

he might not have been present at that his jubilee ceremony. Like Newton, again, Stokes was seized too early by the authorities for his administrative abilities, and must have left unfinished much of his best intellectual work.

After his jubilee Stokes felt it incumbent to attend the British Association meeting at Dover in 1899, and the memorable occasion of interchange of international courtesies with the French Association at Boulogne.

The connection of Sir George Stokes with engineering may be said to date from about 1843, when he acted as Secretary to a Parliamentary Commission on the strength of railway bridges, appointed after the fall of the Chester bridge. Trace of his work as Secretary of that Commission may be found in a mathematical Paper in the Transactions of the Cambridge Philosophical Society, vol. viii., entitled "A differential equation occurring in the theory of the bending of a beam under a moving load." This Paper was included with his collected Mathematical and Physical Papers published at Cambridge in 1880.

Sir George Stokes was elected an Honorary Member of the Institution of Civil Engineers on the 1st March, 1892.

An important appreciation of his work, with portrait, by Professor P. G. Tait, was published in *Nature*, 15th July, 1875; in that journal of the 12th February, 1903, Lord Kelvin gave an exhaustive summary of the scientific work of Sir George Stokes, showing the importance of its bearing on recent developments; and Lord Rayleigh has delivered recently at the Royal Institution a most valuable series of lectures on his life and work.—SEC. INST. C.E.

Sir FREDERICK JOSEPH BRAMWELL, Bart., D.C.L. (*Oxon.* and *Durham*), LL.D. (*Cantab.*), F.R.S., Past-President of The Institution of Civil Engineers,¹ died at his residence, 1A Hyde Park Gate, on the 30th November, 1903, in his eighty-sixth year, after a few days' illness from cerebral hæmorrhage.

Frederick Joseph Bramwell was the third son of a banker, Mr. George Bramwell, a partner in the firm of Dorrien and Co., of Finch Lane, London. He was born in the year 1818, the year of the foundation of the Institution, a fact in which he took delight. At the age of sixteen he was apprenticed to John Hague, a mechanical engineer, whose works, situated in Cable Street, Wellclose Square, were bought by the Blackwall Rope Railway,

¹ This notice is based on that which appeared in *Engineering* of the 4th December, 1903.

which originally terminated at the Minories and was afterwards continued to Fenchurch Street.

In those days specialization was not a feature in engineering industry, and Hague's practice covered an unusually wide field. Amongst other matters in which the young engineer was engaged was the vacuum system for distributing power; and it will be remembered that Sir Frederick Bramwell read a most interesting Paper at the Plymouth meeting of the Institution of Mechanical Engineers, held in 1899, in which he described the South Devon Atmospheric Railway. He was so impressed with the prospects of the system that, in the period between 1846 and 1850, in conjunction with his former fellow-apprentice, the late Samuel Collett Homersham, he worked out a proposal for a subterranean atmospheric railway between Hyde Park Corner and the Bank. There was also a proposal for a short length, as an example of the system, to run from the then existing Hungerford Market, the site of the present Charing Cross Station, over the suspension bridge, at that time standing, to Waterloo Station.

When he was out of his time, young Bramwell became the manager of Hague's works, and under his supervision a locomotive of the then considerable weight of 10 tons was built for the Stockton and Darlington Railway. This was in 1843, and the engine was taken north as deck cargo by the paddle-boat Emerald Isle, at that time the only steamer trading between London and Middlesbrough. Just 50 years later Sir Frederick, in speaking of the incident, said that "having driven the engine between Stockton and Darlington, and having received my money, I returned to London by coach." Shortly after this he became connected with the Fairfield Railway Carriage Works, Bow, which were under the management of William Bridges Adams. There he devised a means, of making tires without welding, but experienced the disappointment, common to so many young inventors, of finding that someone had been before him. A similar fate attended the birth of another of his projects—that of constructing an endless band-saw; but in spite of anticipation in the previous century, he persevered with the idea, and designed a multiple arrangement of four band-saws for breaking down timber.

Sir Frederick Bramwell's early connection with what has grown to be the great motor-car movement of the present day has often been described, notably in his interesting Paper read in Section G of the Oxford meeting, in 1894, of the British Association. As an apprentice, he won the favour of Hancock, one of the earliest and most successful of the "steam on common roads" engineers.

Summers, another pioneer in this field, was a relation of Hague, and Sir Frederick not long before his death told how his first job as an apprentice was to hold the chisel whilst a road locomotive boiler was being cut up for scrap.

