, amounting to nearly 200 items.

In his Report to the Board of Visitors in 1837, Airy mentioned that the Rev. Richard Sheepshanks (1794–1855) had presented to the Observatory an object glass of 6·7 inches aperture and 8 feet 2 inches focal length, made by Cauchoix. This gift presented an opportunity for building a good equatorial telescope which the Astronomer Royal was quick to seize. The pier, just to the east of the Circle Room, was erected in 1837 and the instrument was in operation by the autumn of the following year.

During Airy's term of office the Observatory was greatly expanded and

many new instruments added. These are all described in detail in appendices to the Annual Greenwich Volumes. Although these notes are only intended to cover the Observatory's old instruments, Airy's famous Transit Circle deserves special mention.[3] This remarkable instrument, with more than a century's work to its credit, remains at Greenwich defining the Prime Meridian as a permanent reminder of the Royal Observatory's great contribution to fundamental astronomy.

The new fields of investigation opened up in the second half of the 19th century resulted in more expansion than the facilities of the old site could provide although many decades were to pass before the Royal Greenwich Observatory was re-established at Herstmonceux.

The full cycle at Greenwich having run its course, the Octagon Room was converted into a museum of navigation and astronomy and opened by H.R.H. The Prince Philip, Duke of Edinburgh, on 1953 May 8. Since then further restoration and extensive alterations to the rest of Flamsteed House have been carried out, providing additional galleries which will be opened by H.M. The Queen on 1960 July 6, the whole forming a fitting memorial to the work performed by the Royal Observatory during nearly three centuries.

References

(1) P. S. Laurie, *The Observatory*, **76**, 24, 1956.
(2) P. S. Laurie, *The Observatory*, **78**, 113, 1958.
(3) Those requiring further information on the Transit Circle should consult the late W. M. Witchell's excellent article in *Occasional Notes*, *R.A.S.*, **2**, No. 14, 147, 1952.