December, 1888, published in the final Official Report of the Board, gives an idea of the work he had to do. It occupies fourteen closely printed folio pages and refers to no less than nine hundred and fifty detailed reports he had made in the course of the year.

Sir Joseph was on many occasions consulted by foreign governments with reference to schemes for the drainage and improvement of large continental cities, and in his own country he frequently gave advice and assistance to the authorities of provincial towns.

Sir Joseph Bazalgette was connected with the Institution for more than fifty-three years, and at the time of his death only four members survived of older standing than himself. Entering as a Graduate on the 6th of March, 1838, he was transferred to the class of Member on the 17th of February, 1846. He was elected a Member of Council in December, 1867, a Vice-President in December, 1879, and filled the office of President in 1884. His Presidential Address was mainly devoted to considerations affecting public health and welfare in all the large cities of the world.

Sir Joseph married, in 1845, Maria, fourth daughter of the late Mr. Edward Kough, J.P., of New Cross, County Wexford, by whom he had a family of six sons and four daughters. Although of small stature and of somewhat delicate health, he possessed great energy and strength of will, which enabled him to combat and surmount the difficulties, often considerable, of his responsible public post. He had in later years often suffered seriously from asthma. He died, much regretted, at his residence at Wimbledon on the 15th of March, 1891.

JOHN MARLEY, youngest surviving son of Mr. Thomas Marley, of Middridge Grange, near Shildon, in the County of Durham, was born there on the 11th of November, 1823. He received his early education from the Rev. J. Birkbeck, of Denton, near Darlington. In March, 1840, he was articled to Mr. John A. Forster, of Bishop Auckland, a brother of the late Mr. Thomas E. Forster, M. Inst. C.E., passed subsequently under Messrs. George Hunter and William Longstaff at the Marquess of Londonderry's collieries, and finally completed his pupilage with Mr. Edward F. Boyd on the 30th April, 1844. He was soon afterwards appointed Lessor's Agent for some mineral estates in the County of Durham, and in October of that year was engaged under Mr. John Bourne in railway surveys between Newcastle and Berwick. Later in the same year he was employed at Whitehaven in getting up plans

for the Whitehaven and Furness Railway. In 1845 he was engaged under Mr. John Dixon, the Engineer of the Stockton and Darlington Railway, in surveys for the Wear and Derwent Junction Railway, and, together with Mr. Thomas Bouch, in surveys for the Wear Valley Extension Railway. In October, 1846, he was appointed Manager of Woodifield Colliery by the young firm of Bolckow and Vaughan, and entering upon his duties on the 1st of November, 1846, remained with that firm until it was converted into a Limited Liability Company in 1864, when he was retained as Chief Mining Manager. He continued in charge until he resigned that appointment at the close of 1867, remaining, however, a Consulting Engineer of the Company for two years longer. During Mr. Marley's connection with the firm of Bolckow and Vaughan colliery was added to colliery, important winnings made, limestone quarries opened, and the great Cleveland ironstone district explored and opened up, all under his charge and direction. The latter event deserves special notice, for it was Mr. Marley and Mr. John Vaughan who made, what was felicitously termed, the "commercial" discovery of Cleveland ironstone. The actual discovery of ironstone in Cleveland had taken place years before, at least as early as 1811, and attempts had been made to bring some of it into use at various periods. Early in 1848 Messrs. Bolckow and Vaughan had collected and shipped to Middlesbrough several thousand tons found on the coast between Redcar and Skinningrove, and in the same year the main bed was discovered at Skinningrove and a shipment made from it in August. In September Messrs. Bolckow and Vaughan first requested Mr. Marley to examine it, and led his attention to the subject. They desired that efforts should be made to discover the same main bed or seam in the Eston and Upleatham hills, which were much nearer to Middlesbrough, and to which easy railway communication was possible. A seam was soon discovered, but it was only the one known as the top seam and of little value. This made Mr. Marley of opinion that the main seam should be found at Eston, and in March, 1849, he opened negotiations with landowners for right to search. All were not willing, and it was not until early in 1850 that, having made arrangements with one landowner, and still without having found the main seam, systematic search was prepared for. On the 8th of June, Mr. John Vaughan and Mr. Marley went to examine and decide upon the place for boring, and were so fortunate that day as to find the outcrop of the main seam, which rendered boring unnecessary. No time was lost in opening out the seam and laying tramways. Some of the ironstone was

very soon in the furnace, by the end of the year 4,000 tons had been sent away, and in 1851 the output increased to 187,950 tons; the branch railway, 2 miles long, having been opened on the 6th of January of that year. The industry for which, on that occasion, a great future was predicted, has grown to be of world-wide fame.

The next important event during Mr. Marley's connection with the firm of Bolckow and Vaughan was the discovery at Middlesbrough of a bed of rock-salt in 1863. This occurred incidentally in the prosecution of borings for the supply of water. In 1868 Mr. Marley was engaged with Sir George Elliot in the compilation of information and statistics relating to the County of Durham for the Royal Commission on Coal. In 1870 he associated himself with the North Brancepeth Coal Company, Limited, as Chairman and Managing Director, an office which he held down to his last illness. He was much engaged in arbitrations respecting railway and mining undertakings, his services being retained as umpire and arbitrator as well as witness. He also had great experience in Parliamentary railway work. He had visited professionally nearly all the coal- and iron-fields of the United Kingdom, and some in Germany, Spain and Italy. In 1884–85 he was engaged in Cleveland to formulate the scheme for the rating of the Cleveland ironstone mines. From its formation, on the passing of the Mines Regulation Act of 1872, he was a member of the Mines Examination Board for South Durham, and was also on the chief committees of the Durham Coalowners Association.

Mr. Marley was a Member of the North of England Institute of Mining and Mechanical Engineers from its commencement in 1852. In 1857 he was elected a Member of Council, in 1872 a Vice-President, and in August, 1888, President, which office he held for two years to the great satisfaction of the members, devoting himself with characteristic energy to the interests of the Institute. To the Proceedings of the Institute he contributed several Papers, the chief being those on Cleveland ironstone. He took a leading part in the federation of the Mining Institutes, and was elected in 1889 first President of the Federated Institute of Mining Engineers.

He was a man of indomitable energy, and of great application, ability and resource, and was valued and respected by those with whom business brought him in contact. His manner was quiet but firm, and his bearing manly and courteous. He had many friends. His life was active and useful, and his loss is deeply felt.

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 PERKINS[1] 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

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[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.