

The stumbling-block had been an expansion of the potential due to Lagrange and Laplace. No proof had been given that this expansion was admissible. Liapounov replaced it by a new expansion having a smaller parameter, established the admissibility of the new expansion, applied the methods of successive approximations, showed how to find these approximations to any required order, proved that his approximations were convergent, and generalised his investigations.

Liapounov's papers on Chebichev's problem are contained in four volumes published between 1906 and 1914, written in French and extending to 768 folio pages. It is understood that Liapounov left a large amount of manuscript which will be published when circumstances permit. This remark applies also to the papers of Leonard Euler. In

1902, the Academy of Sciences proposed to mark the bicentenary of the birth of Euler (1707) by the issue of a complete edition of his works. A committee consisting of A. A. Markov, B. B. Galitzin, and A. M. Liapounov was appointed to deal with the matter. It is possible that the latter has left papers dealing with the subject.

It is painful to describe the last days of Liapounov. Russia was involved in political and social turmoil, and it was at one time feared that Liapounov might suffer like Lavoisier. This fear happily was unfounded. His wife was attacked by tuberculosis and he was threatened with cataract. They went to Odessa in search of health, and there his wife died. A few days later, on Nov. 3, 1918, he died in Leningrad as the result of a voluntary act.

¹ Ann. T(oulouse), 2 ser. t. 6; 1904. Ann. T., 2 ser. t. 9; 1908.

Two Historic Electric Power Stations.

AT an ordinary general meeting of the Newcomen Society held in London on April 15, and at the seventh annual meeting of the American members held in New York on April 16, two papers were presented dealing with two historic electric power houses. One of the papers was by Mr. G. A. Orrok and dealt with the Pearl Street station in New York, the first central station in the world; the other was by Col. R. E. B. Crompton and gave a history of the first installation of house-to-house electric supply in England, the power house of which was described as "the parent generating station of Great Britain". It was the invention of the incandescent light, the perfecting of the dynamo, and the invention of the multiple arc system, with its corollary in the feeder system and three-wire system, which brought the central station into being as a means of furnishing a means of transmitting light, heat, and power in any amount and to such distances as might be required. In the early 'eighties, many private installations of electric lighting plant were laid down, and generating plant was supplied to individual buildings and ships, but the two stations referred to at the meeting of the Newcomen Society were the first stations in the United States and England respectively to supply electric current to customers in the same way that gas and water had been supplied.

The Pearl Street station was due to the genius of Edison, from whose note-books of 1878 and 1879 can be gathered some of his earliest ideas on electric power generation and distribution. The Edison Electric Light Co., the parent company of all the Edison companies, was incorporated early in 1880, and the Edison Electric Illuminating Co. of New York, the local company, held its first meeting on Dec. 20, 1880.

To the latter belongs the credit of erecting the Pearl Street station, which began operations on Sept. 4, 1882, and by the end of 1883 had 455 customers and more than 11,000 lamps installed. The original plant consisted of four Babcock and Wilcox boilers of 200 h.p. each, supplying steam at 120 lb. pressure to Porter-Allen high-speed engines

of 125 h.p. each, directly coupled to the famous 'Jumbo' dynamos. As the station was half a mile from the river, it was a non-condensing station and the coal consumption at first was about 10 lb. per kw. hour. A serious fire on Jan. 7, 1890, interfered with its operation for a time, and five years later this pioneer station was closed down and the property disposed of.

Many interesting particulars of the electrical equipment of the station were given by Mr. Orrok. From the dynamo brushes the current was led by round copper bars to spring-controlled switches, the design of which was taken from the short-circuiting switch under the telegraph key. The station bus bars were fixed to wooden insulators bolted to the walls. There were neither voltmeters nor ammeters, as such things had not been invented.

Crude as many of the devices were, they met the situation and enabled central station companies to do business. Referring especially to Edison's chemical meter, in which each unit of current invariably removed a definite amount of zinc from one metal plate to another, Dr. Orrok said: "Was there ever a more beautiful combination of parts—each dependent on a simple physical or chemical law—than was presented in this ingenious commercial device for translating first the lamp-hour, then the ampere-hour, and finally the kilowatt-hour values into dollars and cents? . . . It is no exaggeration to say that no single device in the whole system did more to lay the solid foundation for the commercial and financial success of the Edison stations from the first than the chemical meter."

The first central station in Great Britain, dealt with in Col. R. E. B. Crompton's paper, was situated in Kensington and was erected by the Kensington Court Company, afterwards the Kensington and Knightsbridge Company, started by Col. Crompton to supply electricity to the houses they erected on a site which had been cleared by the company promoter, Baron Grant, but which had passed into the hands of the Land Securities Company.

