

tion being a new system of signalling. His death, which occurred on the 28th of November, 1875, was very sudden and unexpected. It is supposed that the severe shaking he received two or three months before in a railway accident at Kutnee, caused by the parting of a bolt of the cow-catcher, was the primary cause of it. The estimation he was held in, where he was best known, may be judged by the notices in the local journals. One writes: "A competent and learned engineer, a kind and just master, a great mover in public matters, a social and urbane member of society, and, above all, a true Christian—Mr. Spencer was liked by natives and Europeans alike, and his death is being lamented by all." Another writes: "The deceased gentleman was highly respected by all, but more especially by those who had the pleasure to serve under him, as testified by the universal sympathy expressed by both European and native: it would, indeed, be difficult to recall a single instance where he used even a harsh expression to any of his subordinates during the many years he served the East Indian Railway Company; he was ever ready to listen to any just complaint, and was equally prompt in administering redress." Such extracts might be readily multiplied, but these are sufficient to show that by the death of C. I. Spencer the East Indian railway has lost a good engineer; his acquaintance, servants, and colleagues a good friend; his family, a good man.

Mr. Spencer was elected a Member of the Institution of Civil Engineers on the 1st of April, 1862.

MR. CHARLES BLACKER VIGNOLES was one of the oldest survivors of that class of eminent civil engineers who have, during the present century, raised the profession to which they belong to the highest distinction, and have at the same time conferred on their country substantial and enduring benefit. Mr. Vignoles was descended from a family of position in France, some of whose members embraced Protestantism in the seventeenth century, and one of whom, the Sieur de Prades, took refuge in Holland, eventually settling in Dublin at the beginning of the eighteenth century. The descendant of this refugee, Charles Henry Vignoles, father of the subject of this memoir, exactly one hundred years ago, served his country as an ensign in H.M. 43rd Regiment of Light Infantry, known as the Monmouthshire. In 1793 this gentleman—then Captain Vignoles—was stationed in Ireland, where his only son, Charles Blacker, was born, at Woodbrook, in the county of Wexford, on the 31st of May in that year.

The infancy of Mr. Vignoles was spent in the West Indies with his parents, though he was soon destined to be deprived of both; for Captain Vignoles was wounded in action at the storming of Fort a Pietre, on the east side of the island of Guadaloupe, and died of his wounds, his wife (daughter of Dr. Charles Hutton, F.R.S.) surviving her husband only one week. At the death of his parents the child was a prisoner of war, and by way of effecting his release, and doubtless also in consideration of his father's premature death, Sir C. Grey, the General Commanding in Chief of the Forces, bestowed a commission upon Captain Vignoles' infant son, and he was gazetted as an ensign in the 43rd Regiment, and put on half-pay.

He was now claimed by his uncle, Captain, afterwards General, Hutton, R.A., to whom he was surrendered by the authorities of the island. The young officer was afterwards brought to England, and placed by a friend under the care of his grandfather, Dr. Charles Hutton, the celebrated mathematician, then, and for many years subsequently, professor at the Royal Military Academy, Woolwich. There can be no doubt the foundations of a sound and liberal education were carefully laid by this accomplished man, who adopted the child as his own. An incidental proof of the estimation in which Dr. Hutton was held, is furnished by the fact that the father of the late Earl Stanhope bequeathed to his distinguished friend the original portrait in oil of Sir Isaac Newton, which had come into the possession of that noble family. The subject of the present notice inherited from his grandfather this valuable picture, and it was presented by him several years ago to the Royal Society, of which learned body Mr. Vignoles was himself a member.

About the time that Dr. Hutton resigned his professorship, viz., 1807, he seems to have articulated his grandson to a proctor in Doctors' Commons, and the usual term of seven years' apprenticeship is mentioned in the indenture. He gained, no doubt, considerable insight into the subtleties of legal procedure during the two or three years devoted to those studies; but it is quite clear that he did not complete his articles, for in his nineteenth year he was a student at Sandhurst, under the care of Professor Leybourne. This must have been a more congenial place than a lawyer's office for one of his lively and active temperament.

