

of mean velocity to velocity at the axis being avoided. The formula for the displacement of the interference fringes must henceforth be written with a factor $\int_0^l v_{\max} \cdot dl$, instead of the simple product $v_{\max} \cdot l$.

Finally, the value of the ratio of the mean velocity to the velocity at the axis may now be calculated. We obtain 0.844. This number is not, however, a physical constant, but a constant of my apparatus.

Only quite recently have I become acquainted with the extremely important and exhaustive work done at the National Physical Laboratory, published by Drs. Stanton and Pannell in their memoir on similarity of motion in relation to the surface friction of fluids. From their data I find for the often mentioned ratio 0.82, when the values of maximum velocity and diameter of the tubes in my case are substituted. Their observations were made, however, after the passage of a length of pipe varying from 90 to 140 diameters, sufficient to enable any irregularities in the distribution of the velocities to die away. In my repetition of Fizeau's experiment this condition was, of course, largely departed from, so that there is no conflict between the results.

Amsterdam, August.

P. ZEEMAN.

THE NEWCASTLE MEETING OF THE BRITISH ASSOCIATION.

JUDGING by the number of members who have already intimated their intention to be present at the meeting of the British Association in Newcastle-upon-Tyne, which, as previously announced, will open on Tuesday, September 5, and close on Saturday, September 9, and taking into account the numbers who have enrolled locally, an attendance of about 1200 is expected. The intention is to hold a purely business meeting—a meeting in keeping with Newcastle in particular and the world in general.

The general title of the President's address, which Sir Arthur Evans will deliver in the Town Hall on the Tuesday evening, is "The Cradle of European Civilisation."

The work of the sections will commence on the Wednesday morning, and so far as can be ascertained at present the following are the programmes:—

Section A (Mathematics and Physical Science). The title of Prof. Whitehead's address to Section A is "The Organisation of Thought." The address is a brief examination of the nature of scientific thought. The crude immediate experience of Nature is contrasted with the refined scientific conceptions and with the exact deductions of applied mathematics. The problem considered is, "How do these two sides of scientific knowledge fit together?" Two discussions have been arranged, one on gravitation, to be opened by Mr. E. Cunningham, and the other on osmotic pressure, to be opened by Prof. A. W. Porter. Papers to be read are:—"The Partition of Numbers," by Major P. A. MacMahon; "The Measurement of Time," by Prof. H. H. Turner; "X-Ray Spectra of the Elements," by Sir E. Rutherford.

On the Friday of the meeting the section will divide into departments of (a) General Physics,

(b) Cosmical Physics, and (c) Mathematics. In (a) Prof. W. M. Hicks will deal with "Can the Frequencies of Spectral Lines be represented as a Function of their Order?" Dr. R. T. Beatty is to read a paper on "Measurement of the Energy in Spectral Lines"; Prof. J. C. McLennan on "Ionisation Potential"; and Dr. S. Chapman on "The Kinetic Theory of Gases." Communications to Department (b) are "Efficiency of Sun-spots in relation to Terrestrial Magnetic Phenomena," by the Rev. A. L. Cortie; and the Report of the Seismology Committee. Department (c) is to consider:—"Oscillating Asymptotic Series," by Prof. G. N. Watson; "Suggestions for the Practical Treatment of the Standard Cubic Equation," by Prof. R. W. Genese; and "On a New Method for the Solution of Quartic Equations," by Mr. P. Burton. By way of explanation of the section devoting its main attention to problems which may seem remote from those especially in the nation's thoughts at the present time, it is explained that much of the work now being done by members of the section is of a confidential nature, and that it is considered undesirable to discuss such subjects as, say, aviation or optical problems, on which it would be impossible to speak freely without indiscretion.

In the presidential address to Section B (Chemistry), Prof. G. G. Henderson proposes to give a short account of the chief developments in chemical technology during the last quarter of a century, and then to deal with the future prospects of the chemical industry in this country. The papers to be read before Section B are:—"The Future of the Organic Chemical Industry," by Mr. F. H. Carr; "The British Coal-tar Colour Industry in Peace and War," by Mr. C. M. Whittaker; "The Preparation of Chemicals for Laboratory Use," by Mr. W. Rintoul; several short papers on iron and steel problems by Dr. J. E. Stead; and "On the Stepped Ignition of Gases," by Prof. W. M. Thornton. There will be joint discussions with Sections A, C, and G.

