# MEMOIRS OF DECEASED MEMBERS.

SIR CHARLES WHEATSTONE,[1] born in February 1802, was the second child of a family of two sons and two daughters, his father being a musical instrument manufacturer in Gloucester. In 1806 his parents removed to London, where the father established himself in business, which he carried on for some years at 128 Pall Mall, and in addition gave instruction on the flute and flageolet. Charles Wheatstone's instruction commenced at an early age, for he was sent to a village school near Gloucester before he was brought to London, at which date he was able to read "verses out of the Bible." A child of under four years who can read is generally less gifted than the average at forty. But this was not the case with Charles Wheatstone; the early power of memory exhibited in this instance went on increasing until it developed into the mental power of the physicist.

After he was brought to London he was sent to a school at Kennington, kept by a Mrs. Castlemaine, who was astonished at the progress made by young Wheatstone while under her care. This progress and his love of learning had great allies in the naturally nervous and timid nature of the child. Most children at times hide their faces in their books, but young Wheatstone hid his there always, and used his eyes in conning their contents. At this school he acquired the character of being unsociable, from his disinclination to join in the sports of his schoolfellows, whilst timidity and nervousness were at the bottom of it.

Later on he was sent to pursue his studies at an establishment which appears to have been unworthy of the pupil, for in addition to youthful disputes with his teacher over what he was taught, which he considered inaccurate and deficient, he got utterly disgusted with the school, and ran away. Those who in after life have known the extremely hesitating and cautious nature of Charles Wheatstone, can well estimate how enormous must have been the effort in the child to make up his mind to this step. The

[1] *Vide* also Proceedings of the Royal Society, vol. xxiv., p. xvi., and obituary notices in the journals at the time of his decease.

history of his escape is not romantic; he got as far as Windsor, and was brought back again.

At another school, conducted on the Lancastrian principle, in Vere Street, he, in 1813, in the half-yearly reports got the character of "application moderate," yet he made considerable progress, for he carried off a gold medal in competition for "French language," the other competitors being considerably his seniors in date of study, as well as in age. But a rule of the school was, that the happy victor should recite a speech on the occasion of the prizes being distributed. This young Wheatstone could by no threats or coaxing be persuaded to attempt, and his obstinacy was punished by the application of a sound rule, "no speech, no medal."

About the year 1816 he was placed with his uncle and namesake, who carried on business as a music-seller at 436 Strand. The novelty of business may have interested the lad for a short time; but this did not last, and the uncle complained that he neglected work to pore over books. Another unbusinesslike habit was to shut himself up in an attic, and be quite happy if only he was not disturbed. Seeing the evident bent of the lad's mind, and despairing of success in opposing it, the father sensibly encouraged him in the pursuit of his studies, took him away from his uncle, and procured him the loan of books from the Society of Arts in the Adelphi. About 1817 he translated a considerable portion of some French poetical works. He wrote also two songs, which, fearing his uncle would not look at as his, he gave to Omera, who took them, offered them as his own composition, to the uncle, by whom they were published and appreciated, in ignorance of their real authorship. He was only fifteen when he wrote some lines on the Lyre, since quoted in an engraving by Bartolozzi.

In 1819, when Wheatstone was seventeen years old, he exhibited in Pall Mall some highly interesting practical experiments in acoustics. Then he opened a Museum at the lower great room, Spring Gardens, where he showed the most novel and startling phenomena. Among these were his "Central Diaphonic Orchestra," by which he obtained an immense augmentation of the tones of musical instruments in richness and power, and an "Œdephone," an equivalent substitute for a band of wind instruments when played in his diaphonic orchestra. But the prettiest experiment was the "Acoucryptophone" (he was very partial to hard words) or Enchanted Lyre. This Enchanted Lyre was included in the Loan Collection of Scientific Apparatus at South Kensington in 1876 (No. 701A in the catalogue). It consists of a hollow box of the shape of an elegant antique lyre. This