To follow Sir Frederick Bramwell's career through its earlier episodes would be largely to give a history of engineering progress of the day. To the present generation he was known as a "consultant," and it was in this field that he made his great reputation. Of the many societies to which he belonged, this Institution claimed him as essentially its own, although, as a mechanical engineer, he was strongly attached to the sister Institution at Storey's Gate, and up to the last few months of his life he was a frequent attendant at its Council meetings. In 1854 Sir Frederick Bramwell was elected a Member of the Institution of Mechanical Engineers. In 1874 he was elected President; and older members will remember the interesting and instructive address he delivered at the Cardiff meeting of that Institution. It was in the writing of an address such as this that he was particularly happy; the subject which he most loved was mechanical engineering—and from the rich storehouse of his memory he brought forth facts which he arranged with the skill of one who fully appreciated their significance in the march of engineering progress. In that address he said he could not indicate what would be the grand inventions of the subsequent half-century; but some years later—at the York meeting of the British Association in 1881, in the discussion on a Paper read by Mr. J. Emerson Dowson, on the subject of using cheap gas for gas-motors, he did venture on a prediction which seems not unlikely to be fulfilled, in spirit if not in letter. At that time the gas-engine had not been introduced to anything like its present extent; and the oil-motor, as it is now seen, was practically unknown. Nevertheless, he prophesied that in 1931, when the British Association might be holding its centenary meeting in York, the steam-engine would only be seen as an interesting relic of a past age, having by then been superseded by the internal-combustion engine. To an engineer, realising what an imperfect instrument the evaporation of water affords for the generation of power, the forecast may not seem now a very bold one, with gas-engines up to 1000 HP. no longer a thing to wonder at, and with boats driven by oil-engines at a speed not to be approached by steam vessels of the same size. In all cases, however, the fulfilment of a prediction such as this takes from its wonderment, and to Frederick Bramwell must be given all the credit of priority in his forecast.

He was elected a Fellow of the Royal Society in 1873, and occupied an important position in that learned body, serving for a time on its Council. He was also a most prominent Member of the Royal Institution, becoming Honorary Secretary in 1885, and from that time, until his retirement from the office in June 1900, taking a most active part in the affairs of the Institution. He was a constant attendant at the annual meetings of the British Association, being President of Section G—then known as the “Mechanical Science Section”—in 1872, when he delivered another most interesting address, in which he again described, with a lucidity characteristic of him, certain mechanical inventions, the influence of which he traced. In 1888 he was elected to the presidential chair of the Association, the meeting that year being held in Bath. On that occasion he delivered an address, his theme being “Next to Nothing,” by which he worthily upheld the reputation of the branch of applied science which he represented. He joined the Society of Arts in 1874, and was for a number of years a Member of Council and a Vice-President, and filled also the posts of Treasurer and Chairman of the Council; occupying for a short time the post of President before the present Prince of Wales accepted that office. His communications to the proceedings of these and other bodies were numerous, but it is unnecessary to select any for special mention here; and still more numerous were his oral contributions to the discussions, in which he took a prominent and pertinent part. In 1883 Sir Frederick Bramwell delivered before this Institution one of the special series of lectures on the Applications of Electricity, his subject being Telephones. During his period of office as President, he and Lady Bramwell gave a memorable *Conversazione*, in June, 1885, at the International Inventions Exhibition, of the Executive Council of which he was Chairman.

In this sketch of Sir Frederick Bramwell's career mention has been made chiefly of his consulting practice and of his connection with scientific societies; but he was also engineer to many undertakings of varied kinds during later years, being associated in such work with his partner, Mr. H. Graham Harris. Although Sir Frederick was born before the era of technical education, he had a keen and just appreciation of the value of scientific attainments in the equipment of the engineer. He took a leading part in the movement which led to the great City Companies and the Corporation founding the technical schools which have become associated in the City and Guilds Institute. His work on the Ordnance Committee, to which he was appointed in 1881, and

his labours in connection with the Inventions Exhibition are well known, the success of that most successful Exhibition being chiefly due to his energy and genial tact. He received the honour of knighthood in 1881, whilst in 1889 he was created a baronet. The title, however, expires with his death, as he leaves no son. He was a D.C.L. of Oxford and Durham and LL.D. of Cambridge and McGill University, Montreal. He was married in 1847, and is survived by Lady Bramwell and two daughters, of whom one is the wife of Sir Victor Horsley and the other of Sir Henry Bliss.

To the last he was an active worker, with mind as vigorous and heart as warm as ever; even when his bodily powers began to feel the increasing weight of advancing years, his zest for engineering and all its associated interests seemed to be but enhanced thereby. Seventy years of active work out of a life of eighty-five constitute a conspicuous example of energy combined with longevity. His experience during so long and active a life naturally embraced an extensive variety of subjects and of places, of which his reminiscences were continually cropping up, enlivened by a never-failing touch of humour. Sir Frederick maintained, even to the day of his death, a foremost position amongst engineers. His strong mechanical instinct, retentive memory, ready wit, and, not by any means least, his picturesque and venerable appearance, enabled him to hold his own, in his particular field, among those of a younger generation whose advantages for acquiring knowledge had been infinitely greater. It was as a debater and expert witness that he especially made his mark. The forensic ability which characterized his distinguished brother, the late Lord Bramwell, seemed to be his by right of inheritance. Never at a loss, he could baffle the most wily or most resolute cross-examiner, and probably no lawyer ever extracted from him anything he did not want to say. Many are the tales told, both in the Inns and at Great George Street, of the wordy duels between Sir Frederick and his would-be persecutors; but whether the weapon used against him was the rapier or the bludgeon, he had a guard that seldom failed.

