high temperature on the properties of the insulating material. The object of the investigation is to determine the current carrying capacity of standard cables of various types and sizes under different conditions of laying, both for alternating and direct current.

For work in connexion with the testing of fuses, the laboratory facilities have been extended to cover the latest specification of the British Engineering Standards Association for domestic fuses up to 250 volts and 100 amperes. The specification requires that the tests be made at 260 volts and at suitable short circuit currents up to a maximum of 6500 amperes. With the new equipment, the short circuit is made from a distance by means of a solenoid controlled switch, the cut-out being observed through a wired glass panel in the door of the test enclosure. An auxiliary circuit incorporating a neon lamp indicates whether iron-clad cut-outs show any tendency to arc to their cases.

In the Wireless Division a new type of dynatron oscillator has been developed by the use of the negative resistance characteristic of the screen grid valve. By coupling the anode to the control grid through a small capacity and including a resistance of the order of a megohm in the filament-control grid circuit, higher frequencies than are possible with normal dynatron circuits have been obtained. The exhibit shown can be used for the generation of oscillations of wave-length as small as 6 metres.

The same principle can be applied to the problem of selective amplification. With the usual triode valve the presence of the positive shunt resistance of the valve decreases the selectivity of the tuning circuit through damping. If the negative resistance characteristic of the screen grid valve be utilised, the selectivity of the amplifying stage can be made greater than that of the tuned circuit alone. A demonstration of this was given by means of a circuit incorporating a valve of this type.

The investigation on behalf of the Radio Research Board in connexion with the development of transmitting and receiving apparatus for very short wave-lengths has been continued, and equipment capable of transmitting and receiving oscillations of wave-length as small as 1.5 metres was shown. The apparatus has been used for the study of the propagation characteristics of very short waves.

The apparatus for testing the performance characteristics of wireless receivers has now been extended to cover the shortest wave-lengths in commercial use. Improved apparatus has been installed capable of carrying out comprehensive tests at wave-lengths from 7 metres to 2000 metres. The tests comprise over-all sensitivity, radio-frequency, selectivity, and fidelity in the reproduction of radio-frequencies. The last-named test is carried out by the use of an input

modulation free from harmonics. Any harmonics present in the output constitute a measure of the distortion produced.

In the High Voltage Building, equipment for the measurement of the dielectric loss of high voltage porcelain insulators was exhibited. Demonstrations were given of flashover tests to determine the maximum voltage withstood by a 132-kilovolt porcelain insulator string.

In the Photometry Division an investigation was in progress in connexion with the light-diffusing properties of diffusing glassware. These properties are governed by the size and concentration of the particles, and apparatus has been developed in the division for the measurement of these two quantities by the use of a powerful microscope. Half-silvered interferometer plates are fitted to the fixed and movable stages of this instrument, enabling the movement of the latter to be obtained directly in terms of light wave-lengths. The diameter of a particle can be determined by observation of the interference fringe system, as the particle is made to traverse a fixed cross wire, or alternatively by attaching the cross wire to a travelling microscope, the scale of which can be calibrated by means of the interferometer. To determine the concentration, the field is limited by an aperture of known diameter. The microscope is focused through the particles by a slow-motion device, the distance traversed being measured by a second interferometer.

The fundamental work on glare has been extended to cover the glare effect of coloured light sources with white and coloured backgrounds. Practical application has also been made of the results already obtained with normal light sources by the design of an instrument for the determination of the glare effect due to an actual lighting system. Two measurements of the brightness difference threshold, one with the glare sources exposed to the observer's eyes, and the other with the glare sources screened, give a ratio which is a measure of the glare effect.

In the William Froude Laboratory a model of a single-screw vessel was being tested to compare its behaviour in shoal and deep water. There are reasons for supposing that there is a scale effect leading to differences between the model and the full-sized ship. The model under test was equipped with its own inboard motor and propeller and apparatus for determining its resistance through the water. A model twin-screw vessel fitted with its own propelling and recording gear and utilised for research work on the backing qualities of propellers was exhibited. The tests are designed to show the thrust capacities of propellers of various shapes and diameters to destroy and reverse the motion of the model.

The International Congress of the History of Science and Technology.