was suspended from a wire passing through the ceiling of the room and hanging upon the sounding board of a piano or other musical instrument in some upper storey. When the instrument was struck the vibrations passed down the wire and became audible in the lyre. The instrument was not heard, and the deception was complete. Ackerman's "Repository" for March and May 1822 contains a full account of all that Wheatstone did on this occasion. In 1823 Charles Wheatstone returned to the Strand, and, on the death of his uncle shortly afterwards, he, in conjunction with his brother, took to the business, with which he was connected for about six years, although he never took an active part in it. In the same year he published, in Thomson's "Annals of Philosophy," a Paper entitled "New Experiments on Sound," which is rich in experimental facts concerning vibrations of chords, rods, and surfaces. The attention of physicists was directed to it, and it was reproduced in France in the "Annales de Chimie," and in Germany in "Schweiggers Jahrbuch." He was very proud when his paper was translated into foreign languages. There is no encouragement so great as being appreciated.

The peculiarity of Wheatstone's mind seems to have been not to trust to anything but actual experiment. He sought diligently after new facts, but quite as diligently after new means of seeking them. He knew of the existence of waves, but he wanted to see them in all their variety, and, seeing them, he wanted to learn more about them. "New Experiments in Audition" appeared in 1827 in the "Quarterly Journal of Science," and in the same year a Paper describing his beautiful invention the "Kaleidophone." This consists of a steel wire fixed in a firm base and surmounted by a bead of silvered glass. When the rod is set in vibration the reflection of a light point (from a window or candle) in the glass bead is seen by persistence on the retina to follow the most beautiful and symmetrical paths. In compound vibration, by an appropriate displacement, the section of the rod being suitable, all ratios of vibration are obtained. This instrument he modified by means of a mechanism which kept the rod in action, by a combination of rectangular vibrations of any given ratio.

In all this the direct outcome of the music-shop was carried by Wheatstone out of its sphere, into those higher principles which underlie the science of sweet sounds. But the music-shop still claimed him, and he conscientiously thought that he devoted a good deal of time to its interests. He travelled also on business affairs, but it is doubtful whether this was not done as a matter of duty, and it was always distasteful. But

his conscience must have been lightened by the knowledge that his suggestions and inventions returned a profit to the concern, which more than compensated for any disinclination to the drudgery of shop life. The award which (like his schoolmaster in younger days) his brother might have given, "application moderate," would perhaps have been strictly untrue, for Wheatstone worked all this time bravely, and well and earnestly; but it was work which a higher class audience only could appreciate.

In 1828 appeared in the "Quarterly Journal of Science" his admirable Paper on "Resonance." In 1829 the house in the Strand was pulled down for alterations in the neighbourhood, and with this Wheatstone's connection with the music-shop virtually ceased. His brother removed to 20 Conduit Street, where he carried on the business. In 1831 Charles Wheatstone summoned courage to read a Paper on "Transmission of Sound through Solids" before the Royal Institution. In this lecture he showed the transmission of sound through wires and rods, and probably brought before a more scientific audience than formerly his "Enchanted Lyre." At the autumn meeting of the British Institution in the same year he gave an interesting experimental proof of Bernoulli's theory of the vibrations of air in musical instruments.

From this date Wheatstone's life became that of an earnest and unassuming, quiet and hard-working, man of science. To his unconquerable repugnance to public speaking is perhaps to no small extent due the fact, that he cultivated so assiduously actual experimental inquiry. Had he been eloquent, he might, and possibly would, have gone the road of many clever men, and degenerated into a mere lecturer. As it was, he clung to the last to actual experiment upon any subject in which he was interested. As a lecturer he was a failure: he has been caught more than once turning his back to his audience and mumbling to his diagrams; notwithstanding this, he read beautifully, and had a good, although not a powerful voice. Feeling that his place was the laboratory, and not the lecture-room, he gave up the attempt, and hence it was that Faraday and others brought his inventions and discoveries before public audiences.

