your Aberdeen stone monuments which are well worth investigation.

I hope, also, that Aberdonians will see that the necessary work is done. How I wish I could be with you to help in it, and renew the pleasures you allowed my wife and myself to feel, going about among the relics of a long bygone past in your most modern motor car.

Always sincerely yours,
NORMAN LOCKYER.

APPLICATIONS OF THE MICROPHONE PRINCIPLE.

AN interesting booklet upon applications of the microphone principle has been written by Messrs. Jensen and Sieveking, of the physical laboratories in Hamburg and Karlsruhe.[1] By the term "microphone principle" the authors mean all those phenomena which are due to the change of ohmic resistance between loose contacts. The memoir contains a very exhaustive collection of what is to be found scattered in scientific literature from the time of Munck of Rosenschoeld, to the present day. The explanation that in loose contacts the nearer approach of the particles resulting from the application of pressure is the cause of the diminished resistance observed, is ascribed to du Moncel and Beetz, who gave it almost simultaneously, though independently. Among the early practical applications of this property of loose contacts was Hughes's induction balance, which is so well known that no lengthy reference need be given here. A less known though also interesting application may, however, be mentioned, namely, the demonstration of nodes and antinodes in acoustic waves in cylindrical vessels. By lowering a small microphone into the cylinder, Fossati succeeded in locating the position of the nodes and antinodes by means of a telephone receiver connected with the microphone. The sound waves impinging against the loose contacts produce a rasping sound in the telephone, which vanishes when the microphone reaches the position of a node. In a darkened room minute sparks may be seen between the microphone plates when the microphone is in the position of an antinode.

Another acoustic application of the microphone made quite recently by Hebb is the determination of the velocity of sound. He uses two parabolic mirrors facing each other, and placed on the same axis. The one is fixed, and the other can be moved to a greater or lesser distance. In the focus of the first or fixed mirror is placed a tuning fork and a microphone, in the focus of the movable mirror a second microphone. The secondary of an induction coil having two primary windings is connected to a telephone. The primary windings are connected each with a battery and one of the microphones. The sound waves of the tuning fork act directly on the microphone next to it, and the reflected sound waves on the microphone in the movable mirror. It is easy to see that the loudness of the tone given out by the telephone depends on the frequency of the tuning fork, the distance between the two mirrors, and the velocity of sound. If both microphones receive antinodes at the same time, the tone is loudest, and if there is a phase difference of half a period between them the tone is weakest. Now the phase difference depends on the distance between the mirrors, the length of the acoustic wave, and the frequency. By first carefully determining the latter, and then finding the position of strongest and weakest sound, Hebb was able to determine with great accuracy the velocity of sound. He found it to be 331.29 metres, the probable mean error being only 0.04 m.

The attempts to use the microphone in seismography do not seem to have led to any practical or trustworthy result. Rossi, in 1887, used a microphone consisting of a silver plate and pointed lever in his underground observatory near Rome, and noticed that the telephone gave out sounds which were unmistakably the effect of seismic movements, and when afterwards the apparatus was tranferred to Vesuvius and came under Palmieri's observation, a general agreement between the sounds in the telephone and the records of the seismograph was observed, but the difficulty of separating sounds due to other causes seems to have stood in the way of further developments. Nevertheless, the authors think that the microphone may be made a seismographic instrument of great sensitiveness.

An ingenious application of the microphone for the detection of fire-damp has been made in France by Hardy. If the sound waves of two pipes of equal pitch impinge on microphones connected in series with a telephone a clear note is heard, but if one of the pipes emits a but slightly different note there will be beats heard in the telephone. Now if one pipe is on the bank and the other underground, the latter, if there be fire-damp, will be blown with air of a different density and emit a different note. The telephone, by sounding beats, will then give warning of the presence of fire-damp. The apparatus when tested with coal gas showed great sensitiveness. An admixture of but 0.1 per cent. gave three beats in twenty seconds, and an admixture of 1 per cent. gave thirty beats in twenty seconds.

The memoir deals very fully with the use of the microphone in telephony, including the production of graphic records such as are given by the instruments of Nernst, Lieben, Poulsen, and others. Also the use of the microphone in wireless telephony is touched upon. The most directly useful part of the memoir is, however, a very full account of the work done by a large number of experimenters in order to ascertain the best composition of the material forming the loose contact of the microphone, its mass, area of contact, specific pressure, and other determining factors as regards strength and clearness of sound.