THE Second International Congress of the History of Science and Technology, which assembled in London on June 29-July 4, has achieved a notable success, thanks to the untiring efforts of its distinguished president, Dr. Charles Singer, and the executive committee, and thanks also to the active interest it has aroused among scientific workers and historians throughout the world. The Congress, which was really the first of its kind, originated with the Comité International d'Histoire des Sciences, which was founded at Oslo on Aug. 17, 1928. It has, however, been fortunate in enlisting the co-operation of the Comité International des Sciences Historiques, of the American History of Science Society, and the New-

comen Society for the Study of the History of Engineering and Technology, of London. It has thus been possible to show, in its widest extent, the important part played by the sciences in historical and technical research. The papers and discussions of the Congress, and the large attendance of official representatives, who came not only from most of the universities of Great Britain and the Empire, but also from the Continent, North and South America, Asia, and Africa, bear witness to this fact.

At the inaugural session of the Congress, which was opened by the President of the Board of Education, the Right Hon. H. B. Lees-Smith, M.P., in the Great Hall of the Royal Geographical Society, Dr. C. Singer

read some paragraphs of his inspiring presidential address on "The Beginnings of Science", which was published in full in *NATURE* of July 4. He emphasised the dynamic rôle of science, which is best illustrated by its history, and pleaded for the introduction into school-teaching of the broad lines of scientific history.

The work of the Congress itself was divided into four main sections, which met most fittingly in the lecture hall of the Science Museum. The first section, with Prof. G. Loria (Genoa) as chairman, dealt with "The Sciences as an Integral Part of General Historical Study". In his opening paper, Prof. G. N. Clark (Oxford) showed the complexity of the relations between the history of science and general history, and claimed that science has more truly a history than have other human activities, owing to the fact that the history of science is distinguished by more definite achievements and a more orderly development. This point was further emphasised by Sir William Dampier-Whetham (Cambridge), who proposed that the teaching of history should follow the natural order of its development, moving onward from primitive emotions to law, economics, and science. In support of these views, Dr. T. Greenwood (London) maintained in his paper that even the development of mathematics is a necessary constituent of both philosophy and technology, and illustrated the point that a critical history of mathematics should help in getting a deeper knowledge of the various philosophical systems which, in turn, provide the fundamental causes of the periodical and progressive changes in the mental and material outlook of the human race. Some stimulating remarks were made in this connexion by Prof. A. V. Hill (London), who submitted that if history is to deal with human greatness, with things which have given man control of himself and his surroundings, that have relieved him of superstition, ignorance, ill-health, and incompetence in the face of natural forces, then the great figures of science and their discoveries deserve a more worthy place even in children's history-books. For after all, the forces that move us are forces of our own making, which cannot be of less importance than the results they produce.

To this individualistic interpretation of history and to the paramountcy of the history of science, the representatives of the U.S.S.R. took exception, and proposed instead a communistic explanation of scientific development, in which the integrative work of the masses is exalted at the expense of the glorification of genius. Prof. B. Zawadovsky (Moscow), for example, does not conceive history as the history of personality, but rather as the process of development of mankind conforming to certain laws, as a social whole in all the multifariousness of its class structure. From this angle, the history of science begins only from the moment when we discern the particular conditions of material culture and the economic requirements of production which determine the direction of the interests of the scientific workers concerned, and the readiness of society to utilise their discoveries. In seconding this opinion, Prof. E. Colman (Moscow) was able to illustrate the influence of the spiritual atmosphere of his time on Darwin himself by means of a letter written by the great naturalist to Karl Marx, in which Darwin admits having refrained from writing on religion in order to avoid surprising his contemporaries and his relatives, although he was all the same an advocate of free thought on all subjects. Prof. M. Rubenstein (Moscow) shared the views of his colleagues, suggesting that history has not been made by great men, but by the economic and social forces of which they have been the expression. It might be said here that the attitude of the Soviet

delegates can scarcely explain any history, however stimulating their message and their endeavours to put it into practice in their own educational institutions.

