at Mount Morris, New York, of English parents who had emigrated to the United States in 1830, Powell was educated at Illinois and Oberlin College. He served in the army during the Civil War, losing an arm at the battle of Shiloh, and in 1865 became professor of geology in the Illinois Wesleyan University at Bloomington. Two years later he began a series of hazardous and important expeditions to the Rocky Mountains and the Green and Colorado Rivers, which led to a Government geographical and geological survey of the Rockies. Powell served on this for several years and his reports, together with those of F. V. Hayden and G. M. Wheeler, were embodied by Clarence King in the United States Geological Survey bulletins. In 1879 Powell was made director of the United States Bureau of Ethnology, and in 1881, on the resignation of King, he became also director of the Geological Survey. He held the latter post for thirteen years, but retained the former until his death at Haven, Maine, on September 23, 1902. Powell was one of those pioneer geologists of the Far West, who as von Zittel said, "by their vivid portrayal of the work of subaerial denudation . . . roused the intellectual life of the middle of the century to new conceptions on a grand scale".

The Electron in Electrical Engineering

MR. C. C. PATERSON gave on March 15 the Faraday lecture to the Institution of Electrical Engineers, choosing as his subject "The Electrical Engineer and the Free Electron". It was the kind of lecture that one could have imagined Faraday himself to have given, consisting of lucid explanations and practical demonstrations of fundamental principles. Mr. Paterson stated that the science of electrical engineering was born again when the physicist showed how electricity could be liberated from metal. In the free state it has potentialities of which no one dreamed before its discovery by Sir J. J. Thomson. Just as physiologists learned that disease can be envisaged in terms of isolated germs and their life-history, so the physicist found that electricity can be thought of in terms of the individual electron, its habits and affinities. Two of the main reasons for the practical usefulness of electricity are the ease with which it can be transported and the ease with which it can be controlled. In the latter respect the free electron has now given the engineer new and extraordinary power. Many applications have been already revolutionised and there are doubtless many more surprises in the future. The secret is that a stream of free electrons, whether in a vacuum or a gas, can be manipulated with such facility that the electrical energy output can be reversed at the rate of millions of times a second. Alternatively, it can be made to fluctuate at any given slow speed. While the agency which imposes this control on the electron stream is usually itself electrical, it is possible to control it by light, magnetism or heat.

NORMALLY the electrons are confined within metal conductors. When a portion of a circuit (a thermionic valve cathode or filament) is heated, electrons emerge freely, like water pouring through a porous section of hose pipe. Heat is the agent which liberates the electrons from the interior of the wire. They swarm in a thin layer round the outside surface, ready to be attracted away by externally applied electrical forces exerted by another metal electrode. As the electrons travel between the electrodes, the control causes them to flow or ebb, reverse or oscillate. Frequencies up to 3,000 million per second are attainable. The photoelectric cell is another liberator of electrons. In this case they emerge from a sensitised cold surface (cathode) where light falls on it, and are collected on the anode. These cells are capable of receiving more than 300,000 impulses per second. Mr. Paterson explained and demonstrated the way in which sound and speech are reproduced in various devices. He said that the electron often behaves as if it were a solid particle, but under other conditions it appears to be a group of waves. It acts the same whether it has the particle or the wave characteristics. In free space it acts like waves, but when it collides with something it has particle characteristics. The filament of the incandescent lamp causes the electrons to crowd together and this heats it so much that it gives out light. If the electrons escape from the filament its light-giving properties deteriorate, but if the gas envelope is filled with suitable gas mixtures, the escaping electrons collide with the gas atoms and produce a brilliant and highly efficient light source. This is the principle utilised in luminous gas discharge tubes. Cold cathode tubes need a high voltage to induce the electron stream, but a hot cathode produces a much more copious stream and enhances the brightness of the light. Some of these luminous tubes produce twice as much light as an ordinary filament lamp taking the same power.

Excavations at Ur

OWING to the late date at which excavations were resumed at Ur this year, Dr. C. L. Woolley's first report on the season's work has only just been received and is published in the *Times* of March 16. The operations of the joint expedition this year are to be directed to the exploration of a cemetery of the Jemdet Nasr period of about 4,000 B.C., which lies at a depth of 54 ft. below the surface and involves the removal of about 5,000 tons of accumulated rubbish. The three weeks' work which had been completed at the time Dr. Woolley wrote has produced a remarkable example of sculpture in the round in the form of a woman's figure in alabaster with lapis lazuli inlay forming a fillet outlining the face, lapis lazuli and shell eyes, bituminous inlay for the eyebrows, which meet above the nose, and hair in dark paint. The statue is ten inches high. It is not only the earliest known example of sculpture in the round at Ur, dating from about the last quarter of the fourth millennium, but it is also remarkable as being the first statue to be found in a grave. It lay in a soldier's grave, close to his head and touching the blade of a bronze axe which he carried over his shoulder. This grave is situated in what would appear to have been a military cemetery in the latter

half of the Royal Cemetery period. This at least is the inference which Dr. Woolley draws from the number of battle axes, adze-shaped axes and daggers which have been found in this area. An interesting feature in the economy of the city is conjectured to interpret the existence in the very heart of the town of an area which throughout the history of Ur was a mere rubbish heap. A section shows that while this rubbish heap was continually receiving additions, it was at the same time constantly being removed to provide material for the terraces on which new buildings were erected.

