every *li*. With regard to the paddlewheel boat, we must now assume that the anonymous Byzantine "De Rebus Bellicis" of *c.* A.D. 370 was genuine but uninfluential. The idea also developed in China about the sixth century.

Water-raising machinery such as the swape (shaduf) with its origin in the Fertile Crescent had reached China by A.D. 170 and probably much earlier. Water-power developed in the West and China at just about the same time. The Pontus water-mill of 65 B.C. (Strabo) is followed within a century by water-power applied in China (A.D. 31) to blowing blasts of air for iron furnaces and forges with the use of complex machinery, so that considerable previous development has to be postulated.

In those cases where China borrowed from the West, the sources are sometimes explicit. Thus Ling Lun, the legendary minister of the Yellow Emperor, is said to have obtained the harmonic progression by travel to the West just as Pythagoras is said to have travelled in Asia. The origin of both Greek and Chinese acoustics must be Babylonian. Likewise the seventh century horizontal windmills of the windy region of Seistan (East Persia) were specifically suggested as models for China by Yehlu Chhu-Tshai in the Mongol period. Some Central Asian prayer wheels used wind power so cleverly as to resemble cup-anemometers.

Really new ideas which reached China through the Jesuits in the seventeenth and eighteenth centuries were few. The Chinese accepted from them the screw, the crankshaft, the cylinder-pump proper and cable ploughing. Gearing, cranes, the crank, the continuous chain excavator, etc., were unnecessary, as the Chinese already had them in use. The Chinese rejected some devices, such as the Vitruvian drum-treadmill (their pedals made it unnecessary), the Archimedean screw (though this was used for mine-drainage in Japan), the vertical windmill and the flume-swape.

In the discussion which followed, several speakers expressed the hope that the illustrations and Dr. Needham's discoveries would soon be available in print.

OBITUARIES

Dr. Bernard Lyot

The world of science, and French astronomy in particular, has suffered a severe loss in the sudden death, at the comparatively early age of fifty-four, of Dr. Bernard Lyot, one of the most brilliant observational astronomers of this century.

Lyot's early work in the 1920's consisted of measurement of polarization in the light of the moon and planets, and started characteristically enough with the construction of a new sensitive polarimeter. With this he also examined a considerable number of terrestrial substances, and showed that the moon's surface behaves as though covered with a layer of volcanic ash or dust. He discovered a fairly close resemblance between the polarization from Mercury, Mars and the moon, he found that Mercury could have at most a very tenuous atmosphere, showed that polarization from Mars was sometimes affected by haze or dust, and discovered irregularities of polarization from the Martian south polar cap, which he attributed to the frequent formation of clouds. His examination of the planet Venus, however, revealed a quite distinct behaviour, apparently due to the reflexion of sunlight from a cloud layer composed of droplets of refractive index near that of water, with diameters about 2 μ. Lyot also studied the polarization of light from Jupiter and Saturn, including Saturn's rings, finding a number of small effects still not fully explained.

In 1931 Lyot announced to an astonished and somewhat incredulous astronomical world that he had successfully observed the solar corona in full daylight. This feat had been attempted often enough in earlier years, sometimes by the most eminent observers, but had by then become to be generally regarded as impossible. Lyot had nevertheless succeeded, by inventing a new form of telescope in which all sources of scattered or false light were rigorously suppressed, and by using it in the best weather on the Pic du Midi (altitude 2,870 m.), up which he himself carried much of the equipment, on skis. Two years later he had made a polarizing filter of the type now known by his name, permitting (in contrast with the spectroheliograph) simultaneous photography over a field as big as the solar disk, in a spectrum band of the order of 1 A. wide. With this and with spectrographic equipment he worked on the Pic du Midi during the 1930's, following a very active programme of observation of the corona and the prominences, adding greatly to our knowledge of both. He measured the changes of surface brightness in the corona from day to day, particularly in the green and red emission lines, explored its spectrum thoroughly, adding five new lines and classifying the whole emission spectrum (its origin then still unknown) into groups of lines with common characteristics. He showed that the lines are wide and that their width increases with wave-length, and he demonstrated that the corona rotates at least approximately with the rest of the sun. He also studied prominence spectra, measuring the polarization in the continuous spectrum and in the lines $H\alpha$ and D_3, and produced some of the first cinematograph films showing prominence movements, films which are still unsurpassed in their fineness of definition.

Lyot's work relied on the production of flawless optical surfaces; he therefore invented new and sensitive methods of examining by phase contrast minute irregularities in the polish of a lens surface, and of discovering small inhomogeneities in large glass disks. Among his later achievements, he designed a large $f/1$ spectrograph for studying the light of the night sky; he attempted to detect a lunar atmosphere and showed that there is none with a density greater than 10^{-8} of the earth's atmosphere; he devised and used a simple but sensitive polarimeter for examining minor planets; his photographs of Mars and other planets are among the best yet obtained. Within the past two years he had published a method by which he had successfully observed the corona at sea-level. His last work consisted of spectroscopic observations of the corona at the total solar eclipse of February 25 of this year, and it was while travelling in Egypt shortly after this that a recurrence of heart trouble led to his death.