Ensign Vignoles' anxiety to see something of actual warfare was gratified by an order to join his regiment in the Peninsula, and he was present in the rearguard at the battle of Vittoria, on the 21st of June, 1813. It is worthy of remark that through this very

region, and over the passes of the Cantabrian Pyrenees, half a century later, Mr. Vignoles constructed a railway from Bilbao to Miranda and Tudela, on the Ebro. The young soldier, now in his twenty-first year, was in the following November transferred to the York Chasseurs; and in January 1814, by the influence of the Duke of Kent, by whom he was favoured with a personal interview, he received a commission in the First Royals, or Royal Scots. He was present with a detachment at the repulse of the British forces at Bergen-op-Zoom, on the 14th of March in that year, and whilst holding a flag of truce on the ramparts, the top of the staff was shot away by a musket-ball. In the summer of the same year he was ordered to Canada, and was in the transport-ship "Leopard" when she was wrecked on the island of Anticosti, at the mouth of the St. Lawrence.

Young Vignoles did not return to England till after the battle of Waterloo, when he obtained his lieutenancy, and was ordered to Fort William, in Inverness-shire, at the foot of Ben Nevis. During his furlough at Christmas time, he made the acquaintance of Professor Stuart, the celebrated philosopher, and through him obtained an introduction to General Sir Thomas Brisbane, who, a few months later, appointed him an extra aide-de-camp, and he joined the General at Valenciennes in May, 1816. He seems now to have been put on half-pay, but did not actually sever his connection with the army till 1833.

Mr. Vignoles married in 1817, and immediately afterwards sailed for South Carolina, with a view to recover a large estate which had been granted to the family by the British Government. He found that the Americans had confiscated the property, and was therefore unable to reclaim it. He, however, soon obtained employment, and for the next few years was engaged on a survey of South Carolina and the adjoining States. In 1822, just before he returned to England, he published in America a full account of the Dominion of Florida, accompanied by a highly-finished map, which remains to this day the best, and, indeed, the only trustworthy, map of that little-known country.¹

On reaching Europe he was almost immediately engaged by the Messrs. Rennie on the projected railway to Brighton and on other works; and shortly afterwards undertook surveys in connection with the proposed Liverpool and Manchester railway. He even began, in a measure, an independent career, part of which he has sketched out in his comprehensive and interesting address on

¹ *Vide* "Observations on the Floridas." 8vo. New York, 1823.

assuming the chair as President of the Institution, on the 6th of January, 1870.¹

In 1830 Mr. Vignoles, in conjunction with Captain John Ericson, devised a new method of ascending steep inclines on railways by introducing, in the centre of the road, a third rail, which was nipped by two horizontal rollers actuated by a lever from the locomotive. This centre-rail system was the same in all essentials as that afterwards employed in the zigzag line over the Mont Cenis Pass; but the system was not practically worked, doubtless owing to the fact that improvements in mechanical construction were proceeding rapidly, and more than enabled the ordinary locomotive to cope with any incline then deemed advisable.

After being occupied on the Oxford canal, and on a branch railway to Wigan, and from Wigan to Preston, afterwards called the North Union railway, and also executing some Government surveys in the Isle of Man, Mr. Vignoles was engaged as Engineer-in-Chief of the Dublin and Kingstown railway, the first of the Irish lines, which was opened in December 1834. His position was now established as one of the leading civil engineers, and the works he carried out are too numerous to be minutely detailed in this notice; but mention should be made of, amongst others, the Sheffield and Manchester railway, with the longest tunnel then projected in England, and at the time thought to be almost impossible of execution. About this time Mr. Vignoles was consulted concerning the execution of many of the earliest Continental lines, of which it may suffice to name the Paris and Versailles, the German Union railway, lines in the then Duchy of Brunswick, Berlin, Hamburg, and the Hanoverian lines.

Contemporaneously with these undertakings he occupied himself in studying the possible improvement of the railway bar then mostly in use, and introduced the flat-footed—now generally known as the ‘Vignoles’—rail, which has, on the Continent, nearly superseded every other form.

In 1841 Mr. Vignoles was elected to the first Professorship of Civil Engineering established in England, and gave his opening lecture at University College on the 10th of November. He was also pressed by the Government of the day to plan the system of railways for India; but the negotiations fell through owing to Mr. Vignoles requiring very heavy insurances on his life. In 1844 he was specially invited to Germany by H.M. the King of Würtemberg, and he spent a few months at Stuttgart in consultation

¹ *Vide* Minutes of Proceedings Inst. C.E., vol. xxix., p. 272.

with the King and his advisers as to the projected railways of that State. On the completion of his mission he was presented by His Majesty with a gold snuff-box set with diamonds, with a portrait of the King on the lid.

