

British Science Guild  
Annual report of the Executive  
Committee  
1917



*Our work from the Dominion Meteorology Service*

# Eleventh Annual Report

OF THE  
EXECUTIVE COMMITTEE  
OF THE  
**BRITISH SCIENCE GUILD**

JUNE, 1917

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# ELEVENTH ANNUAL REPORT

OF THE

## EXECUTIVE COMMITTEE

OF THE

# BRITISH SCIENCE GUILD,

Adopted at the Annual General Meeting of the Members of the Guild, held at the Mansion House, on Monday, 30th April, 1917, at 4 p.m., the Right Hon. THE LORD MAYOR presiding

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The Guild very much regrets to announce that Sir William Mather recently intimated his desire to retire from the position of President of the Guild. At a meeting held on the 30th March, 1917, the following resolution was passed by the Executive Committee :—

*“ That the members of the Executive Committee desire to place on record their very high appreciation of the services of Sir William Mather as President of the Guild during the past four years. They consider that the greatly increased prosperity of the Guild has been very largely due to the interest which Sir William Mather has shewn in its work, and to the personal influence which he has brought to bear upon it, as well as to the very large amount of assistance which he has so generously given in forwarding its aims.”*

The Guild has very great pleasure in announcing that Lord Sydenham has accepted the invitation to be nominated to succeed Sir William Mather as President; and also that the Rt. Hon. the Lord Mayor has consented to become a new Vice-President of the Guild.

### THE PROMOTION OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

During the past year there have been many signs of awakened interest in the national significance of scientific method and work; and not the least encouraging among them is the action taken by scientific workers, individually and collectively. Until the war compelled attention to be given to all matters affecting national efficiency, both in the present and the future, little heed was paid to the warnings of those who discerned clearly the consequences of the neglect of science by the State.

The only body which has seriously endeavoured to show the bearing of science and scientific method upon public affairs of every kind is the British Science Guild. It is a satisfaction to know that the pioneers of the movement for a fuller recognition of science by the State have exerted a sub-conscious influence upon the minds of scientific men, as evidenced by the manifestoes issued, and meetings held, upon the subject of the co-ordination of science with industry, education, and administration, which the Guild has been

urging for the last twelve years. The Royal Society has formed a conjoint committee of members of scientific societies; a Committee on the Neglect of Science has been formed to deal with science in the public schools, at Oxford and Cambridge, and in examinations for the public services; an Education Reform Council, having upon it representatives of science, industry and commerce, as well as of education, has been brought into being by the Teachers' Guild; and suggestions for reforms have been issued, or are being deliberated, by these and other bodies.

The Board of Scientific Societies, formed by the Royal Society, consists of representatives of twenty-seven scientific, including technical, societies, and has been established for the furtherance of the following objects:—Promoting the co-operation of those interested in pure or applied science; supplying a means by which the scientific opinion of the country may, on matters relating to science, industry, and education, find effective expression; taking such action as may be necessary to promote the application of science to our industries and to the service of the nation; and discussing scientific questions in which international co-operation seems advisable. The executive committee consists of the following members:—Sir Joseph Thomson (Chairman), Dr. Dugald Clerk, Sir Robert Hadfield, Mr. A. D. Hall, Prof. Herbert Jackson, Sir Alfred Keogh, Sir Ray Lankester, Prof. A. Schuster, Sir John Snell, Prof. E. H. Starling, Lord Sydenham, Mr. R. Threlfall, and Prof. W. W. Watts.

A deputation from this Board was received in December last by Lord Crewe, Chairman of the Committee of the Privy Council for Scientific and Industrial Research, and Lord Crewe then announced that the Government had decided to form a new Department for this work. He stated that a block grant would be made to cover five years' expenditure, and in addition there would be an annual vote in the estimates for various purposes and a sum would be set aside to meet cases in which assistance was required by individual workers or by professional societies which were in need of funds to carry on research work. The Civil Service Estimates for 1917-18 include a grant of £1,000,000 (which is presumably the block grant referred to for operations during the next five years) and also the sums of £24,000 for investigations carried out by learned and scientific societies, and £6,000 for students and other persons engaged in research. The new Department represents the beginning of the Board of Science and Industry, the establishment of which was suggested in the Memorandum to the Reconstruction Committee published in the Journal of the Guild for November, 1916; and it is to be hoped that its functions will eventually comprise all the lines of work suggested in that Memorandum.