In 1834 Wheatstone was appointed to the Professorship of Experimental Philosophy at King's College, where he delivered some lectures on "Sound." He, however, soon gave up the lecturing part, and, becoming afterwards engrossed in electrical matters, virtually held his post rather nominally than really. The first invention after his appointment to the Professorship was his beautiful rotating mirror, by which he determined the

time the electric impulse, discharged from a Leyden jar, took to reach a point ¼ mile distant along a copper wire, and to jump across a small space of air. The greatest use, however, to which this apparatus was put was in the determination of the velocity of light by Foucault. From this date Wheatstone's attention was pretty well divided between Sound and Electricity. In 1835 he made a speaking machine, an india-rubber mouth before which the hand was manipulated, which produced such simple words as "rum," "mamma," &c. He did not, however, prosecute the subject far, and, after contributing a Paper "On the Various Attempts which have been made to imitate Human Speech by Mechanical Means,"[1] he appears to have let the subject drop.

The determination of the velocity of electricity naturally turned his attention to the subject of utilising travelling electricity as a means of communication. Much had been already done at an early date in crude attempts to effect this, notably by Stephen Grey in 1827, Dr. Watson in 1747, Sömmering in 1808, and others. On the Continent rapid strides were being made by Schilling, Sternheil, and Ganos, whilst in England inventors appeared to have been discouraged. This may to some extent have been due to the adverse opinion expressed by the Government as to the utility of telegraphs in general. In 1816 Mr. Francis Ronalds had invented an impracticable anachronism, in the form of a telegraph with frictional electricity, which he offered to the Government, who replied through the Secretary of the Admiralty that "telegraphs of any kind are now wholly useless, and no other than the one now in use will be adopted." Had the reply simply been that telegraphs of the kind suggested would be wholly useless, and that if nothing better were forthcoming the one in use would of necessity be retained, it would have been nearer the mark than this unhappy generalisation. Two men, however, began to take up this work on a rational basis at the same time. One was Wheatstone, led to it as a direct outcome of his velocity experiment; the other was Mr. W. F. Cooke, now Sir William Fothergill Cooke, Assoc. Inst. C.E., a young military man, who, returning from India on leave of absence, passed through Germany and saw such an invention in action. Wheatstone was plodding quietly on very scientifically, whilst Cooke, more practical, was casting about him how to turn the idea into money. At

[1] *Vide* Report of the British Association for the Advancement of Science, 1835 Transactions of the Sections, p. 14.

this stage mutual friends brought them together, and they combined their ideas in the form of a patent. To Wheatstone and Cooke the world owes the fact that the electric telegraph became a practical reality at an early date, whereas without the scientific and inventive ability of the one, and the sound business judgment of the other, telegraphy might, and in all probability would, have been long years before it attained the thoroughly useful form with which they endowed it.

In 1836 Wheatstone began to direct his attention to the subject of a submarine telegraph, but his plans were not matured until the year 1840. He then gave evidence before the Railway Committee of the House of Commons on the practicability of establishing a submarine line from Dover to Calais. In the autumn of the same year he prepared detailed drawings of the machinery and methods for making the cable, and the processes of laying, jointing, and underrunning. In 1844 Wheatstone carried out an experiment in Swansea Bay, where he submerged an insulated wire, and succeeded in telegraphing between a boat and the Mumbles lighthouse. Beyond the credit of being the inventor and constructor of the first practical telegraph instrument, there is also due to Wheatstone the honour of being the first to suggest and to design a submarine telegraph. The starting point of submarine telegraphy most unquestionably dates from this experiment in Swansea Bay, although it was six years later before his idea of joining France and England by this means was actually carried out in an improved manner by Mr. Brett and others.

It would occupy too much space to enumerate all the improvements and inventions made by Wheatstone in the domain of telegraphy. Two of his instruments are conspicuous: his A B C dial instrument found at the ends of every private telegraph wire in the kingdom; and his Automatic system, by which messages are sent at the rate of about 150 words a minute—the system by which the Post Office is enabled to get through the long columns of news it transmits for publication in the daily papers, besides the ordinary message traffic on the principal trunk lines of the country.

In scientific, as well as in practical, electricity Wheatstone's name will ever be remembered with respect. It was he who first devised a means (Wheatstone's bridge) of measuring quantitatively the resistance of a metallic circuit, a system by which all such resistance measurements are still made.

