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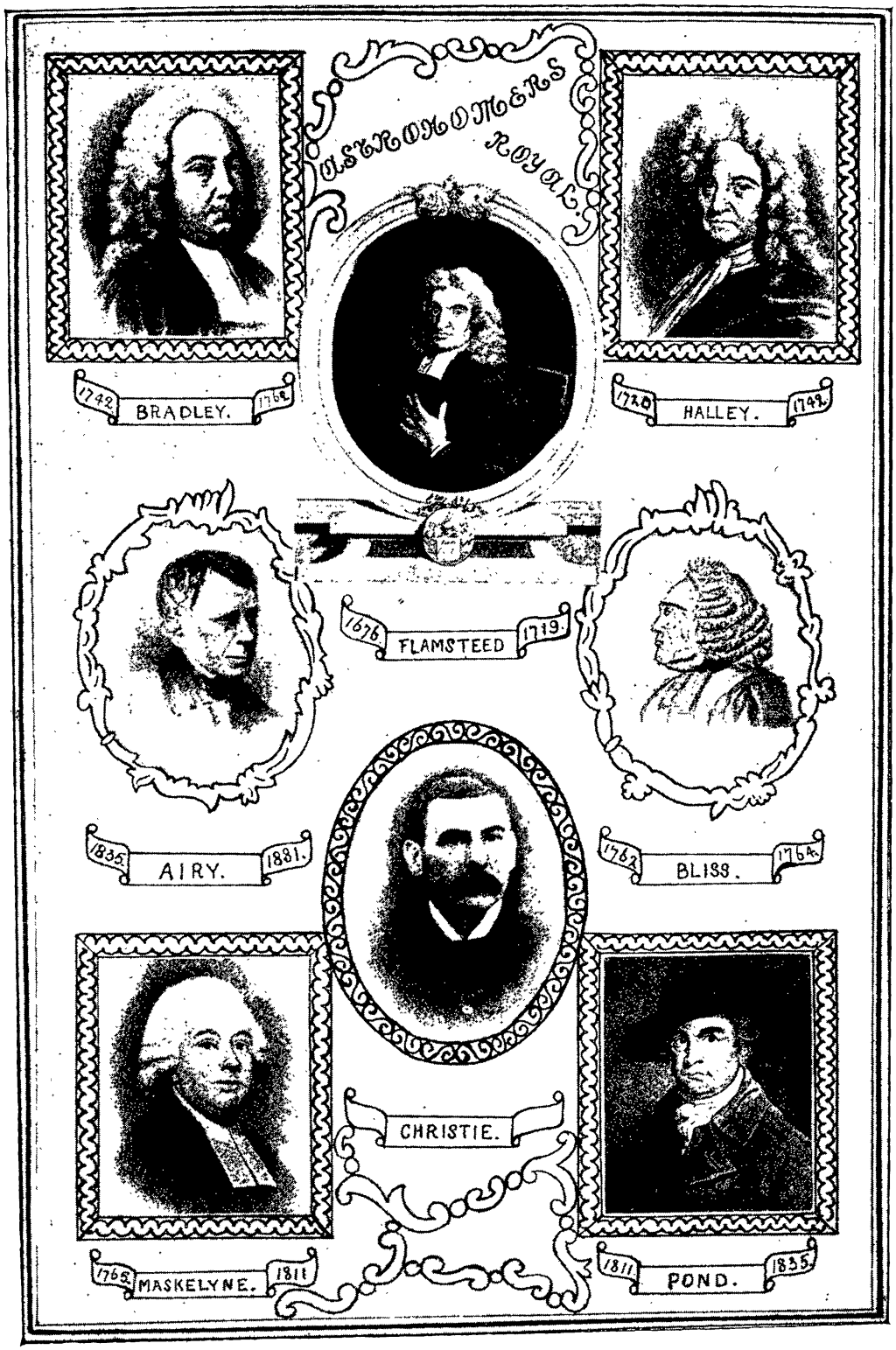
The Astronomers Royal.

THERE may seem no special reason for the publication at this particular time of the frontispiece to this number, for the reputation of the eight men whose pictures are there given is not ephemeral; but the completion of the new building at Greenwich, on the entablature of which their names are inscribed,* in the most honoured places, suggested the collection of the lineal presentiments of the astronomers who form the dynasty of Greenwich Observatory. Any attempt at detailed histories to accompany the portraits would be merely to repeat what has been most efficiently done in other places, but it may be well to add some salient points of the life and work of the subjects of the pictures.

