on the Commission for the improvement of the Columbia River. He was a Member of the American Society of Civil Engineers, of which he was Vice-President in 1896–97, and of the Société des Ingénieurs Civils de France. Mr. Hutton died at his residence, The Woodlands, Clopper, Montgomery County, Maryland, on the 11th December, 1901.

He was elected a Member of the Institution on the 2nd December, 1890.

WALTER ROBERT KINIPPLE, born at Limehouse on the 31st July, 1832, was the son of Mr. George Topliff Kinipple, who was engaged in shipbuilding on the Thames for many years. His family, of Danish origin, was connected with shipping and shipbuilding for generations, and some 160 years ago one of his ancestors constructed a bascule bridge over the harbour at Copenhagen which is still known as the Kinippel Bridge.

In 1846 the subject of this notice was articled to the late Mr. J. B. Redman, who had been Chief Assistant for a number of years to Mr. James Walker, Past-President. The period of pupilage lasted seven years, and was followed by a term of five years as an assistant to Mr. Redman, during which period he was engaged on the drawings and construction of Greenwich Pier, Gravesend Pier, Mowlem's Wharf, Tidal Docks at Greenwich, and other works.

In 1858 Mr. Kinipple commenced to practise on his own account, and from that date until he retired in 1896 he had a busy and prosperous professional career. His engineering training had been principally in connection with marine works, and to that class of work he devoted himself largely, but not exclusively, throughout his subsequent career. Thus, after starting on his own account, he had overhauled and reconstructed in a few years a large number of graving docks and riverside properties on the Thames, amongst which may be mentioned Princes Dock, King and Queen Dock, Limekiln New Dock (one of the largest then constructed), Bull Head Dock, Commercial Dry Dock, North Woolwich Dock, Regent's Dry Dock, East Greenwich Graving Docks, Union Docks, Nelson Dock, Limehouse Dry Dock, Cubitt's Town Dock, and Deptford Green Dock. During that period, 1858–67, he was also engaged actively in the preparation for Parliament of schemes of railway works projected for the eastern and southern counties of England.

Between 1855 and 1860 Mr. Kinipple spent considerable

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time in experimenting with Portland cement, as to the uses to which it might be applied, especially in connection with marine works, in stopping leaks and cementing materials together under water. These experiments proved useful to him at the time in stopping leaks in dams and dock entrance works, and subsequently were of much service in carrying out dock, harbour and breakwater works.

Between the years 1860 and 1890 Mr. Kinipple submitted competitive designs for a number of works amongst which may be mentioned the harbours of St. Helier's, Jersey, Greenock, Quebec, and Poole. The adoption of his design for the new harbour works at Greenock was the origin of his long connection with the Harbour Board there, from 1868 till 1887, during which period he acted as Chief and Consulting Engineer for the Greenock Harbour Trustees, constructed the new harbour works at the east end of the town and remodelled the old works. These works were fully described in a Paper[1] he contributed to the Institution in 1897, so that detailed reference to them need not be made here. Previous to his connection with Greenock he had designed and patented a travelling caisson, with lowering deck for harbour purposes. This caisson serves the double purpose of dock gates and opening bridge for road and railway traffic across a dock or harbour entrance. Three of these caissons are in use at the Greenock Docks, one at the Clyde Navigation Docks, Glasgow, and six at other ports in various parts of the world. In the reconstruction of the West Harbour at Greenock, Mr. Kinipple spanned the entrance by a bridge constructed on the same principle as the caisson, but with open instead of closed sides, thus allowing free passage of the tidal waters to and from the harbour. This bridge, which provides railway communication across the harbour entrance, is a careful adaptation of design to site and requirements. The travelling caisson and bridge are described fully in the Paper above referred to.[2]

Mr. Kinipple's official connection with the Greenock Harbour Trustees terminated in 1887, on the completion of the new works, after which he devoted himself to his London practice.

The works carried out at Quebec Harbour, in accordance with the competitive designs of Mr. Kinipple, were described in Papers contributed to the Institution by Mr. St. George James Boswell[3]

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[1] Minutes of Proceedings Inst. C.E., vol. cxxx., p. 276.
[2] *Ibid*, p. 287. [3] *Ibid*, vol. lxiii. p. 265.

