

speak of the early engineers, and of those who had helped him on in his successful journey through life.

Although to a certain extent bedridden, when the summer-time came, he was carried on board his beautiful yacht the "Pandora." He remained in the covered cabin, and visited the Loire, or the Seine, or the coast of France. In like manner he visited Belgium and Holland, sailing along the great canals. One of his last visits was to the coast of Italy. When the steam yacht stopped at a seaport town visitors flocked on board to see the ship. Mr. Penn was always glad to chat with them in their own language, whether it were French, German, or Italian.

He died on the 23rd of September, 1878, at the age of seventy-three; and thus passed away a great man, one of the most distinguished workers of this age and country.

Mr. WILLIAM WEST, the second son of a family of fifteen, was born in 1801 at Dolcoath, near Camborne. He was one of the many men born in that district who have raised themselves to prominent positions in the world by their industry and talents, and who have left their mark on their day and generation. Mr. West's father was connected with the famous old mine of Dolcoath, for which he managed the mine farm, and was also accustomed to buy the horses required by the adventurers. His son William received but a scanty education at a dame school. While still very young he was put to work on the mine, first at the surface, and then underground with his brother-in-law, Thomas Opie. His health failing, he stopped work for a time, but afterwards resumed it for a while, working on tribute with a young fellow of his own age, named John Rabling, who afterwards became manager of some important silver mines in Mexico. Mr. West and Mr. Rabling remained fast friends all their lives. Renewed ill-health at the age of seventeen compelled young West finally to abandon mine work, and it was not long before an opportunity arose for carrying out a long-cherished wish of becoming an engineer. This was at the time when great improvements were being made in the steam engine, by a notable band of Cornish engineers, of whom Trevithick, Woolf, Andrew Vivian, and Hornblower were among the chief. Trevithick was engaged on his Cornish boilers, his high-pressure "puffer" engines, and his locomotive. Mr. West always

recalled with pride the fact that he once held the candle to Trevithick while he was engaged in the construction of the locomotives. Andrew Vivian and Trevithick had been occupied on their road steam carriage. Woolf was producing his two-cylinder compound engine, which, after lying many years in abeyance, was at length resuscitated, to produce a revolution in marine engineering. Watching the work of such men as these, West had his desire to become an engineer still further stimulated. One day, a brother-in-law, William Mathews, working engineer on Dolcoath, was turning a piston-rod for a winding engine with the old-fashioned hand tool. Mr. West was asked to try and rough-turn the rod while Mathews was called away to attend to a breakage in one of the engines. When Mathews returned, he found, to his surprise, that the work had been executed in a very creditable manner. This led to young West's obtaining employment in the fitting shop, where his indomitable industry and quickness of perception soon brought him into notice. Mr. West's first independent employment, apart from Dolcoath, was his engagement as a working engineer by Captain Joseph Vivian in erecting a pumping engine at South Roskear; and he was soon afterwards engaged in a similar capacity in erecting engines on several neighbouring mines. These works led to his paying frequent visits to Hayle Foundry, where he attracted the attention of the late Mr. Henry Harvey, founder of the well-known firm of Harvey and Co. One of those periodical depressions to which mining has always been liable throwing Mr. West out of work, Mr. Harvey introduced him to Messrs. Bolitho of Penzance, who engaged him to erect an engine to work a flour mill. So successfully was this carried out that Mr. Harvey ever afterwards took a deep interest in Mr. West's career, and furthered his interests in every way he could. Mr. West's next engagement was on the Great Wheal Towan mine, St. Agnes, reworked by Captain Nicholas Vivian, with Captain S. Grose as chief engineer. At this mine were erected a couple of 80-inch cylinder pumping engines, the most powerful at that time in Cornwall. During one of the intervals between his chief's periodical visits of inspection, and with the consent of Captain Vivian, Mr. West had the boilers of one of the pumping engines covered with sawdust, to prevent radiation. Up to this time, boilers and steam pipes had always been left uncovered; and this method of protection resulted in such a reduction in the consumption of coals, that Captain Grose, at his next visit, had the cylinder and pipes enclosed with the same material. The result was