The second section of the Congress, with Prof. W. H. Welch (United States) in the chair, discussed the important problem of "The Teaching of the History of Science". M. Aldo Mieli, the active permanent secretary of the Comité International d'Histoire des Sciences and editor of *Archeion*, told the Congress how this body is directing an inquiry into the teaching of scientific history, which will be completed in time for the Congress of History to be held at Warsaw in 1933. Going into the heart of the debate, Prof. A. E. Heath (Swansea) tried to show that our social and cultural disharmonies are largely due to our failure to acclimatise ourselves to modern cosmologies; and proposed, as a solution of this difficulty, the creation of a scientific history more in accord with the facts of the modern world. On the other hand, in advocating the development of special courses in the history of science in secondary schools and colleges, Prof. F. S. Marvin (University of Cairo) outlined, in his paper, the advantages to be gained by introducing the historical side into scientific work: such a method would present science as a growing thing; it would show the link with the other aspects of our knowledge; it would present the mass of scientific facts in a more human form; and finally it would illustrate the collective work of the human mind, building up an increasingly coherent framework of the universe. One may add, too, that the history of science can suggest new lines of research, and thus lead to unexpected discoveries.

Prof. A. Wolf (London) outlined the teaching of the history of science in the University of London, which owes so much to his own efforts, pointing out as one of the difficulties of the organisation of such courses the existing hostility towards new subjects, which are wrongly imagined by many to be side lines to something else. Prof. P. Diepgen (Berlin), Prof. H. Dannemann (Bonn), Prof. Q. Vetter (Prague), Prof. M. Stephanides (Athens), and Prof. D. E. Smith (United States) gave some interesting details about the teaching of the history of science in their respective countries; while Prof. Laignel-Lavastine, the new holder of the chair of the History of Medicine in the University of Paris, expressed the feeling of the whole Congress when he urged the necessity of university chairs of the history of science in the principal universities of the world.

The third section of the Congress was devoted to the "Historical and Contemporary Inter-relationship of the Physical and Biological Sciences", and was presided over by Prof. W. Ritter (United States). It developed into a lively debate between 'organicists', represented by Prof. J. S. Haldane, Prof. D'Arcy Thompson, Dr. E. S. Russell, and Mr. L. L. Whyte, and the 'mechanists', represented by Dr. J. Needham, Dr. J. H. Woodger, Prof. L. Hogben, and Prof. Baas-Becking (Holland). The case for organicism was put forward forcibly by Prof. J. S. Haldane (Oxford), who claimed the independence of biology from physics, while admitting that the advances of physics during the present century have made it much easier to realise the true relations between these sciences. The discovery that atoms are not mere inert elastic bodies, but centres of intense specific and persistent internal activity, and that on this internal activity their physical and chemical properties depend, has upset the physical conceptions which we inherited from Galileo and Newton. Atoms seem now as if they had properties similar to those which the vitalists attributed to living organisms. Yet, on the other hand,

biology deals with parts and events which are manifestations of the co-ordinated whole which we call the life of the organism. Hence, it looks as if, while we shall retain the old physical and mathematical conceptions for practical purposes, the more fundamental physical and mathematical conceptions are assuming characters similar to those of biology. This fundamental attitude was further explained by Mr. L. L. Whyte, who showed how the study of the structure of material bodies and of radiation is beginning to influence biology. The adequate description of ordered structures, which was impossible by classical methods, is now expressed by 'quantum conditions' which refer to systems as a whole, each part having in it definite positions and motions. Thus the conflict between the analytical methods of classical physics and the organic concepts of biology is thinned down to such a point that it may be hoped to see the study of biology leading ultimately to the discovery of exact biological laws defining the structural characteristics of living systems.

Dr. Needham's cry for an increase in the use of the style of physics in biology, and Dr. Russell's slogan, 'Back to Aristotle', alike strengthened the resistance of the mechanists, who, like Prof. L. Hogben (London), emphasise that there was never a time when biologists entertained more confidence in the usefulness of classical physico-chemical methods as instruments for arriving at predictable conclusions about how organisms behave. The ecclesiastical origins of modern culture and the contemporary social unrest were quoted as causes for the public distrust of the mechanist conception of life, at a time when the materialistic tradition appears to be entrenched in the laboratory more strongly than ever before. Dr. J. H. Woodger (London) went a step further by proposing to apply to the study of biological questions, not only physical methods, but also an appropriate notation of mathematical logic derived from the method of Russell and Whitehead. He was thus led to predict a gradual displacement of the notion of 'stuff' by that of 'system'; so that the notion of 'protoplasm' or 'living matter' would have to go the way of 'hereditary substance', when the scientific worker will learn to think of cells more in term of systems, and less in terms of stuff. A mechanist conception of biology