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and Mr. Woodford Pilkington.[1] A masonry graving dock was also constructed at Quebec, of a length of 500 feet by a width of 100 feet, and the dock entrance was closed by one of Mr. Kinipple's caissons. The climatic conditions in Canada are much more severe than in England, and the system of execution of work requires to be modified considerably. The modification which Mr. Kinipple adopted was that of cribwork construction.

At Esquimalt in British Columbia he constructed for the Canadian and Imperial Governments a graving dock for men-of-war and merchant vessels. This dock, 451 feet long by 90 feet wide at coping, with 41 feet depth of water on cill at high water of ordinary spring tides, is constructed of masonry set in Portland cement mortar and faced with ashlar. For Newfoundland he and Mr. Morris surveyed and prepared drawings and specifications for about 100 miles of railway, and reported on water-supply and sewage-disposal. Mr. Kinipple's advice was also sought by Governments and Harbour Authorities in other colonies, especially with regard to dredging plant, and he acted as Consulting Engineer for such to the Governments and Harbour Boards of New South Wales, Victoria, South Australia, New Zealand, and Aden.

He was consulted by the Aberdeen Harbour Trustees with respect to the construction of their new graving dock, and the proposed National Harbour of Refuge for which a Government enquiry was held. For the Wick Harbour Trustees he rendered secure the breakwater which had been endangered by a severe storm, and furnished designs for a complete scheme of harbour works with breakwater protection. He constructed a fishing harbour at Girvan in Ayrshire, consisting of two sheltering moles on breakwaters with inside quay-works, and dredged channel-way. At Llanelly he laid down the lines of training wall for the improvement of the channel-way in the Burry Estuary and constructed a considerable length of the training wall. He also constructed the Llanelly and Mynydd Mawr Railway for the development of part of the South Wales coalfield.

In 1889 he was instructed by the Harbour Committee of the States of Jersey to extend the Hermitage Breakwater at St. Helier's, reconstruct the Victoria landing stage and the North Pier, and provide by dredging increased depth of water in the harbour, and in the channel-way outside the harbour. In the

[1] Minutes of Proceedings Inst. C.E., vol. cxxxix. p. 286.

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execution of these works he carried down all foundations, whether of breakwater or quay-walls, to the rock through varying thicknesses of overlying sand and clay up to as much as 22 feet in depth below the sea or harbour bottom. Both in the breakwater and quay-walls a system of concrete blockwork construction was adopted, each block having projections and recesses which fitted into corresponding recesses and projections in adjoining blocks. The external joints of the work were caulked with strips of canvas, and neat Portland cement grout was then passed down through an iron tube from above water-level, which cemented the blocks firmly together into one mass. A level bed on the irregular surface of the rock was previously prepared for the reception of the blocks by depositing loose rubble and shingle within a barrier of bags of concrete; the surface of the rubble and shingle was levelled off by divers with levels and long straight-edges, and the loose materials then cemented into a solid mass with neat Portland cement grout. The system proved to be thoroughly effective in practice, and since its application for breakwater and quay-wall purposes in Jersey it has been employed with satisfactory results by other engineers. Grouting for various purposes had been employed by Mr. Kinipple since 1858, but the first breakwater and quay-wall works where it was used systematically and on a large scale were at the Jersey Harbour works in 1887. In the previous year he contributed to the Institution a description of these methods in a Paper entitled "Concrete-work under Water."[1]

At Poole Mr. Kinipple advised the Harbour Board as to the steps to be taken to increase the depth of water over the bar and improve the channel-way to the harbour; and he carried out the reconstruction of the quay-walls along the frontage of the town, and provided an increased depth of water. In the construction of the new quay-walls at Poole, and of the new quay-wall, over 2,000 feet in length, at Great Yarmouth, for which he acted as Consulting Engineer to the Town Council, he adopted the same method as that employed at Jersey.

Other works which Mr. Kinipple carried out were a large graving dock at Blackwall for Messrs. Green; a graving dock at Limehouse 440 feet long for Messrs. Fletcher Son and Fearnall; the enlargement of Renfrew Harbour, the construction of a large sugar factory at Silvertown for Messrs. Lyle, and piers at various

[1] Minutes of Proceedings Inst. C.E., vol. lxxxvii. p. 65.