Amongst his studies and labours that of light came in for a full share. In 1835 he seems first to have seriously turned his atten-

tion to the subject, and read a Paper at Dublin, "On the Prismatic Decomposition of Electric Light,"[1] in which he made known the existence of bright lines in the spectrum of any metal when volatilised by the electric spark. His subsequent discovery of the stereoscope, and the train of reasoning which led to it, may be found in his Paper on "Binocular Vision." His "polar clock," used lately on the North Polar Expedition, consists of a Nicholl prism as an eye-piece and a plate of selenite as an object. The plane of polarisation of the sky being always 90° from the sun, if the instrument be directed to the North Pole, the position of the prism will require to be adjusted accordingly, in order to reproduce any neutralised or other given effect of the selenite plate. The account of this adjustment or rotation on its axis gives the hour of the day. Practically valueless where watches are cheap, this instrument on a polar expedition, were it possible to attain the highest latitudes, might be of the greatest value.

In cryptography, or the means of writing secret cipher, Wheatstone was unequalled. He not only invented a cryptograph which has never been deciphered, but succeeded in unravelling some of the cipher MSS. in the British Museum, which until then had been unintelligible.

There is scarcely a branch of applied science which Wheatstone's mind has not enriched. The great scope of his ideas was, in fact, occasionally a drawback, for, unlike the majority of men, he was unable to work steadily at one subject for a length of time. Something would occur to call into prominence momentarily a different subject, for which the first would for the time be laid aside. To this is due the fact that so many subjects remained unfinished when he died—subjects which had been in the interim worked out exhaustively by others. Of Wheatstone it may be said that he outlived his own work, which he saw taken up and completed or pushed farther by younger men.

Charles Wheatstone belonged to a race of scientific men which is fast disappearing. The traditions of conscientious hard work in which he had been born and bred, and the life of actual experimental investigation in which, up to the hour of his death, he passed his time, may have induced in his mind a contrast unfavourable and sometimes perhaps unfair towards the newer order of scientific men, whose attention is directed more to mathematical reasoning on already established experimental investigations, than

[1] *Vide* British Association Report, 1835. Transactions of the Sections, p. 11.

in either verifying the older experiments, or in making new ones on their own account. He clearly saw that the earlier half of the present century had produced the facts which have revolutionised science, and he was perhaps severe in thinking that the second half of the century was producing the men who do little more than apply algebra to them.

As a worker Wheatstone was industrious and original, and he kept steadily in view the purpose for which he laboured, that defined by Tredgold as the conversion, adaptation, and application of the great sources of power in nature for the use and convenience of man, an infinitely higher purpose than either satisfying an unreasoning curiosity to peep into the secrets of nature, or the mere desire to obtain patent-rights.

He was elected an Honorary Member of the Institution on the 2nd of March, 1875, "because of his distinguished attainments in physical science—of his numerous discoveries and inventions in acoustics, optics, electricity and magnetism—more especially of his profound and successful researches in the practical development of the electric telegraph, and of his many important modifications of the system, and appliances for transmitting intelligence through that agency."

Of his private life there is little to record, as it was most uneventful. He married on the 12th of February, 1847, at Christ Church, Marylebone, the daughter of a Taunton tradesman, a young lady of considerable personal attraction, who died in 1866, leaving him the task of bringing up five young children.

His death took place on the 19th of October, 1875, in Paris, whither he had gone to conduct some experiments on a telegraph receiving instrument which he had invented in the previous spring. He was buried at Kensal Green in the grave which contained the bodies of his wife and his brother and sister.

---

Mr. CHARLES FREDERICK BEYER, who died at his residence, Llantysilio Hall, in the county of Denbigh, on the 2nd of June, 1876, was the head of the well-known firm of Messrs. Beyer, Peacock, and Co., of Gorton, Manchester. He was born at Plauen, in the kingdom of Saxony, on the 14th of May, 1813, and his parents, who were in humble circumstances, supported themselves by hand-loom weaving. They were unable to give their children more than the usual education demanded by the State; and as they intended