The official statement as to the constitution of the new Department is as follows:—

#### DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

The Government have decided to establish a separate Department of Scientific and Industrial Research for Great Britain and Ireland under the Lord President of the Council, with the President of the Board of Education

as vice-president. They have also decided, subject to the consent of Parliament, to place a large sum of money at the disposal of the new Department to be used as a fund for the conduct of research for the benefit of the national industries on a co-operative basis.

The Board of Inland Revenue have decided, with the approval of the Chancellor of the Exchequer, that no objection shall be offered by their surveyors of taxes to the allowance, as a working expense for income-tax purposes, of contributions by traders to industrial associations which may be formed for the sole purpose of scientific research for the benefit of the various trades; and the allowance would be equally applicable as regards traders' contributions specifically earmarked to the sole purpose of the research section of an adapted existing association.

In both cases the allowance would be subject to certain conditions, *e.g.*, the association or the research section to be under Government supervision and the traders' contribution to be an out-and-out payment, made from his trade profits and giving him no proprietary interest in the property of the association, etc.

In order to enable the Department to hold the new fund and any other money or property for research purposes, a Royal Charter has been granted to the official members of the Committee of the Privy Council for Scientific and Industrial Research under the title of the "Imperial Trust for the Encouragement of Scientific and Industrial Research." The trust is empowered "to accept, hold, and dispose of money or other personal property in furtherance of the objects for which it has been established, including sums voted by Parliament to that end." The trust can take and hold land, and can "accept any trusts, whether subject to special conditions or not, in furtherance of the said objects."

A substantial gift has already been made to the trust by two members of the Institution of Mechanical Engineers for the conduct of a research in mechanical engineering to be approved by the Department in the hope that this example will be followed by other members of the institution.

Mr. H. Frank Heath, C.B., has been appointed permanent secretary of the new Department.

#### TRADE ASSOCIATIONS.

Several Trade Associations have been formed during the year, and among their objects are the promotion of industrial research, as referred to in the foregoing statement of the work of the Imperial Trust.

British firms engaged in the chemical and allied trades have formed an Association of Chemical Manufacturers, with the following objects:—(1) to promote closer co-operation and to place before the Government the views of the chemical trade generally; (2) to further industrial research; and (3) to facilitate closer co-operation between chemical manufacturers and various universities and technical schools.

Broadly, the association aims to represent the chemical industry when dealing with the Government, to develop technical organisation, and to promote new industries and the extension of existing ones. The subscription, which is based *pro rata* on the size of the subscribing undertakings, is

sufficiently large to ensure that the association, if successful, will have ample funds at its disposal.

A number of members of The Manchester Engineers' Club have formed themselves into a Council for Organising British Engineering Industry, which has secured the support of almost every important engineering concern in the Manchester district, and all but very few throughout South-East Lancashire. Steps have already been taken to extend its activities to the Midlands, and to co-operate with the British Engineers' Association in the organisation of British engineering industry. A report drawn up by the Council, and submitted to the Board of Trade, includes the following recommendations as to research :—

(a) That university teachers be encouraged to undertake research on behalf of, and in co-operation with, manufacturing firms; and that additional Government grants be paid to universities and colleges with this end in view.

(b) That, by the establishment of such an association of manufacturing engineers as we have advocated and by other means, the volume of research work carried out in connection with the British engineering industry be greatly increased; and that provision be made for this increase in the volume of research by fully utilising and extending the facilities already available in universities and colleges, as well as in the works of private firms, and also by establishing a central research laboratory for investigations that cannot be undertaken elsewhere.

The relations of Trade Associations to technical education and industrial research have been stated by Dr. William Garnett in a paper read before the Scientific, Technical, and Trade Circle of the Institute of Journalists. The chief conclusions arrived at were summarised as follows :—

(1) Education in elementary and secondary schools must be more directly associated with *things* so as to develop self-reliance and resourcefulness, not to teach trades.

(2) A considerable proportion of teachers should devote a third year of training largely to practical work under conditions enabling them to become acquainted with the practice of some trades.

(3) A general knowledge of the phenomena of nature and the processes applied to industry must be more widely diffused by means of popular lectures and otherwise.