JOHN FLAMSTEED came to the Observatory a young man, 30 years of age, with a Cambridge degree, and in holy orders. The circumstance that he was appointed to the living of Burstow soon after he was made Astronomer Royal, and that he inherited a private income, somewhat mitigates the fact that his salary was only £100 a year. The general opinion about astronomy in his day is indicated by a sentence in a letter he wrote to Wren, inviting Wren and Newton to dinner. He says:—"The gentlemen of our Society (the Royal), however ingenious and well wishers to all sorts of ingenious study, know little of mine." Possibly this feeling of want of sympathy induced in some way the querulousness he showed in his relations with Halley and Newton, although it has been said that Flamsteed's greed of money was the cause of his troubles with these men. Flamsteed observed positions of the brighter stars, the Sun, Moon, and major planets for 42 years. His results are contained in two volumes of the 'Historia Cœlestis,' of which there is a so-called corrected edition by Halley. Flamsteed's observations of the Moon were used by Newton as material

* The name of the present Astronomer Royal is not on the building.



THE ASTRONOMERS ROYAL.

for making his lunar theory. His star-positions were collected early in this century by Mr. Francis Baily to form the British Catalogue of (3310) Stars. Flamsteed spent part of his time in teaching pupils. It was part of his official duty to instruct two boys from Christ's Hospital in mathematics and navigation, and besides these he had others—dukes, lords, and captains of vessels, one biographer says. He had as assistants Abraham Sharp, the renowned instrument-maker, and Joseph Crosthwait. The names of three men who acted as computers—Hudson, Leigh, and Ryley—are recorded. On the ceiling of the Painted Hall at Greenwich Flamsteed is depicted with Thomas Weston, who was probably a pupil. Our portrait of him is copied from the engraving which forms the frontispiece to his 'Historia Cœlestis.'

Edmund Halley was a man of higher attainments than Flamsteed, but he was not so well fitted for his office, for in the first place he was 63 years of age when he was made Astronomer Royal, and secondly he was not a good observer. His work at Greenwich may be summed up by saying that he erected the first transit-instrument in the Observatory, and also put up the iron quadrant, so that he may be considered as having created the type of two instruments which are at present combined in the Greenwich Transit-Circle. His observations are of little value, but his reputation was made before he came to Greenwich. Halley was an energetic, many-sided man—courtly, well known at court, and evidently able to use influence in high places. He was second only, and a good second, to Newton in gravitational astronomy. He was the first of the many English astronomers who have been to the southern hemisphere to observe, for as a young man he sojourned at St. Helena for this purpose. He went to Dantzic to discuss with Helvelius the merits, as a measuring-instrument, of the then newly-invented telescope, as compared with the old method of sights: above all, he was far in advance of his time in appreciation of terrestrial magnetism as a science, and obtained from King William III. the use of a vessel for a voyage to the South Seas in 1694 to make magnetic observations. This voyage, however, was not successful. Halley was Savilian Professor of Geometry at Oxford from 1704 to 1742, so that he held this office concurrently with that of Astronomer Royal. Through the good offices of Caroline, Queen of George II., who visited the Observatory in 1727, he drew half-pay as a Commander in the Navy, having at some time held the King's commission. Our portrait is from an engraving in the Royal Observatory.

James Bradley was 50 years of age when he came to Greenwich in February 1742, and he married shortly after. He had already made the first of the two great discoveries, that of the aberration of light, by which his name will be ever remembered. Twenty years before he had been made Savilian Professor of Astronomy at Oxford, and he held this office till his death. He was a clergyman,

