

APPENDIX TO VOL. XXI.

MEMOIRS.

MR. EATON HODGKINSON was born on the 26th of February, 1789, at Anderton, in the parish of Great Budworth, near Northwich, Cheshire, at which place his father was engaged in farming pursuits. On the death of his father, which occurred when the boy was only six years old, he was, at the instigation of his uncle,—the Rev. Henry Hodgkinson, rector of Arberfield, Berkshire,—placed at a classical school, with the view of his proceeding to the University, and of ultimately entering the Church. In the study of the Classics he does not appear to have made any progress, and he was soon transferred to the care of Mr. Shaw, at that time the master of the grammar-school at Northwich, under whom he laid the foundation for his future mathematical acquirements, and to whose careful tuition Mr. Hodgkinson frequently alluded in after-years.

The pecuniary circumstances of Mrs. Hodgkinson induced her to remove, in the year 1811, to Salford, Manchester, where she entered into business, and, with the assistance of her son, eventually attained a comfortable position. He was not, however, intended by nature to emulate the thrifty and active examples around him in that city of millionaires; his tastes led him rather to listen to the mathematical teaching of Dr. Dalton, one of whose most distinguished pupils he became, and with whom he formed a friendship which was only dissolved by the death of Dalton. For nine years Hodgkinson's studies and researches led to no apparently useful result; but at length, on the erection of a fire-proof factory, he was engaged to make some experiments, which induced the proposition of a new form of cast-iron girder, differing materially from the form hitherto advocated by Tredgold and others. In the cross section of the girder recommended by Hodgkinson, the upper and lower flanges presented sectional areas proportioned to the power of resistance to compression and to extension respectively. This assumption was verified by careful experiments, conducted by Hodgkinson, at the works of Messrs. Fairbairn and Lillie, at Manchester; and for many years after he

continued to conduct investigations of the same nature, either in conjunction with, or at the suggestion of, Mr. William Fairbairn, who, in his various works, has communicated to the world the interesting and practically valuable results of these investigations.

The Manchester Philosophical Society, of which Dr. Dalton was the President, naturally attracted Hodgkinson's attention; and in 1826 he became a Member, having as early as in 1822 contributed some Papers. There are published in the "Memoirs" of that Society seven Papers, chiefly on the mechanical principles of engineering. Eventually, in 1848, he was elected President, and Mr. William Fairbairn, with whom he had unfortunately had some differences, embraced the opportunity of gracefully writing:—

"June 28th, 1848.

"MY DEAR SIR,—I cannot resist the temptation to congratulate you on your election to the Presidency of the Manchester Philosophical Society. I think the Members have exercised a sound discretion in the selection, and I am heartily glad, after all our squabbles, to find you in a position to which you are so justly entitled.

"I am yours faithfully,

"W. FAIRBAIRN.

"To Eaton Hodgkinson, Esq."

Mr. Hodgkinson soon began to convey to other scientific societies the details of his labours; and in 1840 he communicated to the Royal Society a Memoir on "Experimental Researches on the Strength of Pillars of Cast Iron and other Materials," which was published in the "Philosophical Transactions" of 1840, and won for him the Royal Medal in 1841, and ended in securing his election as F.R.S. in the same year. From that period his reputation increased rapidly, and his formulæ were accepted with such confidence, that they have now a place in all engineering textbooks.

When Mr. Stephenson conceived the idea of constructing the Britannia Bridge in the form of a wrought-iron tube, he engaged the assistance of Mr. Fairbairn, whose experiments, commenced in April, 1845, were verified as to their mathematical value by Mr. Hodgkinson in the month of September of that year; and during the subsequent trials and investigations at Millwall and at Manchester, Mr. Hodgkinson gave his assistance. These experiments were important, as confirming the results previously obtained by Mr. Fairbairn, and although Mr. Hodgkinson entertained doubts of the self-supporting principle advocated by Mr. Fairbairn, his mathematical investigations, and his subsequent experiments, nevertheless, proved the correctness of the principle,

and thus aided in establishing that which is perhaps the most remarkable event in the history of Engineering science of modern times. For his co-operation in this work, he, in conjunction with Mr. Fairbairn and Mr. Edwin Clark, received a Silver Medal at the Paris Exhibition in 1855, when the great Gold Medal and the Cross of the Legion of Honour were conferred upon Mr. Robert Stephenson.