In Section C (Geology) there will be papers read on "Local Geology," by Prof. G. A. Lebour; "The Old Red Sandstone Rocks of Kiltorcan, Ireland," by Prof. T. Johnson; "Description of a Plexographic Model of the South Staffordshire Thick Coal," by Mr. W. Wixham King; "The Acid Rocks of Iceland," by Mr. Leonard Hawkes; "The Petrology of the Arran Pilchstones," by Dr. Alexander Scott; "The Carboniferous Succession in North Cumberland," by Prof. E. J. Garwood; "The Permian of North England," by Dr. D. Woolacott; "Geological Characters of Glass Sands," by Dr. P. G. H. Boswell; and "Some Geological Aspects of Moulding Sands," by Dr. Boswell. There is to be a joint meeting with Section B on "Coal and Coal Seams, with Special Reference to their Economic Uses." The section will also hold joint meetings with Section E and Section K.

Prof. MacBride's address to Section D (Zoology) will take the form of a review of our progress during the last twenty years in elucidat-

ing the laws governing the development of the germ into the adult animal. Some of the lantern-slides to be shown will illustrate the results already obtained by Prof. MacBride in the salt-water tanks in the Imperial College of Science, where for some years he has been perfecting his arrangements for rearing marine animals. The papers to be read before the section are:—"Bitharzia," by Dr. R. T. Leiper; "Further Materials for a Graphic History of Comparative Anatomy," by Prof. F. J. Cole; "Some Points of Bionomic Interest observed during the Visit of the British Association to Australia," by Dr. F. A. Dixey; "The Exploitation of British In-shore Fisheries," by Prof. W. A. Herdman; "The Coastal Fisheries of Northumberland," by Prof. A. Meek; "The Further Development of Shell Fisheries," by Dr. James Johnstone; "The Scheme of Mussel Purification of the Conway Fishery," by Dr. A. T. Masterman; "The Scales of Fishes and their Value as an Aid to Investigation," by Prof. A. Meek; "Some Notes on the Determination of the Age of Fishes by their Scales," by Dr. A. T. Masterman; "Review of the Fluctuations of the Herring, Mackerel, and Pilchard Fisheries off the South-west Coasts in the Light of Seasonal Variations of Hydrographical Factors," by Dr. E. C. Jee. On Friday morning four papers are to be dealt with, viz. "Amœbæ in Relation to Disease," by Dr. Pixewell-Goodrich; "Notes on the Amœbæ from the Human Mouth," by Dr. T. Goodey; "The Flagellate Protozoa associated with Diarrhoea and Dysentery," by Dr. Annie Porter; "War and Eugenics," by Mr. Hugh Richardson. In the afternoon of Friday the section will visit the Dove Marine Laboratory at Cullercoats.

In Section E (Geography) there is to be a discussion on political frontiers, to be opened by Sir T. H. Holdich, and the following papers are to be dealt with:—"France—a Regional Interpretation," by Mr. H. J. Fleure; "Generalisations in Human Geography," by Mr. G. G. Chisholm; "The Weddell Sea," by Dr. W. S. Bruce; "The Adriatic Problem," by Dr. R. W. Seton-Watson; "Salonica: Its Geographical Relation to the Interior," by Mr. H. C. Woods; "Recent Exploration in the Japanese Alps," by the Rev. Walter Weston; "Nepal, the Home of the Gurkha," by Mr. A. Trevor-Battye. The section on the Friday will hold joint meetings with Sections C and E.