such an increase in the duty of the engine, that the reports were received with a great deal of suspicion by the mine agents and engineers, until a public trial completely vindicated the reported duty. Mr. West remained at Wheal Towan two or three years, and during that time largely extended his store of information by his acquaintance with a well-educated friend named Davis. In 1831, being strongly recommended by Captain Vivian, the late Mr. J. T. Treffry appointed Mr. West engineer to the famous Fowey Consols and Lanescot mines, then approaching the height of their productiveness. Here he had the entire control of the engineering department, and his work speedily attracted the attention of the whole mining community of the county. It was in 1833-34 that he erected at Fowey Consols an 80-inch pumping engine, which embodied all the latest improvements, and which in July 1834 had a reported duty of 90 millions, and in the following September one of 97·8 millions. Not unnaturally, the accuracy of these astounding figures was questioned. A public trial then took place, which lasted twenty-four hours, and which far more than substantiated the duty reported. As the result of the trial, the committee of engineers who had conducted the investigation stated that the duty done in the twenty-four hours was 125 millions of pounds raised 1 foot high, by the consumption of 94 lbs. of coal. The success of this engine soon brought Mr. West an abundance of work from all parts of Cornwall and Devon, and it was not long before his engagements extended to the most distant parts of the kingdom; while in later years he supplied engines and other mining machinery to various parts of the continent of Europe, to North and South America, Africa, Asia, Australia, New Zealand, and, in fact, to almost every mining district in the world. About this period Mr. West became partner with the late Mr. William Petherick, but this association lasted only a short time, and Mr. West, working single-handed with a constant application and determination which were characteristic of him, soon had his hands full of engagements as a mining engineer. In 1835 the directors of Holmbush mine presented him with one of the many testimonials he received, in record of their appreciation of the skill he had shown in erecting their machinery. About the same time he erected, at South Hue mine, the first of the steam capstans, which are now to be found on almost every mine, and which have proved so economical to the adventurers, and have been such a boon to the working miners, in reducing one of the most disagreeable parts of their work, "capstanning." In 1838 the

late Mr. T. Wicksteed, M. Inst. C.E., visited Cornwall, on behalf of the East London Waterworks, and inspected a number of pumping engines.¹ Struck with the excellence of that at Fowey Consols, he purchased a similar one, which Mr. West had erected at the East Cornwall mines. Mr. West contracted to remove and re-erect it at the Company's works, and Messrs. Harvey, of Hayle, engaged to make the necessary pump work. The diameter of the plunger rod of the pump was 42 inches, and it had a working load of about 32 tons. It was fitted with the common butterfly valves, but the great dimensions of the pump and the enormous load rendered it impossible to work under such conditions. The vibration and shock were tremendous, and it was speedily evident that a radical change was needed somewhere. Mr. West's inventive genius soon overcame the difficulty by devising the double-beat water valve, which was found to work so effectively that it was patented by Mr. West and Mr. N. Harvey, and proved very remunerative to the patentees. The success of the operations at the East London Waterworks also led to Mr. West's being engaged to fit up pumping apparatus in connection with many other large waterworks in the metropolis and other parts of the country. The directors of the East London Company gave him a handsome testimonial. The steady increase of Mr. West's business engagements, and his unwearied activity led, in 1848, to the establishment by him of the foundry and engine-works at St. Blazey, now carried on by his sons Messrs. W. and C. West. He was never idle, and, although for many years connected with numbers of the largest mines in the county, he found time to undertake several other important works. He contracted for building the engine houses for the atmospheric system on the South Devon line, and when this proved a failure, he agreed to receive as payment the materials which the abandonment of the atmospheric system had rendered waste. It was by Mr. West that the Newquay and Cornwall Junction Railway was constructed; and he was the contractor also for the Bodmin and Camborne Waterworks. Nor did his own special calling and such kindred matters by any means exhaust his energies. He was one of the founders, in the year 1864, of two of the most flourishing banks in Cornwall,

¹ The Transactions of the Inst. C.E., vol. i., pp. 117-130, and vol. ii., pp. 61-66, contain Papers by Mr. Wicksteed "On the Effective Power of the High Pressure Expansive Condensing Steam Engines in use in some of the Cornish Mines."