It was not long after this that the great railway mania set in throughout England, and Mr. Vignoles was professionally engaged on a vast number of lines; a few only, however, being completed, and those nearly in accordance with his original design. Amongst these may be mentioned the East Kent, now called the London, Chatham, and Dover, the Little North-Western, now incorporated with the Midland; and in Ireland, the Waterford and Limerick, and other central lines. From various causes the completion of these lines passed into other hands. Mr. Vignoles directed his attention abroad, and undertook works of great magnitude in Russia. In 1847 he visited St. Petersburg at the invitation of H.I.M. the Czar Nicholas, and from this date, during five or six years following, Mr. Vignoles paid many visits to Russia, where he had a large professional staff. His chief work in that country was the suspension bridge at Kieff, over the river Dneiper, the longest of its kind in the world. A beautiful model of this bridge, which was shown in the first International Exhibition of 1851, was unfortunately burnt in the fire which destroyed the tropical end of the Crystal Palace; but a duplicate of it had been presented to the Emperor of Russia, and is now at the Winter Palace in St. Petersburg.

In 1853-5 Mr. Vignoles began and carried out the first railways in Western Switzerland. He had, in 1854, made the first surveys of the Bahia and San Francisco railway in Brazil, but the works were not commenced till the year 1857, and were completed in 1861, Mr. Vignoles being the Engineer-in-Chief. In the winter of 1857-8 he was invited to undertake the line of Spanish railway already alluded to. The late Mr. Brassey was the contractor, and the works were carried out with the fidelity and thoroughness characteristic of all engagements undertaken by that gentleman. The line passes through a mountainous and beautiful country, which has since attained notoriety as one of the principal strongholds of the Carlists. The effect of the desultory civil war lately raging in the Basque Provinces has unfortunately been greatly to injure, if not to destroy, large portions of the works on this railway.

The last important undertaking on which he was engaged was the line from Warsaw to Terespol, in carrying out which he was again able to rely upon the co-operation of his old friend,

Mr. Brassey, as contractor. Mr. Vignoles had for some years retired from the active duties of his profession, but was consulted by many of his brother engineers on important schemes brought forward from time to time.

He took great interest in scientific matters generally. He was elected a Fellow of the Royal Society in 1855, and was also connected with the Royal Irish Academy, the Royal Institution, the British Association, the Royal Astronomical and several other societies. He also received decorations from the Emperor of Russia, the late Queen of Spain, and the present Emperor of Brazil; and was a J.P. for the county of Hants. When superintending the works of the Tudela and Bilbao railway in Spain, he hospitably entertained the members of the astronomical expedition sent out by Government in connection with the total solar eclipse in June 1860, providing also a map of the shadow path thrown by the eclipse. Ten years later he accompanied the Government expedition that sailed in the "Psyche" for the purpose of observing the eclipse of December 1870. In this case his ardour must have been somewhat abated by the wreck of the vessel, but his wonderful energy and vitality enabled him to endure with equanimity hardships and discomfords which would undoubtedly have been attended with grave consequences to any ordinary man of his age.

Mr. Vignoles was one of the fathers of the Institution, having been made a Member on the 10th of April, 1827. In October 1869, the standing order relative to the nomination for the Presidential office was suspended, in order that Mr. Vignoles might be chosen. At the general meeting in December he was duly elected President; and in that capacity presided over the debates of the Institution with a vivacity and intelligence characteristic of his temperament, but really extraordinary in a man of his advanced years. Those mental and bodily faculties he retained unimpaired to the last. Although somewhat imperious, he was of a most kindly disposition, and was a warm-hearted friend. Rather under the middle height, and of well-proportioned, compact build, his energy and capacity for work were remarkable; and in his demeanour and general bearing he was a thorough gentleman of the old school. Mr. Vignoles' death ensued after a short and painless illness, at his marine residence near Southampton, on the 17th of November, 1875, in the eighty-third year of his age. The obituary notices which appeared in the papers at the time were all characterised by a warm appreciation of the services he had rendered, and testified to the respect in which he was held, both by his professional brethren and by the public at large.