extent of the exhibits was also greater, two floors of the physics department of the Imperial College being occupied in place of one, as in previous years, the last being 1913. To some extent this expansion was due to a special reason, namely, the inclusion of a supply of German instruments captured during the war, shown by permission of the Admiralty, the Air Ministry, and the War Office. The attendance was very satisfactory. The fact that the annual Conference of Educational Associations was meeting in London during the week allowed many teachers the opportunity to pay a visit, and we believe this was taken full advantage of.

There are two sides to an exhibition of this kind, the educational and the commercial, and the two react. The visitor is anxious to buy as well as to learn; the exhibiting firms are ready to learn as well as to sell. There is much intercourse and interchange of ideas, which may fructify later in the improvement of old instruments and in the devising of new.

Although business affairs are by no means stabilised as yet, the standard reached by the exhibits shows that a keen, progressive, and enterprising spirit is alive amongst makers of scientific appliances. It is not surprising to learn that a great exhibition of products of the British Empire, to be held in London in 1921, is already in hand.

Two discourses which attracted good attendances were given daily; one on "The Use of Light in the Transmission and Reproduction of Sound," by Prof. A. O. Rankine; the second on "Some Polarisation Experiments," by Prof. F. J. Cheshire. In the former was given an exposition of an application of the selenium cell, which suggests the possible supersession of the purely mechanical method of reproduction of speech and music by the gramophone.

A marked feature of the exhibition was the large number of demonstrations of apparatus in action. There is no doubt that this is widely appreciated, and that the effects in stimulating interest and inquiry are fully commensurate with the pains taken by the firms concerned. Amongst these may be mentioned the production of electrical oscillations by the triode thermionic tube, the indirect compensated illumination known as "Sheringham daylight," and Mr. Darling's simple device for indicating the quenching temperature in the hardening of steel. The model aeroplane cabin with its array of instruments *in situ* (shown by Hughes and Son) was also most instructive.

It is impossible in a brief survey to do justice to all the items of apparatus displayed, or to the firms who participated; only a few can be referred to. First, we would mention thermionic tubes. Few are unaware of the great use that was made of these instruments in the course of the war, and of the many purposes for which they can be employed; and one was naturally prepared to find, though not less grateful on finding, a fairly complete exhibition of various stages in the evolution of the diode, and especially of the triode, forms of tube. These were shown by the Marconi-Osram Co., the Edison-Swan Co., and H. W. Sullivan, the production of electrical oscillations by use of the triode tube being demonstrated.

The electrical $CO_2$ recorder (the Cambridge and Paul Instrument Co.) for the testing of flue-gases furnishes an interesting example of the application of physical principles in combination. The percentage of carbon dioxide in the flue-gases determines the thermal conductivity of the gas; this determines the rate of cooling of an immersed heated platinum wire; and this in turn determines the current in the galvanometer of an unbalanced Wheatstone bridge, of which the platinum wire constitutes one arm. This example recalls another instance of the application of indirect measurement, namely, the dionic (?) water-tester (Messrs. Evershed and Vignoles), where the electrical conductivity serves to indicate the extent of inorganic impurity present.

A collection of glasses by Chance Bros., though on a modest scale, was of great interest. It included the Crookes spectacle glasses, which protect the eye by cutting out the ultra-violet rays, and an ultra-violet glass, opaque to the visible spectrum, but transmissive of the ultra-violet. Demonstrations of their properties were made by the aid of a nichrome arc and a fluorescent screen of barium platinocyanide.

Amongst Hilger's instruments for refined optical measurement we may single out the vacuum spectrograph (shown by courtesy of Prof. Fowler), which permits of photographing the spectrum in the Schumann region.

Optical instruments of high quality were displayed by many firms, including Charles Baker, Hughes and Son, Bellingham and Stanley, Davidson and Co., Watts and Son, W. Ottway and Co., Penrose and Co., Watson and Sons, Newton and Co., and Rheinberg and Co. Exhibits of books by the Cambridge University Press, Macmillan and Co., and several other firms were much appreciated.