A man of charming modesty, Lyot had during the past twenty years built up a well-deserved international reputation for the originality and elegance of his methods, and for his powers as an observer. Looking back over his career, one is impressed not

merely by his inventiveness, but also by his independence of fashions in astronomical thought, by the admirable conservatism he always showed in interpreting his observations, and by the high quality of everything he did. In an epoch during which astronomy has become dominated by huge telescopes, he managed to make contributions of the finest and most significant character by his mastery of the ideas of classical optics, using only small telescopes and comparatively simple apparatus.

Lyot was awarded the Gold Medal of the Royal Astronomical Society in 1939, and the Bruce Medal of the Astronomical Society of the Pacific in 1947. He is survived by a widow and two sons.

R. O. REDMAN

Dr. J. F. Cameron

JOHN FORBES CAMERON, Vice-Chancellor of the University of Cambridge during 1933–35 and Master of Gonville and Caius College during 1928–48, died on March 21 at the age of seventy-eight. He was educated at Perth Academy and the University of Edinburgh before going up to Caius in 1895. In the Mathematical Tripos of 1898 he was Second Wrangler, bracketed with the late Sir James Jeans; and in 1900 he was awarded a Smith's Prize.

Finding that his interests and tastes lay in teaching and administration rather than in original work in mathematics, Cameron devoted his great abilities to these aspects of College and University life, with remarkable success. He had been elected a Fellow of his College in 1899, and in 1900 a lecturer in mathematics. In 1909 he became a tutor and, on his return from important posts in the Ministries of Munitions and Labour during the First World War, senior tutor. Two years later, in 1921, he was appointed bursar. On the death of Sir Hugh Anderson he was elected to succeed him as Master, in which office he governed his College for twenty years; for when, in 1943, he reached the normal retiring age, the College extended his tenure to the maximum permitted by the statutes– to 1948, in which year he reached the age of seventy-five.

Cameron's services to the University of Cambridge were manifold and distinguished. Immediately following his graduation he took a lively interest in the small but growing Department of Engineering, and he played an active part in the development of engineering in the University, being chairman of the Faculty Board for some years. He was elected to the Council of the Senate in 1924 and continued to serve on it for many years. He served also on the Financial Board and on the General Board of the Faculties. He was chairman of the Buildings Syndicate and, for twenty years, chairman of the University Press Syndicate. Cameron also took an active part in civic affairs. He was a town councillor for some years and he was chairman of the Cambridge Gas Company. In College, in the University, and in the town, Cameron's advice and help were often sought and always freely given. His mind was powerful and clear, his approach to problems of any kind was objective, and his judgment sound; and his sincerity and fairness were beyond question. When he retired in 1948 the University paid him the rare honour of conferring upon him an honorary degree of LL.D.; the Orator saluted him as *virum ingeniosum, sagacem, strenuum, amicum firmum et constantem*– a concise and apt description.

He married Miss Elfrida Sturge, daughter of John Edmond Sturge, of Birmingham and Montserrat, who survives him with one son and one daughter. A younger son died as a prisoner of war after being captured in France.

J. CHADWICK

Dr. R. W. Dodgson, O.B.E.

BORN in 1870 in Wigton, Cumberland, of Quaker parentage, Robert William Dodgson went to Owens College, Manchester, and thence in 1890 entered St. Mary's Hospital, Paddington, as a senior scholar in natural science. There he became assistant pathologist and showed outstanding ability as a teacher as well as in his other duties, his time at St. Mary's being rounded-off by a gold medal award with his M.D.(London) in 1898.

Dodgson's subsequent career falls into two periods, the first of which was mostly spent abroad. In 1900 he went to South Africa to inquire into the results of anti-typhoid inoculation of British troops serving there. This War Office appointment was followed by the directorship of the Government Research Laboratory at Cape Town under the Plague Administration, and in 1902 he became director of the Pasteur Institute of Rhodesia at Bulawayo. Two years later he returned to Britain and remained in private work until 1911. He then joined Sir Almroth Wright in an investigation of epidemic pneumonia among employees in the gold mines of the Witwatersrand, but in 1913 he left South Africa after a somewhat severe illness. Dodgson visited laboratories in France and Germany on his way home, and reached England just before the outbreak of the First World War.

The second period began in 1915 with an appointment under the Ministry of Agriculture and Fisheries to devise a method of freeing mussels from dangerous pollution. Dodgson's approach to this problem was through a comprehensive study of the physiology of the mussel, coupled with bacteriological investigation. A brilliant piece of research was the result, and his solution was applied on a commercial scale at Conway in 1916. Described in his report on mussel purification (1928), it will long be associated with Dodgson's name. The method he devised depends on the natural functioning of the shellfish in large tanks of sea water free from the irritating effects of sterilizing agents. The advantages of this principle have now been recognized in the United States, where for many years the exposure of oysters to an initial dose of active chlorine in sea water had been the practice for the purpose of purification. Later, Dodgson was appointed director of the Ministry's Shellfish Services. His study of shellfish problems as a whole led to comprehensive recommendations for compulsory treatment of all molluscs destined for human consumption in Great Britain. Although fulfilment of his ideal has not become practicable, his method of purification has been applied at some other shellfish centres in Britain and abroad. When a chance occurrence directed his attention to the possibility of using mussel purification installations for oyster culture during the off-season, he initiated a series of experiments which have yielded results of much value.

Before his retirement in 1937, which was followed by two years of service as a consultant in shellfish matters, Dodgson's services were recognized by the award of the O.B.E. He died on March 4 at his home in Conway, a bachelor, after a gradual decline in health.