

On account of ill health Mr. Marley had partially to retire from active business in May, 1890. He died on the 4th of April, 1891. He was elected a Member of the Institution on the 2nd of April, 1867.

LOFTUS PERKINS¹ was the third of a family of inventors. His grandfather, Jacob Perkins,² who was born in 1766, in New England, and died in London in 1849, was one of the most prolific of patentees. He took out—in the days of the old patent law—no less than nineteen patents, ranging over a great variety of subjects. Among these the most profitable was one for the method of transferring engraving by pressure, a device which, first intended for such purposes as the production of plates for printing bank-notes, was largely used for printing postage-stamps, and received its most important industrial application in the production of rolls for calico printing and similar purposes. He also devoted much attention to the utilization of steam at high pressures, a subject with which the most important inventions of his son and grandson were connected. The steam-gun was his most remarkable application of the principle, and this invention attracted a great deal of attention both in military circles and among the general public. As a young man Loftus Perkins had much to do with the working out of this invention, and to the end of his life was a great believer in its value, refusing to admit the force of the objections of practical artillerists. Angier March Perkins,³ the son of Jacob, applied high-pressure steam, or rather, water heated under high pressure in a closed circuit, to warming and ventilating, and for the development of this system founded the firm, A. M. Perkins and Son. He also applied the same principle to heating bakers' ovens. This was perhaps the most commercially successful of any of the inventions of the family, though the larger share of the profits was absorbed by the firm of bakers who bought the original patent. Another important application of the same idea was to military field ovens, for which it is of great value.

Loftus Perkins was born in London in 1834, but, being of

¹ In the preparation of this notice free use has been made of the Obituary which appeared in *The Engineer*, April, 1891.

² Minutes of Proceedings Inst. C.E., vol. xxv. p. 516.

³ *Ibid.*, vol. lxvii. p. 417.‡

American descent, always considered himself an American, and like his father and grandfather he passed some portion of his early life in the United States. After some years spent in his father's factory, he went to Germany, but soon returned to enter (in 1866) into partnership with his father, and from that date till the present year he continued the practice of his profession in London.

His most important work was the development of the high-pressure steam-engine. He is justly entitled to the credit of being a pioneer in the utilization of steam at the higher pressures now common in the modern steam-engine. In regard to this question he was in advance of his contemporaries, and many of his ideas, since generally admitted, were at first received with coldness, even with opposition and contempt. As far back as 1859, he had designed an engine which should work at 600 lbs. pressure, and he spent many years in perfecting that idea. The difficulty of lubrication he overcame by the use of metal packing-rings (made of an alloy of copper and tin), a device since largely and successfully adopted. Of the practical success of the high-pressure system in his hands there can be no question, for a certain number of the engines, both stationary and marine, are still successfully at work. Some have even been running regularly for twenty years. Its value was demonstrated by numerous and costly experiments, the most interesting of which was the dispatch of the 70-ton "Anthracite" to New York. The fact that this little yacht carried sufficient fuel to steam both ways across the Atlantic, was justly put forward as a practical and popular demonstration of the economy of the system, while careful tests, perhaps the most searching to which a steam-engine has ever yet been put, showed that, in the small engines tested, the amount of coal used did not amount to more than $1\frac{1}{2}$ lbs. per HP. per hour. The engine was, however, not a financial success, and this was a source of genuine grief to the inventor, who devoted to its development time and thought which might probably have been employed with better pecuniary results in other departments of his business. Commercial profit, however, was almost the last thought of Loftus Perkins, who had the true inventor's desire to realise in perfection the mechanical idea conceived, and was never content with a merely practical success, so long as he saw his way to a real or fancied improvement. Another invention—successful at all events up to the experimental stage—related to the application of steam-power to common-road traction. In this case perhaps the reasons for the invention not coming into actual use

were legislative rather than mechanical, for he constructed a steam road-carriage which made numerous experimental journeys with success, running at high speeds, but under perfect control.

His minor inventions were numerous. Amongst the subjects to which they related may be mentioned, besides those specially referred to, marine propulsion, water-meters, heating and ventilating, and wheels for common-road carriages. An exhaustive test of iron gun-carriage wheels made under his system against the wooden wheels commonly employed led to a favourable report and a small order from Government, but from some unexplained cause the order was not repeated.

One of the earliest freezing-machines working with recovery of the volatile agent was that brought forward in 1834 by Jacob Perkins. At the time it had no great success, nor was there much demand for such an apparatus. Recent improvements in machines for the artificial reduction of temperature, and an increased demand for them in connection with the importation of meat, led Loftus Perkins to turn his attention to the subject. For himself the idea was an unfortunate one, for his work upon the apparatus which he devised, the anxiety caused by it, and the long hours which he devoted to the experiments necessary for its completion, tended to break down his health and bring on the illness which ended in his death. In principle the machine did not differ materially from other freezing-apparatus in which ammonia is employed, but the mechanical arrangements were, as in all Perkins' inventions, of great originality and of marked simplicity. There were no valves or other moving parts, and thus one difficulty in the construction of all ammonia machines was got over, since all joints could easily be made tight, and the risk of leakage was minimised. Unfortunately the apparatus was hardly completed before he was taken seriously ill, and was prevented from turning what was certainly an experimental success into what might have been a genuine commercial undertaking.

That a life still so full of promise should have been cut off at a comparatively early age was a source of sorrow to a large circle of friends, who saw with regret that his genius and original character never received either the appreciation they deserved, or the more solid rewards which might fairly have been expected for them. To those friends the sterling character of the man and his warm and generous heart had greatly endeared him, while his scrupulous honesty and the transparent sincerity of his mind compelled the admiration of all with whom he was brought in contact. With less enthusiasm and more thought for self he

would doubtless have turned his really great abilities to better practical account, but he could not have left to all who knew him a more honoured memory or one to be preserved with more tender and affectionate regard.

Mr. Perkins died on the 27th of April, 1891. He was elected a Member of the Institution on the 31st of May, 1881.

WILLIAM COUPAR RENNIE was born at Kinross on the 3rd of December, 1843, and was educated at Dollar Institution, N.B. In 1862 and 1863, when serving with Messrs. Bell and Miller, of Glasgow, he attended the classes of the late Professor Rankine at Glasgow University, in which he gained some distinction. In 1863 he passed the necessary examination in London for an appointment in the Indian Public Works Department, and on the 24th of June of that year was appointed a Probationary Assistant Engineer. On arrival in India he was posted to the Berar Division, in the province of Hyderabad, Deccan, where he remained till the 23rd of February, 1865, when he resigned the Government service. For the next two years he was employed by Messrs. Lee, Watson and Ayton, contractors, as one of their agents on the construction of the Nagpur branch of the Great Indian Peninsula Railway.

In April, 1867, Mr. Rennie was re-appointed to the Public Works Department of the Government of India, and was again posted to Berar. In Berar, which at that time was a new and backward province, and which, owing to its capacity for growing cotton, had come into prominence by the breaking out of the American Civil War, he did much good work in laying out and constructing roads, and in the erection of the many new public offices and buildings which were required for the civil administration of the district.

In June, 1868, Mr. Rennie was prostrated with sickness, and had to take leave to Europe. On his return to India in November, 1869, he was posted to the Nizam's State Railway, on the survey and construction of which he did much good work. For first-class execution of work he received the acknowledgments of the Governor-General in Council. In December, 1873, he was trans-