There is room, we think, for one criticism of the quality of the exhibits. We refer to the comparative absence of simple forms of apparatus. There is a great need, for teaching purposes in schools and colleges, of apparatus, made without elaboration, of an open type that will proclaim its principle at a glance. Dr. Searle's apparatus occurs to one as a good example of the type desired. Collaboration between teachers and manufacturers would serve to hasten a development that is urgently required, and we commend this field to the attention of both. D. O.

## *THE CHARTERS TOWERS GOLDFIELD.*

THE Geological Survey of Queensland has published a very complete description of the Charters Towers goldfield by Mr. J. H. Reid (Publication No. 256). Although this was for long the most important goldfield in Queensland, and had, in fact, for many years the largest gold output of any of the individual goldfields in the whole of Australia, no full account of the geology of the field or of the nature of the ore deposits has yet been published, so that the issue of the present monograph is fully justified. Furthermore, had the issue of such a work been delayed much longer, it could never have been carried out effectually, as many of the mines are now closing down. The goldfield was discovered in 1871, and ten years later the gold production was close upon 75,000 oz. of gold bullion; in 1887 this output had doubled, reaching 151,500 oz.; and in 1899 the highest output, namely, 319,572 oz. of fine gold, was attained. From that time the production has been a steadily declining one, the drop since 1912 having been particularly rapid, until in 1916 the output was only 33,107 oz.

Unfortunately, it is only too clear from the report that this falling off is not a temporary phase, but is due to the very nature of the gold deposits themselves, and that the field is rapidly approaching exhaustion. It is shown that the principal country rock is a granodiorite of Lower Devonian or pre-Devonian age, traversed by numerous dioritic dykes and by well-marked systems of fault-fissures, the throw of the latter being generally inconsiderable. Within the zones of shattered rock accompanying these fissures veinlets of auriferous quartz have been deposited, undoubtedly, according to the author, by hydro-thermal agencies. The veins are, for the most part, narrow, ranging as a rule from a few inches to 5 ft. in thickness, anything more than 5 ft. being considered exceptionally large.

There are two main auriferous belts, both running north-east to south-west; the more northerly one, containing all the more famous lodes, such as the Day Dawn and the Brilliant, is about three miles long and three-quarters of a mile wide; the less important southerly belt is of about the same length, but never exceeds 200 yards in width. A small number of scattered mines have been worked outside these belts, but most of these are now closed down. The noteworthy feature of all the lodes is that, whilst the fissures persist in depth, the gold values do not, the mines as a whole showing progressive impoverishment in depth. To quote the author:—"It can be affirmed that pay shoots between the surface and the 1000-ft. level were richer than those between 1000-ft. and 2000-ft. levels, and that these were correspondingly richer than those found below 2000 ft."

## *THE NEW ZEALAND SCIENCE CONGRESS,* 1919.

NEW ZEALAND occupies a unique and advantageous position for scientific work. Situated in the midst of the vast Pacific, she has splendid opportunities for the pursuit of the fascinating studies of oceanography and the meteorology and astronomy of the southern hemisphere. Innumerable problems in geography, geology, and physiography, of an entirely novel and supremely interesting kind, present themselves, not only in New Zealand itself, but also in the surrounding Pacific and further south in the mysteries of the Antarctic. In her flora and fauna and native races, in her varied mineral wealth, in her large reserves of water-power, both fluvial and tidal, there are endless opportunities for the man of science. In her political, social, and economic institutions she is bound to make valuable contributions to experimental sociology; and it is the experimental side that chiefly matters and stands most in need of encouragement in these days of nebulous theories and unsubstantial visions.

