foreign gas-works are principally derived from England. Such is a brief outline of the extent and influence of the new industry that was mainly created by Samuel Clegg. Winsor, the two Crosleys, John Malam, and many other of his coadjutors in the great work, have long preceded him to the grave; but we have yet left among us Lowe, Neilson, G. H. Palmer, and Grafton, as connecting links with the past—men who strenuously laboured with him whose death we now mourn, in overcoming the obstacles that stood in the way of the success which they ultimately accomplished."

Mr. Clegg was a very old member of the Institution of Civil Engineers, which he joined in 1829: in the early and struggling days of the Society he was a constant attendant at the meetings, frequently joining in the discussions; and he never ceased to take a lively interest in the proceedings, and to come among his professional brethren, by whom he was universally respected and esteemed.

"In private life, his natural reserve and diffidence prevented Mr. Clegg from being known and appreciated to the extent which his genius and acquirements would otherwise have commanded; but to his intimate friends he was endeared and respected by his sterling integrity of character, by his affectionate disposition, and, by a happy flow of spirits, which he retained to the last. His was not a death of disease and pain: it was the wasting away of the lamp of life, which, after having, during a long career, shone brightly on the world, flickered and expired" on the eighth day of January, 1861, at the mature age of seventy-nine years.

SIR WILLIAM CUBITT, F.R.S., was born in the year 1785, at Dilham, in Norfolk, where his father was a miller. The small amount of early education afforded to him was obtained at the village school; and subsequently, when his father removed to Southrepps, where he rented the mill, young William ingratiated himself with the Rev. Erasmus Drury, the curate of the parish, and, obtaining access to his library, and afterwards to that of the Rev. J. Humphrey, of Wroxham, he well stored his mind with useful information.

At an early age he was employed in the mill, and having exhibited considerable aptitude in the repairs of the machinery, he was in the year 1800 apprenticed to one James Lyon, a cabinet-maker and joiner at Stalham, from whom, after a rude service of four years, he gladly parted, having, however, acquired great dexterity in the use of tools, as is evidenced by the neat construction of several articles of furniture still in the possession of some of his old friends in Norfolk.

During the period of the apprenticeship of the son, the residence of the father was once more changed to Bacton Wood Mill, where,

in the year 1804, young William joined him, and in his leisure hours commenced his first practical invention by an attempt to construct a machine for splitting hides; this machine, although unsuccessful, exhibited considerable mechanical talent. Determined, at length, to commence life on his own account, he joined an agricultural machine-maker named Cook, who resided at Swanton, where they constructed horse threshing-machines, and other agricultural implements, with some success. At this period he became celebrated for the accuracy and good finish of the patterns made by him for the iron castings for these machines.

His attention was at this time naturally directed to windmills, which he was frequently employed to repair, and finding the difficulty of managing, during stormy weather, the large sails then introduced, he was led to invent the self-regulating windmill sails, now in universal use, which were patented in the year 1807, at which time he had settled at Horning, in regular practice as a millwright.

He next commenced the construction of machines for draining the marshes in the immediate vicinity of his residence, and several of these machines, mounted on tripod frames of cast-iron, are still in existence. He obtained considerable employment at this period, but as his progress was not so rapid as he desired, he in the year 1812 sought and obtained an engagement in the then rising works of Messrs. Ransome, of Ipswich, where he soon became the chief Engineer of the concern, to which he afforded great assistance. He remained there for nine years, and during that period was engaged in several engineering works of interest, such as improvements in the port of Ipswich,[1] and in the gasworks of that town. His engagement under the Messrs. Ransome led eventually to his becoming interested in the concern, a position which he held until the year 1826, when his numerous engagements as a Civil Engineer rendered necessary his removal to London.

Before this period, Mr. Cubitt's attention had been directed to the question of the employment of criminals; and for the purpose of utilizing the labour of convicts he invented the treadmill, with the object of using the power for grinding corn, pumping water, &c., not at first contemplating the use of the machine as a means of punishment. This invention was brought out about the year 1818, and it was immediately adopted in almost all the principal gaols of the kingdom.[2]

For some time anterior to his settling in London, Mr. Cubitt had been extensively employed as a Civil Engineer, and among his early Reports are those of 1814, 1820, and 1822, on the

[1] *Vide* Minutes of Proceedings Inst. C.E., vol. xx., p. 4, *et seq.*

[2] In the year 1822 an account of the treadmill was published by the Society for the Promotion of Prison Discipline, wherein the machine is mentioned as "invented by Mr. William Cubitt, of Ipswich."

Norwich Navigation; and it was in the latter year that he first came in contact with Mr. Telford.

From the period of his removal to London, Mr. Cubitt was engaged in almost all the important works of the time, and his opinion and evidence were sought on all the great questions, such as ports, harbours, canals, the improvement of rivers, or the construction of railways, and he was occupied in designing bridges.

It would be impracticable, within the limits of this Memoir, to enumerate the numerous works upon which Mr. Cubitt was engaged, as there was scarcely a question of engineering interest upon which his opinion was not sought either by the promoters, or by the opposition; and his appearance in the Committee Rooms at Westminster, with his never-forgotten slide-rule in his hand, was familiar to all the profession. A few only of his principal works may, however, be alluded to. He was extensively engaged in Canal Engineering, and the Oxford Canal and the Birmingham and Liverpool Junction Canal are among his works under this head. The improvement of the River Severn was designed and carried out by him; and he was frequently consulted and made many important reports on the Rivers Thames, Tyne, Tees, Weaver, Ouse, Nene, Witham and Welland. He was also a Member of the Commission for the improvement of the Shannon, in which his judgment and experience were of material service.