The general title of Prof. Kirkaldy's address to Section F (Economics and Statistics) is "Thoughts on Reconstruction after the War." He will refer to the economic condition and industrial changes resulting from the war, and then attempt a forecast of the industrial future and make some suggestions as to how we may prepare ourselves industrially to meet the changed conditions at home and abroad. The section will give the greater part of the time to the consideration and discussion of the reports of the investigations which have been going forward during the year. These subjects were reported upon last year at Manchester, and were felt to be of such import-

ance that all the investigations were continued. The first three reports, "Industrial Harmony," "Outlets for Labour," and "The Effect of the War on Credit, Currency, and Finance," are being published in one volume, and will be a continuation of last year's volume on "Credit, Industry, and the War." The papers to be read before Section F are:—"Land Settlement," by Mr. Christopher Turner; and "The English Historical Method in Economics—Rent," by Mr. T. B. Browning.

It is understood that Mr. Gerald Stoney, in his address to Section G (Engineering), will deal with various subjects of vital importance at the present moment. The section will hold a joint meeting with Section B (Chemistry) and consider the subject of "Fuel Economy." The papers to be read are:—"Standardisation and its Influence on the Engineering Industries" (with a foreword by Sir John Wolfe Barry), by Mr. C. le Maistre; "The Calculation of the Capacity of Aerials, including the Effects of Masts and Buildings," by Prof. G. W. O. Howe; "The Influence of Pressure on Ignition," by Prof. W. M. Thornton; "Some Characteristic Curves for a Poulsen Arc Generator," by Mr. N. W. McLachlan; "Pressure Oil Film Lubrication," by Mr. H. T. Newbiggin. The section will also receive the reports of the committees on Complex Stress Distribution, Engineering Problems affecting the Future Prosperity of the Country, and Gaseous Explosions.

In Section H (Anthropology) Dr. R. R. Marett will devote his presidential address to the subject of "Anthropology and University Education," in the course of which he will supplement the address delivered to the section in 1913 by Sir Richard Temple on the need, from an imperial point of view, of an applied anthropology. Dr. F. B. Jevons will deal with the disputed question of the exact boundary in primitive culture between practices regarded as religious and liturgical and those considered to belong to the domain of magic and sorcery. Prof. Ridgeway will explain the origin of the actor, with probably special reference to pre-classical times in Greece and the neighbourhood. Prof. Keith will discuss the question of whether the British facial type is not changing. There will be a description given by Mr. and Mrs. Scoresby Routledge of the expedition to Easter Island in the Pacific, with the latest explanation of the mysterious stone statues on that island, which has been inhabited by Polynesians, who elsewhere have been workers and carvers in wood rather than stone. It is believed that this expedition may have solved the mystery. Papers will be read on the Roman wall by Prof. Haverfield, and on Early Christian monuments in Northumbria by Mr. Collingwood. On the Friday there will be a discussion on the cultures of New Guinea and the New Hebrides, and a paper, by Prof. Sollas, on a sub-crag flint implement. Dr. Marett will narrate the story of recent archaeological discoveries in the Channel Islands. Dr. Fraser will continue the account of the excavations in artificial islands in the lochs of the

Scottish Highlands. Miss Czaplicka will relate her experiences during a winter and a summer spent among the tribes of Arctic Siberia, a paper which, illustrated by a unique series of lantern slides, will throw much light on the culture and beliefs of the Tungus and other tribes, and, in a second communication, will deal with the physical types of these tribes. Finally, Miss Freire-Marreco will deal with personal experience as an element in folk tales.

In Section I (Physiology) Prof. A. R. Cushny will deal in his presidential address with the analysis of living matter through its reactions to poisons. He proposes to discuss how far the reaction to drugs may be utilised to test for the presence of different kinds of living matter. The papers to be considered by the section are:—"Report on Chloroform Apparatus," by Prof. A. D. Waller; "Effect of Pituitary Extract on the Secretion of Cerebro-Spinal Fluid," by Prof. W. D. Halliburton; "Arginine and Creatine Formation (Further Investigations)," by Prof. W. H. Thompson; "The Properties required in Solutions for Intravenous Injection," by Prof. W. M. Bayliss; "The Secretion of Urea and Sugar by the Kidney," by Prof. P. T. Herring; "The Effect of Thyroid-feeding on the Pancreas," by Dr. Kojima. There will also be a discussion upon the action of poison gases, inaugurated by Sir Edward Schäfer.