It is perhaps only natural that, in her present stage of development and in view of the smallness of her population, New Zealand should appear to limit her research outlook chiefly to matters of a practical and utilitarian nature. In such a purely agricultural community it is only to be expected that the biological sciences—applied botany and zoology—should occupy a predominant position, as is clearly evidenced by the election of a distinguished botanist as president of the New Zealand Institute and Science Congress, and also by an analysis of the contents of the first fifty volumes of the institute's Transactions. Such analysis discloses that, of the papers contributed, zoology claims 1143; botany, 654; geology, 503; anthropology, 204; physics (including astronomy and meteorology), 152; chemistry, 135; engineering, 76; mathematics, 40; economics, 37; history, 34; metaphysics, 22; medicine, 20; literature, 15; education and statistics, 12 each. It must be remembered, however, that many valuable contributions do not appear in the Transactions; some are published in scientific journals in Great Britain; the Geological Bulletins and the Palæontological Bulletins of the New Zealand Government absorb others. The *Polynesian Journal* takes most of the papers on anthropology.

In commenting on the predominance of the natural history papers, the president, Dr. Cockayne, pointed out that this is only to be expected in a new land with both flora and fauna so little investigated and containing so much that is endemic. Most of the papers are devoted to classification. "This must have been so; it is the natural evolutionary process in the history of biological research the world over. . . . As for chemistry and physics, which make but a poor showing in the work of the New Zealand Institute, little progress can be made in these sciences without well-equipped chemical and physical laboratories and men specially trained in such. Laboratories of this class are now attached to the various university colleges, and chemical and physical contributions—the work of trained students—are slowly but surely finding a place in the Transactions."

When it is remembered that the institute only receives the small sum of 500*l*. per annum as Government grant it is a matter for amazement that so much work has been accomplished. A levy of 200*l*. was made on the affiliated societies, which could ill afford it, but yet there are scarcely funds sufficient to publish the Transactions. Many papers of great value await publication, and much work of national interest awaits initiation. Government financial support and public sympathy are both badly needed, and it is hoped that the Science Congress, the first of its kind in New Zealand, will go far to supply these needs. The Government has, as a matter of fact, promised to do its utmost to place the institute on a firm financial footing, and has already made special grants for economic science.

The New Zealand Institute consists of a number of incorporated societies, namely, the Auckland Institute, the Wellington Philosophical Society, the Philosophical Institute of Canterbury, the Otago Institute, the Hawke's Bay Philosophical Institute, the Poverty Bay Institute, the Manawatu Philosophical Society, the Wanganui Philosophical Society, and the Nelson Institute. The management of the New Zealand Institute is vested in a board of governors representative of the incorporated societies and of the Government, and this board meets annually in Wellington in January.

The Science Congress, organised by the institute this year and held in Canterbury, was the first of its kind in the Dominion, and owed its inception largely to proposals for the reform of the institute made by Dr. J. Allan Thomson in 1917. Dr. Thomson said: "In its relation to the public the New Zealand Institute should, but does not, hold a position analogous to that of the British Association for the Advancement of Science, the body which most keeps the public in touch with science, and from which most of the improvements in the State attitude to science have had their origin. The Australasian Institute for the Advancement of Science meets too seldom in New Zealand to be effective in this direction." The Congress was opened by the Governor-General of the Dominion, who, in his address, enumerated four important matters for investigation and study, namely, (1) public health and pandemic disease; (2) afforestation; (3) the mineral oil industry; and (4) fisheries. The Hon. G. W. Russell, Minister of Internal Affairs, urged the development of natural resources, especially hydro-electric power, and promised the institute adequate financial support. "The State must be prepared to foot the bill. I therefore urge the Science Congress to press upon the Government that without Governmental expenditure science cannot grow and expand; that scientists cannot live on air or on the hope of posthumous fame; and that therefore if the Dominion is to develop by means of science, adequate funds must be provided for research, for the training of teachers and professors, for the equipment of laboratories and staffs, and for the creation of the scientific atmosphere of which I have spoken."

The president of the Congress (and of the New Zealand Institute), Dr. L. Cockayne, gave a brief