seemed to linger also in the mind of Prof. A. Joffe (Moscow), though he admitted that physicists have to use biological methods for the finest measurements. He quoted the experiments of Prof. Gurtwitsch, who claims to have discovered 'biological rays', in support of the closer relationship between physics and biology, which will lead in time, he hoped, to the disappearance of the 'mysterious' vitalistic conceptions.

The fourth section of the Congress, presided over by Sir Henry Lyons, Director of the Science Museum, dealt with "The Interdependence of Pure and Applied Science". Sir Napier Shaw, Prof. C. H. Desch, Prof. F. G. Donnan, Dr. G. Windred, Mr. R. V. Vernon, Dr. Marie Stopes, and Prof. W. Mitkewich illustrated the various aspects of the problem, and seemed to agree that a study of scientific history makes it evident that there can be no independence between pure research and experiment on one hand, and the practical application of scientific principles on the other hand. Further, it appears that the present tendency of intense specialisation makes the progress of science more than ever dependent upon the co-ordination of pure and applied science.

At a meeting of the Committee on July 5, the following were elected members of the International Council for the period 1931-34: Prof. Karl Sudhoff, of Leipzig (*President*); Prof. Gino Loria (Genoa), Dr. Charles Singer (London), Prof. Paul Diepgen (Berlin), Prof. Julian Ribera (Madrid), Prof. George Sarton (Harvard); Mme. Hélène Metzger, of Paris (*Treasurer*), and M. Aldo Mieli, of Paris (*Secretary*). The next Congress will be held in Berlin in 1934.

Such was the general trend of the labours of the Second International Congress of the History of Science and Technology. As Dr. Singer has long been claiming, the history of science can take its place not only among the departments of high scholarship, but also as an integral part of training and discipline in the general study of history. Science cannot assume her just position in education until the educator himself recognises the part that science has taken in shaping the social and intellectual environment in which we live. If the scientific process come to be recognised as a great part of our great inheritance, the Congress will have gone a good way towards achieving its objective. THOMAS GREENWOOD.

The British Australian New Zealand Antarctic Research Expedition.

THE second cruise of the *Discovery*, under the title of the British Australian New Zealand Antarctic Research Expedition, ended on March 27 with the arrival of the ship and party at Melbourne. The health of Sir Douglas Mawson and his men has been excellent, and they have added greatly to our scientific knowledge of the Antarctic continent.

It has been definitely established that the coast-line is continuous through a great arc from Cape Adare to Enderby Land, which is nowhere far removed from the Antarctic Circle. New land totalling 16° of longitude has been discovered, and further detailed charting has been carried out of the 13° discovered on the first cruise last year. The field work extended through one-third of the circuit of the Antarctic region, beginning at the new 180th meridian and ranging west to long. 60° E. Additional features have been added to the coast lines of Adelie Land and Wilkes Land. It has been shown that there is no land in the latitudes assigned for North's Highland, Totten's Highland, or Budd's Land. The name Banzare Land (from the initials of the Expedition's title) has been given to

a stretch of territory running from a well-defined cape near the juncture of the 66th parallel and the 127th meridian. It is proposed to maintain the title Sabrina Land for an area observed from the aeroplane between the 115th and 116th meridians at about the 66th parallel. At the end of Wilkes Land is an ice land about 1300 ft. high, which has been charted as Bowman Iceland, in honour of the Director of the American Geological Society. Princess Elizabeth Land is a newly discovered region commencing at the 80th meridian on the 76th parallel and extending south and west in a great sweep to Cape Amery. All the salient features of the MacRobertson Land coast have been charted and named. It is a most interesting region, diversified with mountains, peaks, and islands.

Apart from the geographical work, an immense mass of scientific data has been accumulated by the Expedition. Considerable delineation of the sea floor has been possible with an echo sounder, and many examinations of vertical marine stations were carried out. Daily nettings for marine life and