

ordained deacon, and in the following year priest, at Oxford. From 1877 to 1882 he was a Fellow of his College.

He began his ministry with a brief period as Chaplain of St. Andrew's Railway Church, Lahore, and Chaplain to the Bishop of Lahore. Returning to England in 1879, he became Lecturer and Chaplain of his old College for two years, and during the following five years he was Director of the Church Missionary Children's Home at Highbury. From 1885 to 1887 he held his first rectorship, at Upton Scudamore, Wiltshire, and in the latter year he was appointed Rector of Sulhamstead Abbots with Sulhamstead Bannister, Reading, a position which he held up to the time of his death. He took a prominent part in the work of the diocese and in Church work generally, and in 1929 August he was appointed honorary Canon of the Cathedral of Christ Church, Oxford. In his later years he was keenly interested in the question of Church schools and Church education, and was one of the promoters and members of the Diocesan Educational Council.

Shepherd took much interest in social work, particularly the administration of the Poor Law. Some forty years ago he was elected a member of the Bradfield Board of Guardians and Rural District Council, and he became chairman of that body in 1911. Outside his religious work, this claimed the greatest share of his attention. Although he was greatly interested in astronomy, circumstances prevented him from taking any active part in it, and this was a source of much regret to him.

In 1881 he married Miss Helen Amey Norton, daughter of John Norton, F.R.I.B.A., by whom he had one son and six daughters. Mrs. Shepherd and five daughters survive him.

CHRISTOPHER THWAITES was born on 1840 December 9 at 74 Holborn Bridge, St. Andrew's, Holborn, in the City of London, and was the eldest son of Sir John Thwaites, Kt., Deputy-Lieutenant for Middlesex and first chairman of the Metropolitan Board of Works.

The first part of his education took place at Uxbridge and Brighton, and subsequently he entered King's College, London, where he studied engineering with distinction and received a prize for the construction of a lathe.

On leaving King's College he went to Ireland and carried out some extensive survey work for the Sligo Railway. In 1865 he received the appointment of Deputy-Engineer to the city of Bombay and later that of Acting City Engineer. During the five years of his residence in India he carried out a large drainage scheme and also a scheme for a new water supply for Bombay.

He came home in 1870 and engaged in practice at Westminster as Consulting Engineer. This he carried on for two years, and then went to Norwich for three years with the appointment of City Engineer. In 1875 he went to Sunderland as Borough Engineer, a post he held until 1879, when a breakdown in health compelled him to relinquish the office. He came to London for a time, then went to live at Beccles, Suffolk, until the year 1893. Then he started a private practice in

Norwich, which he maintained until 1896. Retiring in that year, he removed to Sutton, Surrey, where he lived until his death on 1929 December 4, five days before his eighty-ninth birthday. He was buried in the same vault as his father at Nunhead on his natal day.

Thwaites's first acquaintance with astronomy came while he was at Brighton, the headmaster of his school being astronomically inclined. He developed a love for the science which remained with him throughout his long life, the mechanical side appealing very strongly to his engineering instincts.

His first instrument was a $2\frac{3}{4}$ -inch refractor, and later he became possessed of a 6-inch. He made many observations of the nebula in Orion with a view to seeing if there was any change in the light from the nebula, but he did not publish his results, although he affirmed his belief that there was no variability.

His most important work seems to have been in connection with total eclipses of the sun, and in 1898 he went to India, taking with him a $4\frac{1}{4}$ -inch Cooke photo-visual refractor lent him by G. J. Newbegin. He collaborated with E. W. Maunder and others in organising the B.A.A. Expedition to Talni, Berar, and his previous knowledge of the country marked him out as the proper person to undertake the arrangements. He proceeded to Talni in advance of the main party and selected the site for the observations, and in this he was ably seconded by D. O. Morris. The results of this expedition were some beautiful photographs of the corona.

In 1905 he led the B.A.A. Expedition to Burgos, Spain, taking with him the same instrument, but the results on this occasion were disappointing by reason of some mechanical defect in the driving of the telescope during the exposure of the plate. During the rehearsals for this eclipse King Alphonso XIII. of Spain drove up to the camp and inspected the instruments, and Thwaites had the honour of conducting His Majesty round and explaining the different purposes to which they would be put.

On his return from Spain he purchased the $4\frac{1}{4}$ -inch telescope from G. J. Newbegin and for some years carried on observations of sunspots, both visual and photographic.

He was an enthusiastic photographer, his experience beginning with the wet collodion process, and he was conversant with all branches of the art. For some time he was President of the Sutton Photographic Society.

Of the personal side of the man it is not easy to write, for his modesty was innate, but he had an extremely attractive personality and a charm of manner which endeared him to all who counted themselves his friends. He was widely read, and his knowledge of things in general was always at the disposal of those who sought his advice.

He was very fond of music and played the violin: he also possessed a pleasing tenor voice, and while living at Beccles he sang in the choir of the parish church.

He was a keen sportsman with the gun and rod, and in his younger days was a very good swimmer.

He was gifted with a keen sense of humour, and although he liked to play an innocent joke upon anyone whom he knew well, it was always so neatly done that no offence was ever caused.

About 1875 Thwaites married Miss Emma Grove, by whom he had two sons and a daughter.

He was elected a Fellow of the Society on 1886 February 12.

A. M. N.

WORCESTER REED WARNER was one of the founders of the well-known firm of engineers, the Warner & Swasey Company, which is responsible for the mounting of some of the largest telescopes in the world. He was born on 1846 May 16 on a New England farm near Cummington, Massachusetts, and educated in the rural district school. Agricultural pursuits occupied his boyhood and early manhood, but he acquired also a fondness for astronomy, and, with the encouragement of his mother, devoted his spare time to constructing telescopic models with such means as were available. His growing taste for this type of work led to a determination to leave the farm for industry, and at the age of 19 he entered the Boston drafting-room of a machine works, from which he was soon transferred to the company's shops in Exeter, New Hampshire. Unknown to him, another lad, Ambrose Swasey by name, had had a closely similar career. Born in the same year as Warner on another New England farm, he had found the details of the machinery used in farm work more to his taste than the work itself, and he likewise had decided, at the same age of 19, to give his whole time to mechanics. By a remarkable coincidence he joined the same shop as Warner at about the same time, and the friendship which then began remained unbroken to the end, with results which everyone knows.

Those results, however, were not achieved without difficulty. "The apprentice in those days," we are told, "was viewed more as a convenient drudge than as an asset to be made into a valuable entity, and the two farmer boys had the same ample lack of opportunities as their comrades." At the completion of their apprenticeship in 1870 they entered the employ of Messrs. Pratt & Whitney in Hartford, Connecticut, where, after a short time, Warner was placed in charge of one of the firm's largest departments and was entrusted with the management of the company's exhibit at the Centennial Exhibition in Philadelphia. After working for a time as foreman he undertook, according to the custom in those days, to build machines under contract, and attracted attention by, among other things, greatly reducing the time of production.

The idea that the two friends should set up in business for themselves came to fruition on 1880 May 5, when the firm of Warner & Swasey was established on the strength of the combined savings of the partners up to that time. Four young men from Connecticut formed with them the nucleus of the new organisation. The headquarters of the firm were originally in Chicago, but owing to the difficulty of getting skilled mechanics so far from the industrial centres of New England, a transfer to Cleveland was arranged after about a year's working. In the early activities of the firm astronomy was not conspicuous, hand lathes and