The connection between the microphone and wireless telegraphy is not obvious, and the authors deal with this part of their subject very briefly. One sentence is, however, so interesting that it may, in conclusion of this short review, be quoted verbatim. The authors say:—"Already in 1879 Hughes has used the influence of spark discharges on microphonic resistances for wireless telegraphy over a distance of 400 meters."

GISBERT KAPP.

[1] Anwendungen des Mikrophonprinzips." By Chr. Jensen and H. Sieveking. (Hamburg: Graefe and Sille.)

SIR EDWARD J. REED, K.C.B., F.R.S.

THE death of Sir Edward James Reed on November 30 brought a long, useful, and highly distinguished career to a close. He was in his seventy-seventh year—full of activity, with mind as vigorous, and interests in life and work as keen, as ever. He was an active worker to the end. For the greater part of the last half-century he was the most prominent naval architect of his time. His influence during that long and important period in the progress of naval construction was one of the most potent forces that shaped its development and improvement. That influence was exerted, not only by his work and teaching, but also by constant and earnest efforts from his earliest days to promote the scientific education and training of young men

for the pursuits of naval architecture and marine engineering, and to raise the scientific standard and professional status of those important branches of engineering.

Edward James Reed was born at Sheerness in September, 1830. He received a thorough practical training in the Royal Dockyard there, and was afterwards a student of the School of Mathematics and Naval Construction in Portsmouth Dockyard, where he received the highest education in the science of naval architecture that was obtainable in this country. On passing out of the Portsmouth school he was given a subordinate appointment in Sheerness Dockyard, but he resigned this in 1852, and went out into the world to seek his fortune. He became editor of the *Mechanics' Magazine*, and soon began to play an active part in literary and scientific circles. One of his greatest services to the cause of naval science was rendered in connection with the foundation of the Institution of Naval Architects in January, 1860. This would hardly have been practicable, at that time, but for the devotion and ability with which Mr. Reed performed the onerous duties of honorary secretary during the period of organisation, and those of secretary for three years after.

Mr. E. J. Reed was appointed Chief Constructor of the Navy in July, 1863. This appointment followed upon proposals he had made some time before for improving the design of ironclad ships. The earliest ironclads of the *Warrior, Minotaur*, and other classes were found to be imperfect and unsatisfactory, and Mr. Reed proposed a radical change of design by limiting the armoured portion of the hull to what was merely sufficient for the proper protection of its vital parts—such as the compartments containing the boilers, machinery and magazines, the gun battery, the rudder head and steering gear, and the water-line area before and abaft the gun battery. This became famous as the "belt and battery" system, and it is, in principle, the system adopted in the design of battleships and armoured cruisers to-day. It enables the thickness of armour to be increased to a maximum upon a given size of ship, and admits of the application of thick armour to ships of smaller dimensions than would otherwise be requisite. The wooden ships *Enterprise, Favourite*, and *Research* were ordered by the Admiralty to be converted in accordance with Mr. Reed's proposals in 1862, and the design of the *Bellerophon* followed immediately after he took office in 1863. The last-named was the first of a continually progressive series of historical ships that led in direct line to the last of our armourclads which fought their guns upon the broadside; while the *Devastation*, the last battleship designed at the Admiralty by Sir Edward Reed, is the first in the series of sea-going battleships, the heaviest guns of which are placed in turrets on deck, which now reaches its latest development in the *Dreadnought*. In these typical designs the lines which future progress in battleship design would take are clearly indicated. The design of the structure of the hull in the *Bellerophon* was novel and ingenious. It has been followed in all subsequent battleships and cruisers for the British Navy, and adopted all over the world. An important factor in Mr. Reed's success at the Admiralty, which the writer frequently heard him mention, was that he had as his principal assistants Messrs. Barnaby (his successor for fifteen years as Chief Constructor of the Navy), Barnes, and Crossland, the best of his old fellow-students at the Portsmouth school. He always said that without the aid of men of the highest scientific and technical training, as they were, his achievements would have been impossible. The value of their scientific knowledge and ability in dealing with the new and difficult problems in naval construction that were then continually presenting themselves for solution was so manifest as to furnish one of the strongest proofs to the Board of Admiralty of the necessity of maintaining an efficient school of naval architecture.

