

In spite of impaired sight and increasing feebleness Mr. Cail led an active life to the last. On the 18th of October, 1893, he attended a meeting of the Newcastle Town Council, at which he presented a report on his scheme for supplying the city with water from Lake Ullswater. He became ill during the meeting, but was able to drive home and go to bed. In a few hours, however, he died painlessly, from failure of the heart's action, in the eighty-second year of his age. Mr. Cail's career is an instance of what may be achieved by energy and perseverance. He was respected for his integrity and esteemed for his public spirit.

Mr. Cail was elected an Associate of the Institution on the 7th of December, 1875.

FREDERICK RANSOME,¹ born on the 18th of June, 1818, was one who, by patient research, enriched the world's knowledge of the chemical treatment of minerals. Early in life the idea occurred to him that stone, like iron, might be melted and run into moulds, and that the myriads of little grains of sand by the sea-shore might be cemented indissolubly together. So long ago as 1848 he presented to the Institution a Paper entitled "On the Manufacture of Artificial Stone with a Silica base."² After many years of experiment, during which he made several discoveries, some of them unexpectedly, he perfected his process of manufacture, which was based on one of the most beautiful of chemical reactions. Flints were first dissolved by means of caustic alkali under high pressure, so as to form soda silicate—a kind of water glass. This viscous and tenacious substance was then rapidly mixed with a proportion of very fine and sharp silicious sand in a vessel, so as to form a soft plastic mass which could be moulded into any shape desired. The soft stone was then placed in a bath of calcium chloride solution, which was made to penetrate every pore by means of hydraulic or atmospheric pressure. When this solution came into contact with the soda silicate a double decomposition took place, the silica combining with the calcium and forming a hard solid silicate of lime, and the soda uniting with the chlorine to form sodium chloride in a small quantity. Instead, then, of the particles of sand being covered with a thin film of the liquid silicate of soda, they were covered and united together with a film of solid silicate of lime, one of the

¹ The substance of this notice is taken from "Engineering," vol. lv. p. 624.

² Minutes of Proceedings Inst. C.E., vol. vii. p. 57.

most indestructible substances known. The small quantity of soluble sodium chloride, one of the results of decomposition, was then washed out of the stone by a douche of clean water or by hydraulic pressure, and when dry the stone was ready for use. A cube of stone 4 inches square took 44 tons to crush it, although only ten days old, while sections $2\frac{1}{4}$ inches square bore respectively 870 lbs.¹ and 1,200 lbs.

The artificial material produced by Mr. Ransome was a sandstone, the silicious particles of which were bound together by a cement of silicate of lime. Its composition was precisely that of the best building stone known—such as Cragleith and some varieties of Yorkshire stone, which resist the most trying air and climate. When fractured it showed perfect homogeneity, so that it was admirably adapted for carving with chisels. It could be moulded into the most delicate forms while in a soft state, and could be surface-dressed or finished when hard, if necessary. Its plasticity during the first process of manufacture enabled it to be used with great economy in all elaborate mouldings and repeated ornamentation, and many of the public buildings in England, Bombay, Calcutta, and New Zealand may be regarded as memorials of Mr. Ransome's success, such as the new India Offices, St. Thomas's Hospital, the Brighton Aquarium, the Albert Bridge at Chelsea, and many churches; while for other purposes, as in the Metropolitan Railway stations and at the London Docks, the material was largely used.

The process was utilized for many other purposes, devised in succeeding years by Mr. Ransome, notably for emery wheels and for grindstones. He also constructed a filter, in which the water was passed through porous slabs. While engaged in such minor pursuits, the subject of this memoir continued to direct his studies to the manufacture of other materials, one of the results being the manufacture of cement from blast-furnace slag and lime. Into the details of the process it is scarcely necessary to enter, further than to state that he worked assiduously until he perfected it, overcoming all difficulties and producing a cement the tests of which² showed that it possessed remarkable properties, the strength within a few days of manufacture being stated to be higher than that of Portland cement after seven years. Being made from waste materials, it could be produced at half the cost of Portland cement. He next directed his energy to the mechanical details for burning the cement, and produced a novel type of revolving

¹ "Engineering," vol. iii. p. 671.

² *Ibid*, vol. xxxix. p. 95.

kiln, the characteristic feature of the process¹ being that the material was burned in a state of powder, and that it emerged from the furnace in this condition, the object being to reduce the final grinding from a tedious and expensive process to a very simple and rapid operation.

Mr. Ransome spent the last few years of his life in retirement. He died on the 19th of April, 1893, at the age of seventy-five. His geniality and kindness of heart gained him many friends. In middle life he was a frequent attendant at the meetings of the Institution, of which he was elected an Associate on the 7th of March, 1848, and served as an Associate of Council in 1868-69.

COLONEL JOHN BARNES SPARKS, of the Bengal Staff Corps, was born at sea—off Sierra-Leone, West Africa—on the 19th July, 1841, his mother being on her way to join her husband, then Captain and afterwards Colonel George Mitchell Sparks, who was serving with his regiment, the 12th Foot, in China, and afterwards fell in India.

Educated in India, John Barnes Sparks early attained prominence in his studies at Mussouri, and then proceeded to the Thomason Civil Engineering College at Roorkee, where he highly distinguished himself in mathematics and engineering subjects, obtaining a gold medal and other distinctions. On the outbreak of the Mutiny, in 1857, he was enrolled among the volunteers, but did not take any part in the actual warfare. On the 5th of August, 1859, he received his first commission as Ensign in the 38th Foot Regiment; from which he was appointed to the Bengal Staff Corps, joining the Public Works Department in August, 1863. After being employed on surveying, road construction, and other work for some time, he was transferred to Gwalior, where, besides the construction of government works, he was engaged in the reparation of the Fortress which has been recently restored to Scindia. In 1868 he married Eliza Jane, widow of Frederick Kitchen Buist, of Cawnpore, and in 1870 visited England on furlough. In the following year he was promoted to the rank of Captain.

On returning to India towards the end of 1871, Captain Sparks was posted to Karachi as Assistant Engineer, 1st Grade, and was engaged on the construction of the Indus Valley State Railway, and in the management of the stores of that line. On promotion to Executive Engineer, 4th Grade, in 1872, he was moved to

¹ "Engineering," vol. xlii. p. 156.