The Bute Docks at Cardiff, the Middlesborough Docks and Coal Drops[1] on the Tees, the Black Sluice drainage, and its outfall sluice at Boston Harbour, are among his works.

On the introduction of railways, the evidence of Mr. Cubitt as a practical mechanic was sought with good effect in Parliamentary contests; and, as Engineer-in-Chief, he constructed the South-Eastern Railway, where he adopted the bold scheme of employing a monster charge of eighteen thousand pounds of gunpowder for blowing down the face of the Round Down Cliff between Folkestone and Dover, and then constructing the line of railway along the beach, with a tunnel beneath the Shakespeare Cliff.

On the then Croydon Railway, at the desire of the Board, the application of the atmospheric system of traction was undertaken by him, and he certainly did all in his power to induce its success.

On the Great Northern Railway, to which he was the Consulting Engineer, and which was constructed by his son, Mr. Joseph Cubitt (M. Inst. C.E.), he endeavoured to introduce all the undoubted improvements of other lines, and with great success.

His engineering efforts were not confined to the United King-

[1] *Vide* Minutes of Proceedings Inst. C.E., vol. v., p. 248.

dom, and his opinion was frequently sought for on the Continent. Among other matters, he was consulted by the Hanoverian Government on the subject of the Harbour and Docks at Harburg. The works for supplying the city of Berlin with water were constructed under his advice and direction, and at the great discussions at Paris relative to the rival Companies proposing to construct the Paris and Lyons Railway, Mr. Cubitt, accompanied by the author of this Memoir, made a careful investigation of the country, and his Report exercised considerable influence on the ultimate determination of the question.

On the completion of the railway to Folkestone, the establishment of steamers between that port and Boulogne was a natural consequence, and the improvement of the harbour was inevitable. Then followed the proposition for the construction of a line of railway from Boulogne to Amiens, there to join the Great Northern Railway of France, and to this Mr. Cubitt became the Consulting Engineer, the works being under the immediate direction of Monsieur Bazaine, Ingénieur des Ponts et Chaussées.

Among Mr. Cubitt's latest works were the two large floating Landing Stages at Liverpool, one at St. George's Pier, and the other at the Albert Parade; these works were novel in their details, and most successful in their operation, and the latter still considerably exceeds in dimensions any other work of its kind.

His last work was the Bridge for carrying the London Turnpike Road across the Medway at Rochester. This was founded on cast-iron cylinders, sunk by the then novel pneumatic process, and carried down to the depth of 55 feet below high water.

In the year 1849, when the International Exhibition was under discussion, it was felt that it would be essential to have some good authority to refer to with respect to the construction of the building to be erected in Hyde Park. Sir Robert Peel made inquiry respecting the qualifications of the President of the Institution of Civil Engineers, and being satisfied on the points in question, the definitive appointment of the Royal Commissioners was deferred until after the election of Mr. Cubitt as President, in January, 1850. An arrangement was made forthwith, by which he undertook very active and responsible duties in connection with the construction, and he executed them so satisfactorily that at the expiration of his services in 1852, Her Majesty was pleased to confer upon him the honour of Knighthood, which he had more than earned by his earnest and intelligent conduct of that large and novel work. When the total subversion of the original plan for the building, as designed by the Committee, was proposed to Mr. Cubitt, he did not hesitate to examine the plan submitted to him by Mr. (now Sir Joseph) Paxton, through the intervention of a mutual friend; nor did he decline, when he had maturely considered the plan and the details of construction as given by

Mr. (now Sir Charles) Fox, to give his adhesion to it, and to join in proposing it to Prince Albert. How successful was that novel and unique construction need not here be mentioned; but it must be maintained that to Mr. Cubitt's good mechanical and constructive knowledge, his cool and mature judgment, and his confidence in the plans decided upon, the ultimate triumphant success was in a great measure due.

He became a Fellow of the Royal Society in the year 1830;—he was also a Fellow of the Royal Irish Academy, Member of the Society of Arts, and of other societies.

Labours such as have here been shadowed forth rather than described would suffice to wear out the strongest constitution, and Sir William Cubitt, who had never been a robust man, felt it necessary in 1855 to retire in some degree from the active exercise of the profession; and in 1858 he ceased to give any attention to business; he continued, however, to take an interest in the proceedings of the Engineering world until his final illness, under which he sunk on the 13th of October, 1861, in his 77th year, at his residence on Clapham Common.

Sir William Cubitt joined the Institution of Civil Engineers as a Member in the year 1823; he became a Member of Council in 1831, was elected Vice-President in 1836, and held the post of President in 1850 and 1851. At the period of the great changes introduced into the constitution of the Institution he took a very active and useful part, and throughout his career he was an earnest friend of the Institution, which he considered to be the great bond of union of the members of the profession.

Sir William Cubitt was among the last surviving self-made Engineers, and few men laboured more honestly and uprightly to obtain well-deserved eminence.

Mr. NICHOLAS OLIVER HARVEY was born in the year 1801. When young he was for a short time with his uncle, the late Mr. Henry Harvey, the proprietor of the Hayle Foundry, Cornwall. Subsequently he became a pupil at the Eagle Foundry, Birmingham, then managed by the late Mr. W. Brunton (M. Inst. C.E.), where he remained until he was about twenty-one years of age. He then returned to Hayle, to assist in the management of the foundry, where he had the advantage of working with Trevithick and with Wolff, and derived great benefit from this association; many of the improvements in steam machinery, introduced since that time, having been then discussed in advance of their present adoption. As an example, Mr. Harvey has been heard to relate, that Trevithick, whose tubular boiler is still the one universally adopted for stationary engines, discussed the advantage of using small tubes, in order to shorten the boiler, and