Space will not admit of detailed reference to Mr. Reed's work at the Admiralty during the seven years 1863–1870, but evidence of his great activity and energy there, and of the scientific value of his work, may be found in the Transactions of the Institution of Naval Architects for those years. He left the Admiralty in July, 1870—as the result of the non-acceptance of his views respecting the height of freeboard requisite for sailing ironclads the principal guns of which were placed in turrets on deck—and practised as a naval architect from that time almost to the last day of his life. Almost immediately after he left office the correctness of his views with regard to low-freeboard sailing ships was proved in a tragic manner by the loss of the *Captain*. He was held in high repute all over the world, and designed famous warships for the German, Japanese, Chilian, and other foreign Governments. The last of these with which the long-familiar name of Sir E. J. Reed is connected are the *Libertad* and *Constitucion*, built for the Chilian Government by the Elswick and Vickers firms respectively, which now form part of our own navy under the names *Triumph* and *Swiftsure*. These ships have attracted much attention in naval circles because of the high speed and great fighting power they possess upon comparatively moderate dimensions, and they have proved most successful on service. Sir Edward Reed was also naval architect for the Indian Government and the Government of the Crown Colonies, and designed many successful ships of various classes for those Governments.

Sir Edward Reed was a strenuous advocate, as we have said, of scientific and technical education. The School of Naval Construction at Portsmouth, at which he was educated, was abolished by the Admiralty in 1853, but he joined with other leading members of the Institution of Naval Architects in 1863 to urge upon the Admiralty the necessity for establishing another school for the scientific training of young naval architects and marine engineers for the Admiralty service, and also for the mercantile shipyards of the country. This action resulted in the foundation of the Royal School of Naval Architecture and Marine Engineering at South Kensington in 1864, to which most of the leading naval architects and marine engineers of to-day owe their scientific training. Mr. Reed, as Chief Constructor of the Navy, never failed to promote the interests of this school. He was one of its best and most popular lecturers; and those who passed through the school at that time owe to him their first appointments to responsible posts, in which their qualities could be tested, and their early professional advancement.

In 1873 Sir Edward (then Mr.) Reed contested unsuccessfully the Borough of Hull at a Parliamentary election. He was returned for the Pembroke Boroughs in 1874 and for Cardiff in 1880, and sat continuously in the House of Commons from 1874 to 1895, and from 1900 until last year, when he retired from Parliamentary life. He was made a C.B. in 1868 and K.C.B. in 1880, and served as member, and sometimes as chairman, of many important committees. He was chairman of the Load-line Committee of 1884, which first made legislation for regulating the depth of loading of ships successful in practice, and of the Manning of Ships Committee of 1894. He was also the Government Commissioner

who investigated the cause of capsizing of the *Daphne* in the Clyde in 1883. Sir Edward was one of the Lords of the Treasury in Mr. Gladstone's Government of 1886.

Sir Edward Reed was elected F.R.S. in 1876. He sat upon the council of the Institution of Naval Architects from 1863, when he retired from the secretaryship, until his death, and upon the council of the Institution of Civil Engineers from 1883 to 1896. He was the recipient of very high Russian, Austrian, Japanese, and Turkish honours and decorations. Among the works published by him are:—"Shipbuilding in Iron and Steel," 1869; "Our Ironclad Ships," 1870; "Letters from Russia in 1873"; "Japan," 1880; "The Stability of Ships," 1884; "Modern Ships of War" (in collaboration with Admiral Simpson), 1885; "Fort Minster, M.P.," a novel, 1885; "Corona and other Poems," 1857; and "Poems," 1902. He was also the author of numerous papers in the Transactions of the Institution of Naval Architects and other professional institutions, and of two important papers, "On the Relation of Form and Dimensions to Weight and Material in the Construction of Ironclad Ships," which were communicated to the Royal Society by the late Sir George Stokes, and are published in the Philosophical Transactions of 1868 and 1871. He was also the proprietor and editor of the quarterly magazine *Naval Science* from 1872 to 1875, and contributed many articles to its pages.

