also been placed at the disposal of the Explosives Department for the benefit of other controlled establishments.

The apparatus is compact; the expense involved in its installation, apart from ammonia purification plant, is comparatively small, and its operation is simple. Arrangements have therefore been made for the rapid manufacture of the converters likely to be required, since it is believed that these designs may become standard types for the purpose in question. An explanatory pamphlet, compiled by the research staff and embodying detailed information concerning the construction and operation of the converters, will be available shortly for the use of firms which have already taken up the process or are desirous of doing so.

Further Research.

Up to the present date the research has practically been confined to the two processes mentioned above and to problems arising therefrom. The investigations of the Committee have shown, however, that many important and promising fields still remain to be explored.

In present circumstances all activities have been concentrated upon processes which have a possible value as war measures, and no attempt has been made to extend the programme of research beyond such limits. In view, however, of the national importance of the nitrogen problem, both now and in the future, it is hoped that definite arrangements will be made to preserve the continuity of the research after the war.

The Importance of Cheap Electric Power.

It was realised from the outset that the generation of electric power at a cost decidedly lower than has hitherto been attained in this country was a vital factor if an attempt was to be made to establish certain of the nitrogen fixation industries in Great Britain on a sound economic basis from the point of view of post-war competition. A thorough inquiry has therefore been made as to the possibility of cheapening the production of electric power from coal, not only by its generation in bulk with the most modern plant, but also by the use of methods involving carbonisation and gasification, with recovery of the ammonia, fuel oils, and other by-products hitherto wasted when raw coal has been directly used. The sub-committees concerned have had the advantage of obtaining the personal views of a number of experts who attended to give evidence on different aspects of the problem. This inquiry has been distinctly fruitful, and much detailed information has been collected.

Schemes for the utilisation of various undeveloped water-powers in the British Isles for nitrogen fixation have also been submitted and carefully examined. At least one of these schemes for hydro-electric development on a considerable scale presents *prima facie* prospects of becoming a valuable national asset. The Power Sub-Committee recommended that a survey should be made of the drainage area in question with the view of confirming the details of the scheme as submitted. The survey has recently been completed and is expected to result in the formulation of a definite development scheme for the utilisation of this water-power. It is estimated that the engineering work involved will take about two years to complete, and the scheme is therefore to be regarded as a post-war measure.

Costs of Operating Nitrogen Fixation Processes.

Since many of the nitrogen fixation processes have not only a value for munitions, but also a post-war importance, endeavours have been made to investigate the probable requirements of this country for nitrogen products. A detailed examination has been made of the production, consumption, imports, and exports of such products, and special consideration has been given to the question as to the relative order of the costs involved in operating the synthetic and non-synthetic processes.

Most of the information relating to synthetic processes has had to be obtained from foreign sources, and the Committee has been able to secure many figures of an authoritative character. The information thus collected has been subjected to critical examination in the light of manufacturing experience in allied industries, and conclusions have been arrived at as to the costs likely to be incurred under British conditions.

The magnitude of this part of the inquiry may be measured when it is stated that the Committee is in possession of comprehensive data concerning the cost of manufacture of :—

(*a*) Nitric acid and nitrates by the older methods, and by the arc and ammonia oxidation processes;

(*b*) Calcium carbide and cyanamide;

(*c*) Ammonia and ammonium sulphate by the Haber and cyanamide processes;

(*d*) Hydrogen and nitrogen;

as well as concerning the costs involved in operating the Chile nitrate and the by-product ammonia industries.

Nitrogen Fixation in the United States.

The action taken by the United States Government on the nitrogen question is worthy of notice. Under the National Defence Act of 1916 a sum of 4,000,000*l.* was set aside for the establishment in the United States of nitrogen fixation on a large scale. Committees of the National Academy of Sciences, and afterwards of the Ordnance Department, were set up. Their advisers visited England and the more important nitrogen fixation installations on the Continent outside Germany. Upon the recommendation of their experts, the U.S.A. War Department has decided to erect forthwith works for the manufacture of synthetic ammonia by a modified Haber process.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—At the meeting of the council of the University, held on November 21, the following extract from Prof. Cobb's annual report as Livesey professor and head of the Department of Coal-gas and Fuel Industries was read :—"A valuable donation of carbonising, washing, and purifying plant has been promised, which, in the near future, should prove of very great service to the department and the gas industry; but the erection of the plant must await the conclusion of the war. When installed, this plant is intended to serve as a connecting link between the apparatus of the laboratory and plant on the full working scale. It should allow of the production of any quality of coal-gas and water-gas required for experimental purposes, and will, moreover, from the possibility of exact control and ready modification of its parts, allow studies to be made on the influence of varying conditions of operation which it is hoped will be of a high order of usefulness, both for training and research. For this gift the University is indebted to the generosity of Mr. Henry Woodall, jun., who expresses himself in a letter of June 8, 1917, as happy to provide and erect the plant, 'free of cost, to the University in memory of my late father and partner, whose interest in the University was very deep and sincere.'" The council accepted the offer with great pleasure, and expressed its most sincere thanks to Mr. Woodall for his generous gift.

THE annual meetings of the Geographical Association are to be held on January 5 and 7 next at the

London Day Training College, Southampton Row, W.C.1, and at King's College, Strand, W.C.2. At 11.30 a.m. on the first day Mr. Henry Wilson will lecture on the crafts of Britain, past and future, and at 3 p.m. Mr. W. E. Whitehouse will read a paper on map study in geography and military education. A discussion on geography in advanced courses will be held on January 7 at 10.30 a.m.; and at 5 p.m. on the same day Sir W. M. Ramsay will deliver his presidential address on "The Great Goddess, Mother Earth," at King's College.