The subject of Dr. A. B. Rendle's presidential address to Section K (Botany) is unusual in that it will deal with the application of botanical work to economic uses. It is believed that the circumstances, especially the conditions which will obtain after the war, call for an effort on the part of the botanist to meet problems which will then be pressing. The papers to be read before the section include:—"Leaf Architecture," by Prof. F. O. Bower; "The Botanical Study of Coal," by Dr. Marie Stopes; "On *Rhynia gwynnevaughanii*," by Dr. R. Kidston and Prof. W. H. Lang; "Are Endemics the Oldest or the Youngest Species in a Country?" by Dr. J. C. Willis; "Geographical Distribution of the Composite," by Mr. J. Small; "Survey Work near Bellingham," by Miss Charlotte Measham; "On the Distribution of Starch in the Branches of Trees and its Bearing on the Statolith Theory," by Miss T. L. Prankerd. In addition there will be a lecture by Sir J. Stirling Maxwell on "Afforestation," and a number of reports on various problems; there will also be a discussion on the collection and cultivation of drug plants.

In Section L (Educational Science) the programme will be devoted to three main topics: the position of science in secondary and higher education, the reform of the primary school, and the normal performances of school children. Papers on primary school reform will be read by Mr. J. G. Legge, Prof. T. P. Nunn, and Prof. J. A. Green, and the discussion will be opened by Mr. Crook, president of the National Union of Teachers. Next day Mr. J. Talbot will deal with science teaching in public and grammar schools,

and will be followed by the Rev. H. B. Gray on "The Relative Value of Literary and Scientific Subjects in a Course of General Education"; Principal Hadow on "Science Teaching in the Universities"; and Dr. E. F. Armstrong on "The Value of Science in Industrial Works." On the subject of "The Place of Science in the Education of Girls" Miss M. E. Marsden and Dr. Mary H. Williams will read papers. At the meeting on the Friday, held jointly with the Psychological Sub-Section, Prof. J. A. Green and Mr. C. L. Burt are to open a discussion on "Normal Performances of School Children at Different Ages."

In Section M (Agriculture) the presidential address to be given by Dr. E. J. Russell will be a discussion of the methods by which crop production can be increased. The following papers will be read:—"British Forestry, Past and Future," by Prof. W. Somerville; "The Utilisation of Forest Waste by Distillation," by Mr. S. H. Collins; "Soil Protozoa and Soil Bacteria," by Mr. T. Goodey; "Climate and Tillage," by Mr. T. Wibberley; "Economy in Beef Production," by Prof. T. B. Wood and Mr. K. J. J. Mackenzie; "The Relation of Manuring and Cropping to Economy in Meat Production," by Prof. D. A. Gilchrist; "The Composition of British Straws," by Prof. T. B. Wood; "Losses from Manure Heaps," by Dr. E. J. Russell and Mr. E. H. Richards; "The Fixation of Nitrogen," by Mr. E. H. Richards. There will also be a discussion on motor cultivation, and another on ensilage.

As already announced, several sections are arranging excursions. In this connection it may be mentioned that Section M proposes on the Tuesday to visit the Northumberland County Council Farm at Cockle Park; on the Wednesday Lord Allendale's Farm will be inspected; on the Thursday the woods near Lintz Green will be visited, where H.M. Woods and Forests Department has a plant in operation for the distillation of waste wood; and on the Friday there will be an opportunity to inspect general types of local farming in Durham.

Section H also is arranging to meet the Cumberland and Westmorland Archaeological Society on the Thursday and visit the Roman wall. Papers relevant to this visit are to be read by Prof. Haverfield and Mr. Collingwood on the evening of Wednesday, September 6. In view of the local interest and the fact that leading archaeologists, including the President, are to take part, it is proposed that the meeting be held in the Lecture Theatre of the Literary and Philosophical Society.

Another engagement for the Wednesday evening is that of an informal reception and conversazione, which will be held in the Laing Art Gallery and Museum. The Right Hon. the Lord Mayor of Newcastle has very kindly consented to welcome the guests. Not only will this function provide a common meeting-ground for the members, but it will also give them an opportunity of viewing the special loan collections which have been formed by the Laing Art Gallery Committee in connection with the Association's visit.