The subject of this imperfect memoir was not merely a great naval architect, but a man richly endowed by nature with many and varied gifts. He was cheerful and sanguine in disposition, with an attractive and impressive personality, and unusual force and independence of character. He was lucid, graceful, and fluent of speech, and one of the ablest and most effective speakers and controversialists of his time. He long commanded public attention as man of science, politician, orator, and author, and in the last-named capacity he had the unique distinction of earning laurels in fields so far removed from those of his severe professional labours as poetry and romance. No one was more popular or more genuinely admired among his professional brethren and children for his great abilities and accomplishments, and his genial and sociable nature, than the late Sir Edward Reed. FRANCIS ELGAR.

NOTES.

A REUTER message from Stockholm states that the formal distribution of the Nobel prizes took place on Monday evening. Prof. Moissan, Prof. Thomson, Prof. Golgi, and Prof. Ramon y Cajal each received the prize diploma and a gold medal from the King of Sweden in person. Each prize this year amounts to 7659*l*. Prof. Thomson's prize is awarded to him for his researches extending over many years into the nature of electricity, and Prof. Moissan's for his experiments in the isolation of fluorine, his researches regarding the nature of that element, and for the application of the electric furnace to the service of science. Profs. Ramon y Cajal and Golgi are bracketed for the medicine prize on account of their works dealing with the anatomy of the nervous system.

THE Government geologist of South Australia reports that the discovery of corundum in the Farina district is likely to be one of considerable value. The corundum occurs in metamorphic schist, the proportion in the rock amounting in places to 10 per cent. to 25 per cent.

THE American mail brings the announcement of the death, on November 23, of Dr. William H. Chandler, emeritus professor of chemistry at Lehigh University, at the age of sixty-five years. Dr. Chandler taught for many years in the Columbia School of Mines, and was the author of several important works.

IN an article in the *Pall Mall Gazette* (December 10) with the somewhat sensational title of "The Approaching Conquest of Cancer," Dr. Saleeby states that several cases of cancer have been cured or much improved by injections of trypsin, one of the pancreatic ferments, a method of treatment suggested by Dr. Beard, of Edinburgh. Even if this be correct, however, it by no means follows that cancer is to be conquered in the near future, and the premature publication of such details as these in the public Press serves no useful purpose.

MR. W. R. BUTTENSHAW, who has been scientific assistant on the staff of the Imperial Department of Agriculture for the West Indies during the last four years, has been offered the post of botanist in the Agricultural Department of India. He will vacate his present post as soon as his successor has been appointed.

THE annual conversazione and exhibition of new apparatus arranged by the British Electrotherapeutic Society will be held in the small Queen's Hall on Friday, December 14, from 7.30 p.m. to 10.30 p.m. The exhibition will be open from mid-day.

WE learn from the *Chemist and Druggist* that a wealthy landed proprietor named M. Audrac, who died recently at Le Luc, near Draguignan, has left the Pasteur Institute the whole of his fortune, valued at the equivalent of 50,000*l*. at least. Interviewed on the subject, Dr. Roux, the distinguished director of the institute, stated that he had received a visit from a lawyer, who informed him that a will had been found bequeathing the whole of the property to the institute. The reserve, however, was made that another document might possibly come to light making various bequests or otherwise disposing of part or whole of the property; consequently, Dr. Roux says that some time must elapse before the Pasteur Institute can know definitely how it stands with regard to the inheritance.

BY the death of Mr. John Ward, of Longton, Staffs, British geology has lost one of those quiet, earnest workers who, in the midst of their other duties, achieve so much for science. Mr. Ward was an original member of the North Staffordshire Field Club, and one of the most regular and valued contributors to its Transactions. In 1874 he was elected a Fellow of the Geological Society of London, and in 1898 he was the recipient of an award for his work upon the fossil fauna and flora of the North Staffordshire Coalfield. As a collector, Mr. Ward was the happy possessor of a splendid enthusiasm tempered with sound knowledge; a large part of his collection of Coal-measure fishes is now in the British Museum (Natural History). While attending to the conduct of his business and devoting his spare time to geology, Mr. Ward yet found it possible to take a prominent part in the duties of citizenship. He will be missed greatly by students of Carboniferous faunas, not in this country alone, but by his numerous friends abroad.

THE following telegram, dated Bombay, November 29, has appeared in the public Press:—"Dr. von Lecoq, a scientific emissary of the Prussian Government, has arrived safely at Srinagar after a journey through the most remote parts of Central Asia. He has brought with him a quantity of highly interesting paintings on stucco, the backgrounds in many cases being of gold leaf as in Italian