In the generating station were installed two

Babcock and Wilcox boilers, supplying steam to seven generating sets. The dynamos were coupled directly to Willans central-valve high-speed engines. Three sets were designed to give 500 amp. at 100 volts and four sets 500 amp. at 200 volts. Vibration troubles were avoided by fixing the sets to massive concrete foundations kept clear of the buildings.

Meters were rented to customers and the current was distributed by bare copper strip conductors fixed to porcelain insulators in subways in the

streets. To ensure continuity of supply, a large battery of accumulators was installed. Current was supplied to a certain number of houses in 1886, by 1887 the company was making a profit, and later on another station was erected at Chapel Place, Knightsbridge. As the demand increased, a still larger plant was built at Wood Lane, Shepherd's Bush. This was put into operation in 1901, and soon afterwards the original steam plants in Kensington and Knightsbridge were shut down.

Obituary.

MAJOR T. F. CHIPP.

IN writing an account of the life and labours of those who truly may be said "to have finished their course", after having enjoyed the allotted span and seen the fruit of their work, there is, despite the sadness, an element of satisfaction and the fitness of things. But in the case of one of much promise, suddenly removed in the prime of life and with every prospect of a distinguished and useful career in the future, feelings of grief and sadness predominate and render the task of writing any adequate tribute both painful and difficult.

The tragically sudden death of Major Thomas Ford Chipp, assistant director, Royal Botanic Gardens, Kew, is such a case. Born on Jan. 1, 1886, he died on Sunday evening, June 28, at 9 P.M., shortly after returning to his house. Chipp was thus in the prime of life, tall, strong, vigorous, always happy and cheerful, filled with enthusiasm for his work, and deeply interested in the many duties which fall to the lot of Kew's assistant director. Through his varied colonial and War experiences he had gained a wide knowledge of men and affairs, and in addition he was a man of sound judgment and commendable tact; he was endowed with a very pleasant personality, which, during his nearly nine years' service at Kew as assistant director, had endeared him not only to his scientific colleagues but also to all the student gardeners and the whole of the Kew staff. In the larger botanical world both at home and abroad he was highly esteemed, and this was clear at the International Botanical Congress held last year at Cambridge, and is also borne out by the many letters which have reached Kew. The untimely death of a man of his calibre and powers, when men of this type are all too rare, is a greater loss than Kew has ever before been called upon to bear. His death will be equally a very severe loss to the botanical work of the Empire centred at Kew.

Chipp was the son of Edward Thomas Chipp, chief constable of Gloucester. He received his early education at the Royal Masonic School, Bushey, and there he quickly developed his taste for natural history and served as secretary to the school natural history society. This inclination towards science led him to look to horticulture for a career, and, after a period of service in the gardens of Syon House, he entered Kew in 1906 as a student gardener. After a few months in this capacity, he was selected, owing to his marked ability, for one

of the temporary technical assistant posts in the herbarium, where he remained until 1908. During this period he prepared himself, in his spare time and with very limited means, for the B.Sc. examination, University of London, which he passed in 1909 with honours in botany. He then received an appointment as demonstrator in botany at Birkbeck College, and in 1910 was appointed an assistant conservator of forests in the Gold Coast. Before proceeding to West Africa, he spent a year studying forestry in Germany and the Federated Malay States.

In 1914, Chipp was appointed assistant director of the Botanic Gardens at Singapore, but the War starting while he was in England *en route* for the Straits Settlements, he at once sought permission to rejoin his territorial regiment, the 8th Middlesex, in which he had held the rank of captain. With his regiment he proceeded to Gibraltar and afterwards to France, where he served continuously until 1919, being ultimately attached to the staff with the rank of major, and was awarded the Military Cross. In 1919 he went to Singapore to take up the post of assistant director to which he had been appointed five years earlier.

Chipp's good work while assistant conservator of forests in the Gold Coast had been duly noted, and in 1921 he accepted the invitation from the Gold Coast to be deputy conservator of forests in the colony. His career both at home and in the colonial service had naturally also been closely followed at Kew with interest and appreciation, and on the retirement of Sir David Prain in 1922 and the promotion of the present director, Major Chipp was invited to occupy the vacant post of assistant director of the Royal Botanic Gardens, Kew, and assumed office on Aug. 1, 1922.

Chipp was never idle, and his first scientific contribution of importance, "A Revision of the Genus *Codonopsis*", was made to the Linnean Society of London in March 1908. His university studies and forestry training during the next few years prevented him from carrying out any original work of importance, but on reaching the Gold Coast he soon produced the very useful "List of Trees, Shrubs and Climbers of the Gold Coast, Ashanti and the Northern Territories", in 1913, and a similar "List of the Herbaceous Plants and Under Shrubs" in the following year. Shortly after his return to the Gold Coast, in 1921, he published a "Forest Officers' Handbook of the Gold Coast,