Early Art at Giza

AN interesting account of the excavations of the Egyptian University at Giza during the present season is given by the Cairo correspondent of the *Observer* in the issue of March 18. The expedition, of which Prof. Selim Hassan is in charge, is engaged in investigating the Fourth Pyramid, with its surroundings, which has been identified as that of Khunt Kawas, daughter of Menkaura of the Fourth Dynasty. The exploration of the city attached to the pyramid, the only one of its kind yet discovered, has been carried further and has resulted in bringing to light, among other discoveries, the source of the water supply of the libation chamber and above the libation tank the tomb of an official described as "the purifier and prophet of the king's daughter". The temple of Khunt Kawas has been located adjoining the temple of Menkaura and has been cleared. The most notable of the finds here are the base of a diorite statue of the king Chephren, grandfather of the princess, and the torso of a sphinx and the body of a statuette of the king which lay in the entrance to the temple of the king. In a temple of Ankhtef, the priest of the king's *Ka*, were found two small white limestone statues which are said to be the most perfect examples of the statuesque art of the early period. They represent Ankhtef himself seated and a woman kneeling and kneading bread, which, it is thought, may possibly represent his wife. An almost equally notable specimen of this early art is the statue of a judge of the period, which shows remarkable power in the modelling of the muscles and limbs.

Empire Marketing Board Research Commitments

WITH the abolition last year of the Empire Marketing Board, considerable anxiety was felt as to the provision for numerous investigations, in progress and projected, hitherto financed by the Board. Some weeks ago, Mr. J. H. Thomas stated in a written reply to a question in the House of Commons that provision was being made for such investigations (NATURE, Feb. 17, p. 254). In reply to a question by Sir Arnold Wilson asking for more specific information, Mr. Malcolm MacDonald has given the following written answer: "The research schemes financed from the Empire Marketing Fund comprise agricultural and scientific research in the United Kingdom and also in the Dominions, India and the Colonies. It has been arranged for 39 of these schemes, representing an annual cost of approximately £200,000 in all, to be continued, in each case at the same research institution and with the existing personnel. Of these schemes 23 are in the United Kingdom, eight in the Dominions and India and eight in the Colonies. The sum of approximately £115,000 which is required in the next financial year from United Kingdom funds in respect of these schemes will be charged against Votes administered by various Government Departments in this country. The remaining £85,000 is being met by the Governments of the Empire or by the institutions or industries concerned."

Research Under the Agricultural Marketing Boards

IN a written reply to a question by Sir Arnold Wilson in the House of Commons as to what extent the powers conferred by both Agricultural Marketing Acts to adopt schemes for research in the production and marketing of agricultural products have been exercised by the Potato, Bacon, Milk, Pigs, and Hops Marketing Boards, Mr. Walter Elliot, Minister of Agriculture, stated: "The Hops Marketing Board does not possess any powers of the kind referred to. The other Agricultural Marketing Boards mentioned have certain powers which they may exercise in connection with research services, but I understand they have not yet exercised them." Mr. Elliot said he had no doubt that the Boards in question will give attention to the question of research at the earliest possible opportunity, and that they will approach the Ministry of Agriculture should they think the Ministry able to assist them.

Wool Industries Research Association

THE report of the Council of the Wool Industries Research Association for 1933–34 refers to a 40 per cent increase in fees for private investigations as indication of the growing use which is made of the services of the Association by its members. Income from trade subscriptions has slightly increased, but an income of about £2,000 a year from the Empire Marketing Board has ceased. The activities previously financed by the Board are being continued and efforts are being made to obtain assistance from the Imperial Agricultural Bureaux. At a meeting of the Executive Council of the latter, it was emphasised that the work of the Association at Torridon should be concentrated on investigations of practical value to the grower and to the industrialist, and that Torridon should become a centre from which work on wool utilisation—both as regards research and educational publicity for the Empire as a whole—should emanate. Experiments on the nutritional influences on wool growth have continued in co-operation with the Rowett Research Institute, Aberdeen, and have revealed accentuated differences between a group of sheep fed on a maintenance ration and one receiving a simple supplement of high energy value. Arrangements have been made for further trials of experimental wool packs, including the impregnation of jute packs with rubber latex to anchor the jute fibres so that they do not stray into the wool during transit.

(*Continued on p.* 457.)