but, as the Oxford statutes forbid the Professor holding a clerical appointment, he resigned two church livings to take up the professorship. He was offered the vicarage of Greenwich when he came to the Royal Observatory, which he did not accept; but the salary of £100, which still pertained to the office of Astronomer Royal, was increased by a pension of £250 granted Bradley by the Crown, and which was continued to Bliss and Maskelyne. By the end of his first five years at Greenwich he had made the series of observations which established his second great discovery, the nutation of the Earth's axis, and in the whole 20 years of his tenure of office he made an excellent series of observations of the stars observed by Flamsteed, used by Bessel to form his 'Fundamenta Astronomiæ,' and re-reduced by Dr. Auwers to form a catalogue, whose value for comparison with those of modern days can scarcely be over-estimated. Among Bradley's Assistants there were two of some renown: Charles Mason, who went to America to lay down the boundary-line between the provinces of Maryland and Pennsylvania, and measured a degree of the meridian in that neighbourhood; he observed the Transits of Venus of 1761 and 1769, but specially he edited Mayer's lunar tables for use in the compilation of the Nautical Almanac. The other was Charles Green, who was Assistant also to Bliss and Maskelyne, and went with Captain Cook on his first voyage to the Southern Seas, which was undertaken to observe the same transit. Green died on the voyage home *. Bradley's death is entered in the Transit-book and in the Quadrant-book, after the observation of the Sun on 1762 July 16 (probably made by Charles Green):—"Dr. Bradley exchanged this life for a better at Chalford, in Gloucestershire, July 13, 1762. Aged 70." The books were then closed, and no more observations were entered therein. This is mentioned to show how personal to the Astronomer Royal the Greenwich observations were considered. How jealously Flamsteed guarded his observations is well known. On Bradley's death his executor, Rev. Samuel Peach, took possession of his observations, and there were actions-at-law, first by the Royal Society and then by the Board of Longitude, to recover these. Mr. Peach was successful, however, and then presented the observations to the University of Oxford. Bliss's observations also had to be purchased from his widow by the Board of Longitude, and these were published with Bradley's and those made by Green (see below) by the University. Our portrait of Bradley is from an engraving, the original of which is an oil-painting in the Octagon Room at Greenwich.

The career of NATHANIEL BLISS (1762–64) at Greenwich was too short for him to have left any mark on the institution. He

* Bradley's other Assistant, and first in order of time, was his nephew, John Bradley. There is some doubt as to whether Gael Morris, who helped Bradley with his lunar work, should be considered his Assistant. He was probably not on the Greenwich staff. The annual salary of an Assistant was then £26.

was more than 60 years of age when he received his appointment. Like his two predecessors he was an Oxford man, and had succeeded Halley in 1742 as Savilian Professor of Geometry. Our portrait of Bliss is copied from a small print in the Hope Collection * of the Bodleian Library, which is believed to be the only portrait extant, and to which a curious story is attached. About the year 1750 Lord Parker, who, better known as Earl of Macclesfield, has a reputation as an astronomer and patron of the sciences, was giving a dinner at Shirburn Castle, near Oxford, to some scientific and artistic celebrities of the day, among them being Bliss and J. Skippe, an expert etcher and engraver. Over the walnuts and wine the host challenged Skippe to draw a portrait of Bliss, whereupon Skippe took up a pewter mug and graved this portrait on the bottom. From the mug the prints, of which there are three now in the Bodleian, were made, and in these there is an inscription round the head not reproduced in our picture, which runs, "This sure is Bliss, if Bliss on earth there be."

Bliss was succeeded by MASKELYNE, whose first observation was made on 1765 May 7, after an interregnum of seven months, during which time Charles Green had charge of the Observatory. It has been said of Maskelyne, as of many others, that *he was the founder of modern astronomy*, the statement being justified by the fact that he was the first to make a *fundamental* star catalogue; he limited his observations to a select number of stars (besides, of course, the Sun and Moon and planets), which he observed on every possible occasion, and produced a catalogue, the precursor of the Greenwich Clock-Star List, containing only 36 stars, but the places of which were known with the greatest accuracy. He was the first to observe transits to tenths of seconds. Maskelyne's great work was the establishment of the 'Nautical Almanac,' which was prepared under his direction until his death. It is said that Maskelyne was of so modest and retiring a disposition, that when the king visited the Observatory he left his assistant † to entertain the royal party; but this seems improbable. He died on February 9, 1811. The original of our picture is believed to be in the possession of the Royal Society.

Maskelyne was the first to add to the dwelling-house of the Astronomer Royal, which until 1790 remained entirely as designed by Wren. But about that year the three eastern rooms on the

* We are much indebted to Mr. F. Bellamy, of the Oxford University Observatory, for this reproduction and for the following story. Also to the Curator of the Hope Collection for the necessary permission.