In the more peaceful atmosphere of discussion at the various scientific and technical societies, of which he was a member, his genial nature was more apparent; and to the younger members of these institutions he was always kind and charming, so long as they were not presumptuous or affected.

His connection with the Institution was well summed up in the Resolution which, on the motion of the President, Sir William

White, was adopted unanimously at the Council Meeting on the 1st December, 1903, the day after his death.

"This Council have received with great regret the intimation of the death of their esteemed colleague Sir Frederick Bramwell, Bart., F.R.S., etc., etc., Past-President.

"The Council desire to convey to Lady Bramwell and her daughters the expression of their sincere sympathy in this bereavement, and their high appreciation of the great services which Sir Frederick Bramwell has rendered to The Institution of Civil Engineers and to engineering during his long and distinguished professional career.

"He was elected an Associate in 1856, and transferred to full Membership in 1862. Since 1867 he has served continuously on the Council, having been elected Vice-President in 1880, and President in December, 1884, occupying the Chair until May, 1886.

"The Institution owes much to his unwearied service, his wise counsel, unfailing generosity and active work in connection with the initiation and foundation of the Benevolent Fund.

"His loss will be severely felt both in the business of the Council and at the Ordinary Meetings. No member of the Institution was a more faithful attendant at its Meetings or made more valuable contributions to the Proceedings. With wide and varied experience were united gifts of expression and humour, as well as a ready appreciation of what was most valuable and promising in novel proposals.

"His colleagues desire to record their sense of his distinguished personal qualities, and will ever hold them in remembrance."

In moving the approval and endorsement of this Resolution by the Ordinary Meeting in the evening (which was subsequently adjourned as a mark of respect to the memory of Sir Frederick Bramwell) the President said that he would like to add one or two words of personal acknowledgment, and personally to express his sense of the loss the Institution had sustained by the death of their dear friend, whose long connection with the Institution and whose faithful service could not be exaggerated. Sir Frederick Bramwell was an example to them of loyalty and devotion to the work of their great association. It was nothing short of life-long devotion; he never tired. They all remembered how only four weeks ago he sat among them, and in words which moved him deeply proposed a vote of thanks for the address which he (Sir William White) as President had just read. His great generosity, his interest in everything done for the welfare of those connected with the Institution, his continued work for the Benevolent Fund, were all

signs of the great interest Sir Frederick took in the Institution. Then, too, he was marvellously sympathetic, especially to young men, and he never seemed to grow old in regard to his interest for young men. He was ever interested in what was new, and ever encouraging those who were trying, with never one unkind word, although he said many clever things. He had the art of terse expression, and he could take an idea, clothe it in a new form, and give it back improved to the originator. Sir Frederick loved work; and he remembered his saying, "I shall never retire; life to me is work, and I will work to the end." And so he did. He never gave up, and last Sunday night he dictated to his daughter a message which said he had looked forward to the opportunity of supporting his dear friend Sir William White in the chair as President during the session, and it was a source of bitter regret that that could never take place. He was true till death and never forgot the Institution or his friends, and the resolution he moved expressed their recognition of the gratitude for such a life and for such a death.

Sir John Wolfe Barry, in seconding the motion, remarked that Sir Frederick Bramwell was essentially the father of the Institution, and it was as near to his heart as anything could be in this world. He was a man full of the greatest benevolence, and was ever performing acts of kindness to rich and poor, old and young alike. When they considered his life they could not but be struck with the extraordinary fulness of it. They knew Sir Frederick at the Royal Society, the Royal Institution, the British Association, and the Society of Arts, and each of those institutions, he was sure, would concur with him when he said that Sir Frederick's death left a blank that could never be filled. Of all the institutions he ornamented he loved none so much as this. On a melancholy occasion such as that it was a great satisfaction to be able to look back on the great work of benevolence which he did for members in the initiation of the Benevolent Fund. He was never weary of helping young men along the road he had travelled. They had, he was glad to say, the pleasure of looking back on his life as a very happy one; and in lamenting his loss it must be a satisfaction to those who loved him that the end had come as he had wished. He was in harness, happy in his work, and still occupied with the things he loved best.

A memorial service, held on the 4th December at St. Margaret's Church, Westminster, was largely attended by members of the Institution and representatives of many learned and scientific societies.