DUNDEE MEETING OF THE BRITISH ASSOCIATION, AUGUST 27–SEPTEMBER 3

AS has already been announced, the British Association will meet at Dundee during August 27–September 3, and a preliminary programme referring to general features of the meeting has been issued. The following notes, from the recorders of the various sections, amplify the information given there.

Section A (*Mathematics and Physics*). In his presidential address, Sir Edward Appleton will deal with the way in which radio has been used in communication and also as a method for investigating natural phenomena, by study of the reflexions from meteors and the reception of radio 'noise' from the sun and Milky Way. The session on September 2, devoted to "Coal as a Source of Heat and Power", will hear Sir Charles Ellis, who will be followed by contributors from the Fuel and the Building Research Stations on the efficient use of fuel and domestic heating systems. Prof. J. D. Bernal will review the question of coal economy, and Prof. D. M. Newitt will speak about the use of oxygen in carbonization processes and the storage of gases in liquid form. The British Coal Utilisation Research Association will deal with the combustion of coal in fuel beds. The discussion of modern methods of computation will include a general survey and a description of some large American machines.

Section E (*Geography*) will devote a whole day to a discussion of Scottish problems from the geographer's point of view. The National Atlas and urban geography will each have a morning. There will be an exhibition of maps produced by the Scottish Department of Health and the Ministry of Town and Country Planning.

Section F (*Economics*). Current economic difficulties will receive particular attention. The presidential address is to be on the "Conditions of the Economic Outlook", and there will be papers on "The Significance of the New Issue Market for the Finance of Industry", "Land Compensation", "Social Accounting", "Profit and Enterprise", "Proposed Code of Industrial Management". A joint meeting with Section J (Psychology) will consider "Incentives in Industry".

Section G (*Engineering*). An outstanding feature will be a series of short papers by junior engineers: thirty minutes is allotted to each speaker for his paper and the ensuing discussion. In preparation for the afternoon visits, the last item of the morning programme will be a summary of what is to be seen.

Section H (*Anthropology*) will hold a symposium on problems of "Culture Change", to which members of the staff of the London School of Economics will contribute. The archæological side will discuss Pleistocene chronology under the title "Dating the Past". Papers are to be presented on a variety of subjects, including the technique of excavation, the education of the totally deaf child, the organisation of folk-life studies, reconstruction in the Naga Hills, and recent discoveries of fossil Hominoidea in South Africa.

Section I (*Physiology*) will hold a joint meeting with Sections H and J to discuss "Man and the Machine", with the object of showing how the physiology, anatomy and psychology of the man should be considered in the design of the machine he is to use. Two other meetings include Section J, when "Aviation Physiology" and "Climate and Health" will be discussed. On August 29 Sir Alexander Fleming will open a symposium with Sections B and K on "Penicillin and other Antibiotics". The use of tracer elements will be the subject of a meeting with Section B on the morning of September 2. During the meeting a Children's Lecture on "Colour" will be given by Prof. H. H. Hartridge.

Section J (*Psychology*). The contributions are mainly of practical interest, industrial and educational applications being especially prominent. The Section joins with others in discussing "Man and the Machine", "Allocation to Secondary Education" and "Incentives in Industry". The sectional meetings include symposia on "Selection for Management", "Public Opinion Surveys", "Rehabilitation of an Industrially Depressed Area", "Changes in Abilities with Age" and "The Scientific Study of National Character". Dr. S. J. F. Philpott's presidential address is "Man's Adaptability".

Section L (*Education*). Miss Grier's presidential address will be on the evolution of secondary education. Miss Lambert will present a paper on the "Problems of Selection Technique at the age of Transfer to Secondary Schools". There will be a discussion on adult education in the Services.

Section M (*Agriculture*). The first session will be a joint one with Sections B and D to discuss insecticides. Papers will be presented (by Drs. H. G. Thornton, M. C. Rayner and A. P. Evans) on three aspects of soil biology—the roles of bacteria, mycorrhizas and earthworms in the economy of the soils and the maintenance of fertility. A session is devoted to recent advances in the control of animal diseases, and at the final session the Right Hon. Walter Elliott, M.P., Sir Jack Drummond and Mr. H. D. Walston will discuss, from the points of view of the agriculturist, nutritionist and economist, respectively, the vitally topical problem: How far could and should Britain feed herself? In his presidential address, Dr. W. G. Ogg will speak on "Soil and Health", and will describe recent studies on the effect of soil conditions on the health of plants and animals.

METALLURGICAL PROBLEMS INVOLVED IN THE GENERATION OF USEFUL POWER FROM ATOMIC ENERGY*

THE design of even the simplest atomic energy reactor, the water-cooled carbon pile using natural uranium, presents many awkward technical problems. Metallic uranium has properties which make it a difficult material to work with. It melts at about 1,150° C.; but below this temperature it undergoes two transitions, with unusually large volume changes. It is very reactive chemically, and readily attacked by water. For these reasons, and to retain the radioactive fission products, the uranium rods in a pile have to be enclosed in gas-tight sheaths, of materials which are good heat conductors, non-corrosive and do not absorb neutrons appreciably.

* Substance of the May Lecture before the Institute of Metals delivered by Sir Wallace Akers, C.B.E., on May 21.