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places. He was also consulted in connection with the proposed Vardar reclamation and irrigation works in Turkey, the Cullera Harbour and Railway in Spain, and numerous other projects.

Throughout his career Mr. Kinipple displayed much ingenuity in mechanical appliances, and introduced various improvements in connection with dredging plant, one of which was the system of stern-well hopper-dredger, whereby a full instead of a divided bow was obtained. This arrangement is now largely used. Another invention related to dredger-buckets, whereby the bucket was made in three parts, each easily and quickly replaceable from spare parts kept in stock, in the event of a breakdown or of becoming worn out. A further design relating to dredgers was for a double-ladder dredger having a circumferential movement and mounted on a circular vessel.

In 1874 Mr. Kinipple associated with him the late Mr. William Morris, and all works, except those in Scotland, were carried out jointly from that date until the death of Mr. Morris in 1886. In 1891 Mr. William Jaffrey, who had for a number of years been Chief Assistant to Mr. Kinipple, became a partner and was associated with him in the execution of all works until Mr. Kinipple's retirement on considerations of health in 1896.

Although withdrawn from active pursuit of the profession, his interest in engineering questions was fully maintained, and his advice from time to time sought and given. Thus for the Egyptian Government he went twice to Cairo, examined the Damietta and Rosetta dams of the Nile and the Shubrah Locks, the leakages under the foundations of all of which had caused serious trouble, and reported on the steps to be taken to remedy the defects. He recommended securing the foundations of the work, and cutting off the leaks and runs of water by stock-ramming with clay, and hydraulic lime or cement. His advice was adopted. Bore-holes were put down through the masonry piers for the purpose, and the stock-ramming proved to be most effective.

In 1899 he visited St. John's, New Brunswick, to advise with respect to a graving dock 800 feet long for accommodating the largest liners and men-of-war.

Mr. Kinipple took an active interest in all matters relating to the practical side of engineering. He was skilful in designing and executing works, and fertile in expedients for overcoming difficulties. He contributed to technical journals and lectured to the Royal Engineers at Chatham on Subaqueous Foundations. In temperament he was of a genial disposition, fond of social

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intercourse, and had a wide circle of friends. Amongst engineering friends he liked specially to discuss intricate or awkward engineering problems, and was very ready and resourceful in providing practical solutions.

After retiring in 1896 he lived at Brighton. On the 18th November, 1901, when apparently enjoying excellent health, he had a paralytic seizure, and passed away on the 25th of that month without having recovered consciousness.

Mr. Kinipple was elected a Member of the Institution on the 7th February, 1865.

ALGERNON LEVENTHORPE, son of the late Rev. T. W. Leventhorpe, was born on the 24th April, 1858, and, after passing through the Royal Indian Engineering College at Coopers Hill, was appointed an Assistant Engineer in the Public Works Department of the Government of India in 1879. He was posted to the Buildings and Roads Branch, and was employed in Berar until 1890, in Beluchistan from 1890 to 1892, and in Burma from 1893 until his death, rising in the meantime through the various steps to the position of Executive Engineer, 1st-grade. In 1899 he was appointed Assistant to the Chief Engineer and Under-Secretary to the Government of Burma in the Public Works Department. Mr. Leventhorpe died at Rangoon on the 3rd July, 1902, aged 44.

He was elected an Associate Member of the Institution on the 2nd December, 1884, and was transferred to the class of Members on the 18th December, 1900.

ALEXANDER GRAINGER LINN obtained his first engineering experience as a pupil at the Railway Foundry, Leeds. On the expiration of his pupilage he was engaged for four years at the Grimsby Docks and at New Holland, Hull, and was subsequently employed for a similar period, from 1854 to 1858, as agent to the late Mr. J. Towlerton Leather on the contract for the Nene Valley Improvement Works at Wisbech. On the completion of those works he was for two years in charge of the construction of a section of the Severn Valley Railway, and from 1860 to 1863 he was similarly employed on the Western Division of the

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