stratum under London, contrary to the well-known theory of the late Dr. Buckland, who conceived the existence of a complete basin. He also exhibited many ingenious diagrams, showing the gradual and steady decline of the water in the deep wells. For a Paper connected with this subject, "On the Infiltration of Salt Water into the Springs of Wells under London and Liverpool,"[1] he received from the Institution of Civil Engineers a Council Premium of books, as well as for a subsequent Paper "On the Rise and Fall of the River Wandle; its Springs, Tributaries, and Pollution."[2] He also contributed a Paper "On the Fatigue and consequent Fracture of Metals,"[3] and in general took an active part in many important discussions.

In 1848 he went to Lisbon, where he resided for a considerable time, in the endeavour to establish waterworks in that city; and in 1850 he gave evidence before the Board of Health on the supply of water to the Metropolis.[4]

He latterly devoted much of his time to questions concerning the preservation of iron-clad vessels, and became an Associate of the Institution of Naval Architects. He was a man of intelligence and of considerable attainments, and was much esteemed in private circles for his genial temper. He was well read in geology, chemistry, and other natural sciences, and possessed good perceptive faculties.

Mr. Braithwaite joined the Institution of Civil Engineers as an Associate, May 29th, 1838, and was transferred to the class of Members, March 11th, 1845. He served as an Associate of Council in the years 1842 and 1843, and took an active part in bringing about the limitation of the period for holding the office of President of the Institution. He died on the 27th of February, 1865, in the 68th year of his age.

MR. ROBERT DAGLISH was born on the 21st of December, 1779. He settled at Wigan in the year 1804, as Engineer to Lord Balcarras, the father of the present Earl, where he managed for his lordship, the engineering establishment now known as the Haigh Foundry and Brock Mill Forge. He there constructed the Arley colliery engine, and many other pumping, winding, and blast engines, which were celebrated in their day as improved and efficient machines. After some years' experience at these works, Mr. Daglish took the management of the Orrell Colliery, near Wigan, and whilst there he constructed the railway

[1] Minutes of Proceedings Inst. C.E., vol. xiv., p. 507.
[2] *Ibid.*, vol. xx., p. 191. [3] *Ibid.*, vol. xiii., p. 463.
[4] *Vide* "Report on the Supply of Water to the Metropolis." 1850. Appendix No. II., p. 93.

in connection with it. He at once appreciated and applied to this railway the then novel invention of the locomotive steam engine of Mr. John Blenkinsop, of Leeds, in which the power was applied by means of a large cog-wheel working into a rack laid down beside the ordinary rail. By arrangement with the patentee, Mr. Daglish constructed a locomotive of this description in the year 1812, and started it on this railway in 1813. It was known as the "Yorkshire Horse," and was long looked upon with interest by all concerned in the advancement of engineering science. Under Mr. Daglish's management, the Orrell Colliery became a most successful commercial undertaking, and "Orrell coal" in that district has become the equivalent for the "Wallsend" of the north.

In the year 1825, Mr. Daglish projected, and commenced the survey for, the Bolton and Leigh Railway, in which undertaking, besides the ordinary engineering difficulties, he had to contend against, and eventually to yield to, the wishes of a large landed proprietor, who objected to embankments and cuttings, and insisted upon the line undulating with the natural surface of the land.

Soon after the introduction of the railway system for passenger traffic, the Directors of the London and Birmingham Railway—the largest undertaking of the time—by the offer of a premium of £100, by an advertisement in the columns of "The Times," invited public competition for the best form of parallel rail and pedestals. Mr. Daglish took up the inquiry, and in his tender dated the 3rd of December, 1834, he said: "I am quite sure a velocity of from fifty to sixty miles per hour may be obtained upon a well-constructed railway with greater safety than twenty miles upon any of the present lines yet in operation, not only from their having too light a rail and an ill-constructed pedestal, but also from the mode of fixing them, especially at the joints, which is the great cause of so much deflection and sudden action both vertically and horizontally; so that it is not in the power of man to make a locomotive engine to stand the action they are subject to long together, besides the like effect upon every carriage used upon the line, which can only be attributed to the defective principle of the rails, &c., together with bad workmanship at the commencement." He thus early recognised the difficulty which has at all times occupied the minds of engineers, and of which the fish-plate has now been offered as a partial solution. He also felt the necessity of having the rails of sufficient weight to resist the heavy traffic, which he foresaw must necessarily pass over them; and in the same tender, whilst alluding to the wish of the directors, that the weight of the rail should not exceed fifty pounds per yard, he said—"Allow me to assure you that every public railway will never regret having sufficient strength in the rails at the beginning, and ought not by any means to confine themselves to a pound or two in the yard, in

order to make such a valuable work as the one in question as complete and substantial as possible at the commencement." This advertisement was answered by almost every engineer of eminence at that period, and out of no less than seventy-two competitors, the premium was awarded to Mr. Daglish. His prize rail and pedestal or chair became generally adopted. Mr. Daglish did not patent this valuable invention, but generously threw open its use to the public.

For many years—indeed to within a short time of his death—Mr. Daglish enjoyed an extensive practice as a mining and civil engineer, his advice being sought by many of the principal colliery proprietors in Lancashire, Cheshire, and North Wales. He was largely consulted by foreign as well as by English railway companies. The Great North of England Railway; the Boston and Providence Railway; the New York and Haarlem Railway; the Norwich and Worcester Railway (U.S.); and the Bootle Waterworks, are some of the undertakings upon which he was consulted. He was, some years ago, one of the projectors of, and a partner in, the St. Helen's Foundry, which is still carried on by his son and grandson.

The important subject of the ventilation of mines occupied much of his attention, and he invented an improved anemometer for measuring the air passing through colliery workings. In his own neighbourhood his exertions to ameliorate the social and religious condition of those around him are well known, and will be long remembered.

During an active business life of upwards of sixty years, Mr. Daglish secured and retained to the last the respect and esteem of all who had the good fortune to make his acquaintance, and the memory of his life and works will be an incentive and encouragement long felt amongst those who remain behind him.

He was elected a Member of the Institution on the 30th of March, 1830, and died at his residence at Orrell, Lancashire, on the 28th of December, 1865, at the advanced age of eighty-eight years.

MR. JOHN DINNEN was the eldest son of Mr. Andrew Dinnen, and was born in Liverpool, on the 25th of January, 1808. His father was at that time in business as a brass and iron founder, but he quitted Liverpool a few years subsequently to fill the responsible situation of master-founder and metallurgist of her Majesty's Dockyard at Portsmouth. Mr. John Dinnen received his education under the Rev. John Neave, of the Grammar School, Portsea, and at an early age showed great aptitude for mechanics. After completing his educational studies, he was apprenticed to the late Mr. Simon Goodrich (M. Inst. C. E.) and Mr. William