Mr. Hodgkinson was an active and useful Member of the "British Association for the Advancement of Science," and in the Reports of that Society many of his Memoirs are printed. He was also a Member of the Royal Commission issued to inquire into the application of iron to Railway Structures, and in the Report of that Commission he gave the results of some valuable investigations.

The records of his numerous investigations are to be chiefly found interspersed through the "Transactions" of the British Association for the Advancement of Science, and of the Literary and Philosophical Society of Manchester, as well as in other scientific collections; but the nature of his discoveries may also be gathered from the edition of "Tredgold on the Strength of Cast-iron and other Metals," which he edited, adding a supplementary volume. This edition bears date 1842-46; and subsequent to that period, the experiments for the Britannia and Conway Bridges demonstrated the remarkable fact of the opposite character of wrought to cast-iron, as to the capability to resist the relative forces of tension and compression, and showed the value of the cellular top in a tubular beam. Amongst his earliest writings a Paper on the "Transverse Strain and Strength of Materials" will be found, in the fourth volume of the "Memoirs of the Manchester Society" (Second Series, 1822), in which he put forth his views in opposition to those which were general amongst scientific men, as to the situation of the neutral line in a bent body; and on that subject he was subsequently engaged by Mr. Robert Stephenson, to make a series of experiments, which have not yet been published. In the fifth volume of the same "Memoirs" (1831), are five Papers by him, on the "Forms of the Catenary in Suspension Bridges," of which an abstract was given by the Rev. Dr. Whewell in his "Analytical Statics" (Cambridge, 1833), and an amplification by the Rev. Canon Moseley in his "Mechanical Principles of Engineering; two Papers "On the Chain Bridge at Broughton, Manchester, with an Account of its Failure;" and one on the subject of the strength and form of iron-beams. The Fourth Report of the British Association contains the results of an extensive series of experiments—"On the Collision of Imperfectly-elastic Bodies;" and the Fifth Report, a Paper 'On Impact upon Beams.'

It would unduly extend the limits of this Memoir to endeavour

to give even the titles of his numerous Papers, of which we may hope to see the most important published in a separate form; and for scientific men and engineers, such a collection would be very useful, as the volumes of the scientific societies in which they are now published are not always accessible. To foreign engineers, who highly appreciate the labours of Eaton Hodgkinson, and who have acknowledged their value in very flattering terms, such a publication would be a great boon.

In 1847 Mr. Hodgkinson was appointed Professor of the Mechanical Principles of Engineering in University College, London; and he subsequently removed from Manchester to the metropolis, to fulfil the duties of his post. He delivered several courses of lectures with success; but his health had already suffered, and during later years his labours were only intermittent. It has been stated that his works were highly appreciated by foreign scientific men; to such an extent was this the case that, in 1851, his name was placed upon the list for nomination as a Corresponding Member of the Institute of France; and strenuous efforts were made by eminent men who recognised his merits, to secure his election.

He was unanimously elected an Honorary Member of the Institution of Civil Engineers in 1851, and nowhere could his practical merits be better appreciated. He was a constant attendant at the meetings, and not unfrequently took a prominent part in the discussions. He was personally held in high esteem by the Members, with a large number of whom he was on terms of intimacy. He was acknowledged to be perhaps the most laborious and careful experimenter who had ever devoted himself to the study of the laws which regulate the strength of materials, and his unselfish conduct in gratuitously giving to the world the result of his investigations was generally admired. He was attached to science for its own sake, and he was well versed in other branches than that to which he specially devoted himself.

In private life he was singularly simple and guileless; and his kindly disposition endeared him to all who had the good fortune to make his acquaintance.

His decease occurred on the 18th of June, 1861, at Eaglesfield House, near Manchester, in his seventy-second year, regretted not only by all who knew him, but by those who had professionally benefited by his labours.

GENERAL SIR CHARLES WILLIAM PASLEY, K.C.B., F.R.S., &c., was born on the 8th September, 1780, at Eskdale-Muir, Dumfries, where he received the rudiments of a good useful education; and in the year 1796 he was appointed to the Royal Military Academy at Woolwich where he pursued his studies
[1861-62. N.S.]