These conditions limit the choice to beryllium and aluminium. Beryllium would be excellent, but so far nobody has succeeded in making tubes from it. Aluminium has therefore to be used, although it is not ideal, as water tends to form surface films, which interfere with the heat transfer. The uranium and graphite have to be purified to a degree hitherto unknown on such a scale; the most important impurity is boron, which seems to be present in very small quantities in almost all reagents. The preparation of aluminium-sheathed rods of uranium of the required purity represents a metallurgical achievement of a very high order.

But even when these difficulties have been overcome, it is unlikely that water-cooled plants will produce useful power. In order to achieve a reasonable thermal efficiency, the water would have to be worked at a considerable pressure; the aluminium tubes would therefore have to be much thicker and would consequently capture too many neutrons. More promising is the use of liquid bismuth, or helium, both of which have very low neutron-capture cross-sections. Even then the pile would have to be very large and its design extremely critical; because the very narrow balance between the number of neutrons produced at fission and those left after capture by U238 and the various materials entering into the construction of the pile necessitates the cutting down of the escape of neutrons and their loss in impurities to a minimum.

Much smaller reactors and greater latitude in design become possible, if, instead of ordinary uranium, material enriched in fissile content is employed. The use of uranium enriched in U235 is not economical because of the high cost of separation, but it is feasible to utilize the production of plutonium by capture of neutrons in U238. This may be of vital importance for the supply of fissile fuel, because if it could be arranged that, for every nucleus of U235 burnt up, one plutonium nucleus were produced, the total number of fissile nuclei would remain constant; in fact, their proportion would increase steadily as U238 is being used up. One cannot say at present whether it would be possible to go further than this and produce more plutonium nuclei than of U235 burnt up. If such 'breeding' of plutonium could be achieved, the problem of availability of supplies of fissile fuel would be solved immediately.

In this respect the production of U233 from thorium is more promising. This is done by placing thorium in the outer layers of a graphite-uranium pile so that it is exposed to neutrons which would otherwise escape. The possibility of 'breeding' is in this case more pronounced, since the number of neutrons ejected at fission of U233 may be sufficiently high to make it possible to build a reactor in which more nuclei of U233 are formed than are burnt up. If this turns out to be practicable, then, having once made some U233 from thorium placed in a uranium pile, we could dispense with natural uranium altogether and continue to produce U233, and generate power, using only thorium as a raw material. Furthermore, this would enable us to utilize, by conversion to plutonium, any U238, from graphite-uranium piles, which became useless owing to the impoverishment in U235.

When will atomic energy be available? As a pure guess it would seem that an experimental plant will be running in the United States by 1949, and that in five to ten years there will be some fairly large power stations generating electricity in various parts of the world. It is impossible to say anything definite about the economics of these plants. The figures quoted recently in the United States depend on several assumptions and data not available in Britain; but for more remote places, without fuel resources, atomic power may well be economical even now. For example, an atomic energy power station might be built to provide power and heat for a large air-port near the North Pole, to shorten many important air routes.

The consumption of nuclear fuel is extremely low; one kilogram of fissile material liberates as much heat as the burning of 2½ million kilograms of high-grade bituminous coal. The amount of electrical energy generated in Great Britain is about 50,000 million kWh. per annum. If the heat generated in fission could be utilized with a thermal efficiency of 27 per cent, the consumption of fissile material needed to produce this amount of electrical energy would be about 7½ tons per annum. If only U235 were burnt, the quantity of ordinary uranium required would be about 1,000 tons per annum, which is just what the total world output of uranium was in 1939. Although the production has since then certainly increased, it is clear that uranium has no future for power production if only U235 could be utilized. But if a substantial part of U238 or, still better, if thorium could also be used, then the figures become reasonable.

Contrary to common belief, uranium and thorium are far from being among the rarest elements. In the rocks composing the globe there are on the average about 4 parts per million of uranium and 11½ of thorium, as compared with 0·5 of mercury and only 0·005 of gold. But unfortunately uranium does not occur frequently in large enough concentrations; thorium is rather better in this respect. Granites and rhyolites contain 10 to 20 grams of uranium plus thorium per ton; their 'calorific' equivalent is thus 25 tons of coal per ton of rock; but the very complex nature of the compounds in which uranium and thorium exist in them makes it impracticable to mine and extract the fuel from rocks.

AN INTERNATIONAL UNION OF FAMILY ORGANISATIONS

A MARKED tendency in educational and social thought of recent years, and a tendency accentuated by the strains to which society has been subjected by the War and the ensuing peace, has been the renewed emphasis placed on the family as the basic social unit and as the most powerful educational influence acting upon the individual. It is therefore not surprising that in various countries efforts have been made to set up organisations to co-ordinate activities relating to family life; organisations such as the National Council on Family Relations in the United States, the Family Relations Group in Great Britain, and the Union Nationale des Associations Familiales in France. The next needed step was clearly the formation of some machinery for international information and documentation, and the building of this machinery has now been started.

In Paris, during June 22–29, there was held an International Congress on the Family and on Population. It was attended by some two hundred delegates from twenty-four countries and, although few of the delegates attended with the official support of their