viz., Messrs. Willyams, Treffry, West & Co. at St. Austell and Fowey, and Messrs. Clymo, Treffry, Hawke, West, Polkinghorne & Co. at Liskeard, Bodmin, &c. He held a large interest in various mines, clay works, and quarries; and at the time of his decease was the principal proprietor of Phœnix and West Phœnix United tin and copper mine, and of the Par granite quarries. Phœnix mine, indeed, had been saved from extinction purely by his courage and foresight; and one of the testimonials which Mr. West most valued was that presented to him by the working miners there, in grateful recognition of his labours in preserving what is now one of the most valuable mining properties in the county. The adventurers also most generously recognised the value of his work in this direction. The shareholders in Par Consols Tin and Copper Mine also presented him with a splendid silver tea and coffee service.

Among Mr. West's inventions was one, patented in conjunction with Mr. Darlington, for transferring power in mines by means of hydraulic agency. While Mr. West was engaged at Fowey Consols, the mine was visited by the late Bishop of Exeter, who was at once struck with the shrewdness and capacity of the engineer, to whom his lordship had been introduced by Mr. Treffry. Dr. Philpotts would have no other companion than Mr. West during his inspection; and this led to Mr. West's appointment as mineral agent or toller to the see. This appointment Mr. West retained, assisted by his son-in-law, Mr. William Polkinghorne, for many years, then acting for the Ecclesiastical Commissioners as agent and receiver jointly with Mr. Polkinghorne until the year 1879. The last, though not the least, of the important undertakings carried out by Mr. West, was the taking down of an 80-inch engine at Wheal Pembroke, repairing and refixing it, with additional machinery, at the Great Holway lead mine in Flintshire. This engine was first erected at Par Consols, and thence removed to New Pembroke. It is now the most powerful engine in the district to which it has been transferred.

Mr. West died at his residence, Tredenham House, St. Blazey, after a short illness from heart disease, on the 16th of June, 1879, at the good old age of seventy-eight years. Though delicate in youth, for nearly half a century he had hardly known what illness meant, and his mind remained bright and clear to the last. Mr. West was twice married, and had three sons and two daughters by his first wife. These children with his second wife survive him. He acquired considerable wealth, which was

partially invested in landed estates, and which, apart from a few legacies, he has divided equally between his children, directing that the whole may be kept intact for twenty years from his decease.

Mr. West was elected a Member of the Institution of Civil Engineers on the 12th of February, 1839. He remained a thorough Cornishman throughout his life, proud of his native county and proud of his origin, and of his having made his own way in the world. He was straightforward in all his doings, plain and downright in speech, but with a kindly heart—always ready to do a good turn to those who needed it. He interested himself in the various county institutions and societies, and had a vein of native humour which made his company most enjoyable. He possessed a fund of quaint stories and reminiscences upon which he was never weary of drawing, and which were all the more valuable because in him passed away the last link between Cornwall of the days of Watt and Trevithick, and Cornwall of the present—the last of a school of mining engineers that made the old county famous.

MR. FRANCIS DAWSON was for some time a student in the Applied Sciences Department, King's College, London. In 1852 he entered the office of Mr. W. H. Barlow, President Inst. C.E., as a pupil, and afterwards went to the Crimea in the Army Works Corps, where he was engaged on the telegraph staff. On his returning he continued his articles with Mr. Barlow, and for a short while acted as the assistant of Mr. T. F. Chappé, M. Inst. C.E., on the Gloucester and Stonehouse railway. In the autumn of 1858 he obtained the appointment of "Assistant Engineer," Jamaica; in 1861 he was promoted to be "County Engineer," and in 1868 to be "Deputy Director of Roads." In these several capacities he was engaged in the construction of new roads, improving the communications throughout the island, and in the erection of government buildings. In several cases he exercised much engineering skill in spanning rivers. One of the works he designed and successfully carried out was the Victoria Market, Kingston. He organised and introduced a better means of extinguishing fires, which are frequent and destructive in Jamaica, and formed a fire brigade for that purpose. He was remarkable for an originality of character and inventive talent which attracted