THE annual meeting of the Mathematical Association will be held at the London Day Training College, Southampton Row, London, on January 9, at 5.30, and January 10, at 2.30. On the first day, Dr. W. P. Milne will deal with the graphical treatment of power series. On the second day the following subjects will be considered:—Dr. W. P. Milne, the uses and functions of a school mathematical library; Dr. S. Brodetsky, nomography; and Mr. G. Goodwill, some suggestions for a presentation of mathematics in closer touch with reality. Prof. T. P. Nunn will give his presidential address at 2.30, on mathematics and individuality, and this will be followed by a discussion on the position of mathematics in the new scheme of the Board of Education for secondary schools.

THE Education Bill introduced by Mr. Fisher in the House of Commons last August has been withdrawn, but a revised Bill, in which certain amendments have been included, is to be brought forward at an early date during the present session of Parliament. "The new Bill," Mr. Bonar Law, Chancellor of the Exchequer, announced on December 13, "will be taken at the earliest possible moment next session, and I have every reason to hope that it may be possible to pass it into law without delay." The educational clauses of the Bill that has now been allowed to lapse have received the approval of most of the associations concerned with the professional work of education in England, as well as of other representative bodies, and the country looks to the Government to begin national reconstruction on the lines laid down by them. The Bill was, however, heavily weighted with certain administrative proposals dealing with the relations between the Board of Education and local education authorities, and it is these which have met with opposition. Mr. Fisher has introduced substantial changes in the new Bill to meet the objections raised to the administrative clauses of the old one. This encourages us to believe that we are within sight of the day when a long-deferred and much-needed measure of reform of our educational system will find a place in the Statute-book. The importance of making provision for the future by strengthening and extending our educational foundations is acknowledged on all sides, and we are glad to be assured by Mr. Bonar Law that the Government intends to facilitate the progress of this measure of reform through the House of Commons.

THE Education (Scotland) Bill was introduced in the House of Commons on December 17, and was read a first time. The main object of the measure is to effect a further improvement in the provision of education for all classes of the population and to make that provision available to residents in remote and isolated districts. It is proposed to raise the age for full-time school attendance from fourteen to fifteen, and to make attendance at continuation classes obligatory upon pupils between the ages of fifteen and eighteen who were not in full-time attendance in school; to restrict employment both before and after school hours of children attending school, and to regulate still further the employment of children or young persons under the age of fifteen in factories and in mines. The local authorities are empowered to provide books not only for children and young persons who are attending school, but also for adult readers, and provision is further made to ensure that so far as is practicable no child or young person who has promise or ability shall be debarred by reason of difficulty of access or want of means from full opportunity for the development of his faculties by attendance at secondary schools or universities. As there is a large volume of opinion in Scotland which favours the setting up of a body representative of universities, local authorities, teachers, and other classes of persons specially interested in education, as a forum for the discussion of educational questions, provision is made for the constitution of an advisory council, designed to assist the Minister of Education and the Education Department in framing educational proposals.

SOCIETIES AND ACADEMIES.

LONDON.

Linnean Society, November 29.—Sir David Prain, president, in the chair.—Dr. H. **Wager**: (1) Intensity and direction of light as factors in phototropism. In this communication an account is given of experiments made to determine the influence of the intensity and the direction of light in effecting phototropic responses in foliage leaves. The distribution of the physico-chemical activities in the photo-sensitive tissues is dependent upon both intensity and direction of light, and since the direction of movement may be determined as the resultant of the varying physico-chemical activities in the whole of the sensitive region, it must be concluded that both intensity and direction of light are necessary factors in the phototropic response. (2) Spore-coloration in the Agaricaceæ. The use of spore-coloration as a basis for the classification of the Agaricaceæ is artificial and imperfect. There is no clear line of demarcation between the various colours, and the designation of the colours in the text-books is very indefinite and unsatisfactory. A beginning has, however, been made by members of the Mycological Committee of the Yorkshire Naturalists' Union to obtain more accurate records of spore-coloration in terms of a standard series of tints. It has been found—and this may be a fact of some considerable physiological interest—that, with one or two doubtful exceptions, all the spore colours so far standardised, whether pink, rusty, or purple, fall within the region of the less refrangible half of the spectrum. Spectroscopic examination also shows this. It has been suggested by Buller that these colouring matters may serve a useful purpose by screening off certain of the sun's rays from the living protoplasm. Spore-coloration may, however, depend, partly at least, upon the kind of substratum on which the fungi grow.

MANCHESTER.

Literary and Philosophical Society, November 27.—Mr. W. Thomson, president, in the chair.—Prof. W. Boyd **Dawkins**: Examples of pre-Roman bronze-plated iron from the Pilgrim's Way. The examples were an iron snaffle-bit, an iron harness-ring, and an iron hub of a wheel, covered with a thin layer of bronze, discovered in 1895, on the site of a village in Bigbury Wood, about two miles due west of Canterbury. The village is of prehistoric Iron age, and is traversed by the Pilgrim's Way, and has yielded a considerable number of implements to be seen in the Manchester Museum. Of these the three above mentioned are of peculiar interest, because they show that the art of plating iron with bronze was known at that remote period, ranging indefinitely backward from the Roman conquest. The