† The names of Maskelyne's Assistants, most of whom only stayed for a short period, and one only at a time, are as follows:—Joseph Dymond, William Bayley, Reuben Burrow, John Hillins, George Gilpin, Joseph Linly, Thomas Horrox, Robert Gooch, George Flowman, William Malachy Hitchins, John Brinkley, John Burnstead, Joshua Moore, William Garrard, William Smith, John Crossley, Benedict Chapman, Joshua Garnett, David Kinebrook, Thomas Evans, Robert Wallace, Francis Nisbet, Thomas Ferminger, Thomas Taylor.

south side of the Astronomer Royal's house were built. To those who know the Observatory as it now is, the following statement of the gradual growth of the Observatory proper will be intelligible. Flamsteed's sextant occupied the site of the instrument now known as the "old Altazimuth." Halley's Transit-room was probably a small room at the west end of the terrace which overlooks the river (not the room now covered by a dome); his quadrant was probably on the eastern side of the west wall of what is now known as the old computing-room, in the place where Bradley's brass quadrant now hangs. Bradley added the old computing-room, with the room over as a living-room for Assistants, and the room that Sir George Airy and the present Astronomer Royal occupied as their official room as his Transit-room. The present Transit-circle room was built in 1808 or 1809 by Maskelyne, forming the second of the gable-ends seen from the front court. Pond added the Sheepshanks Dome and the small rooms now used as Assistants' Rooms, in which his Chief Assistant lived entirely, and the Library. The range of buildings was completed by Airy, who added the Record Room and the South-east Tower. Three living-rooms were added at the West of the house for Airy.

Maskelyne was succeeded by JOHN POND *. Although his name is little known, indeed probably not at all outside the ranks of professional astronomers, he was one of the ablest of the men who have filled the chief office at Greenwich. He was a perfect master of meridian instruments. In the year 1806 he had shown that the Greenwich quadrant had changed its form since Bradley used it, which was subsequently verified by Troughton; he invented the method of observing by reflection from the surface of mercury; and the excellence of his observing has lately been proved by Dr. Chandler, who has established his theory of the variations of latitude mainly from Pond's observations. He did a great deal for the Royal Observatory: he equipped it with good instruments, he established a system of reducing observations, and he increased the staff from one to six assistants †. It was said, at his death, that he did more for practical astronomy than any other man since Bradley, and it seems hard that his latter years should have been embittered by a factious clique who wanted his post for their own disposal. He resigned office towards the end of 1835, and died September 1836, aged about 69.

Of the two remaining occupants of the office it becomes us to say little; as has been said, Airy completed the range of buildings

* Our portrait of Pond is believed to be rare. It is copied from a print in the possession of a Greenwich townsman, whose family have lived in the neighbourhood for some generations. We are indebted for this, and also for much help in the preparation of the picture, to Mr. Bowyer of the Royal Observatory.

† The *one* Assistant was Thomas Taylor. The *six* were Taylor, Henry (Belville), Richardson, Ellis (senior), Rogerson, F. Simms.

at the north end of the Observatory domain; he also added smaller and less permanent buildings in other parts of the grounds, as they were required by the addition of branches of work to the Observatory scheme. It was left for Mr. W. H. M. Christie to replace these by a building more worthy the nation and more suitable for the conduct of the daily work. It would be idle and unfair to compare the work of the present day with that of the time of the earlier astronomers. The main difference, apart from the increase in the number of branches dealt with, is that the observations are now reduced and published shortly after they are made, whereas it had to be one of Airy's first tasks to reduce the lunar and planetary observations of Bradley, Bliss, and Maskelyne. One of the annual Greenwich volumes of to-day is bigger than the two volumes which contain Flamsteed's work for forty-two years.

H. P. H.

E. W. Brown's Theory of the Motion of the Moon.

By this time Professor Brown's researches in the lunar theory require no notice from the point of view of those interested in the mathematical difficulties of a numerical lunar theory. The class is a small one, and every member of it is probably pretty well acquainted in detail with the work of Dr. Hill and Prof. Brown. We here attempt, however, to sketch an outline of this work, prefacing it with a popular account of the history of the subject, starting from very early times.

From the time of Copernicus the Sun has been recognized as the centre of the planetary system, and in some way responsible for its motion. Before Newton the prevalent opinion was that the Sun was responsible directly for the velocity of the planets in their orbits. In other words, given the Sun and the planet, it was inconceivable that the planet should not have its actual velocity. The mental attitude may best be conceived by the comparison of a vortex motion in liquid. Stir a basin of water until a cylindrical hollow appears in its centre of a certain shape and a certain velocity of rotation. Then if a match be floating in the water between the vortex and the rim of the basin, its velocity is entirely determined by the circumstances of the moment. In the case of a falling stone, on the contrary, the velocity is determined by the time that the stone has already been falling. It is easy to conceive the same stone occupying the same position and moving in a different way. The match in the basin could not move in a different way. Newton demonstrated that the Sun is only responsible for the change of motion of the planets, and identified the cause that keeps the planets in their orbits with the cause that is responsible for the path pursued by a falling stone. Of course the philosophers who thought that the planets could only