(4) More completely organised courses of instruction without breach of continuity must be provided for industrial workers of all classes, including the leaders of industry, together with the necessary scholarships, fellowships or bursaries to enable the best students to carry on post-graduate research.

(5) Existing institutions must be improved upon and some additional institutions must be provided, especially in the chemical trades, to enable scientific discoveries to be developed sufficiently to demonstrate the conditions under which they can be commercially successful.

(6) Some alterations must be made in the patent law to enable the profits arising from investigations conducted wholly or partly at the public expense to be divided between the State, the scientific workers and the manufacturers.



(7) Trades should be organised for the purpose of superintending the research work in which they are interested, for the collection and dissemination of information, and the distribution of work among firms in the manner in which it can be most effectively and economically carried out in the interest of the industry as a whole.

(8) The Trade Associations should be in close touch with the Advisory Council for Research and the Council should where necessary recommend the award of Parliamentary grants in aid of the industrial research carried on under the direction of the Associations, and make provision for such work in cases in which Trade Associations are not available, and the Advisory Council should utilise to the utmost the services of these Associations and professional and scientific societies.

(9) The National Physical Laboratory should be the Central Institution for all Physical Measurements and Standardisation, but for chemical processes a separate institution for a trade or group of trades will frequently be required for the work intermediate between the discovery of a new product or reaction in the research laboratory and the adaptation of the process to commercial manufacture.

(10) Some method of financing new processes which have been approved by a competent authority, other than the ordinary method of floating a company, is desirable, and this may be provided by some form of Industrial Bank.

A Federation of British Industries has been formed to provide a body capable of representing the interests of the British manufacturing and producing industries. The objects of the federation may be summed up briefly as the organisation and development of industry now and after the war, in co-operation with labour and in conjunction with the Government and Government departments. A condition of membership is an annual subscription of £100 a year, with an obligation to continue such subscription until June 30, 1919.

#### ORGANISATION OF RESEARCH.

The advantages to be derived from the organisation of industrial scientific research on a scale commensurate with our national position were stated fully in a paper by Dr. Kenneth Mees, published in *Nature* of July 13 and 20, 1916. Dr. Mees said:—

“A laboratory on the smallest scale adequate to British industry would, at the beginning, require a staff of about two thousand men, one thousand of them scientifically trained and the other thousand assistants and workmen. It should have about three or four hundred men of the rank of professor or assistant professor in the universities, or of works manager or assistant manager or chief chemist in the factory. It would require land and buildings costing about £600,000, and its annual upkeep with allowance for expansion would be about £800,000.

“Vast as these figures are, they are infinitesimal compared with the value of the industries which they would serve. They represent a charge of

less than 1 per cent., and probably not more than 1/5th per cent., of the net profits of British industry; moreover, after the initial period had been paid for, such a laboratory might be self-supporting, and might, indeed, finally make a very handsome profit on the original investment.

"Suppose that such a laboratory patented all inventions and licensed manufacturers to use them, then I think, it is not too much to expect that after the first five or six years it would be paying for itself, and that five years later it would be able to establish a great many subsidiary institutions from its profits; at any rate, such a vast laboratory would produce far more results at lower cost than would result from any other expenditure of a comparable sum of money on industrial research by the British industries."

The steps taken by our Government to promote scientific and industrial research have led to similar action being induced in other parts of the Empire. The Commonwealth Institute of Science and Industry was described in last year's Report. We have now to record that the Canadian Government has appointed an honorary advisory council on scientific and industrial research to advise a committee of the Cabinet on all matters relating to science and industrial research, with a view to securing the united efforts of scientific workers and industrial concerns, and of selecting the most pressing problems indicated by industrial necessities to be submitted to research institutions and individuals for solution. The members of this advisory council are:—Dr. A. S. Mackenzie, president of Dalhousie University, Halifax, N.S.; Dr. F. D. Adams, dean of the faculty of applied science, McGill University; Dr. R. F. Ruttan, professor of chemistry, McGill University; Dr. J. C. McLennán, director of the Physical Laboratories, University of Toronto; Dr. A. B. Macallum, president of the Royal Society of Canada, University of Toronto; Dr. W. Murray, president of the University of Saskatchewan, Saskatoon; Mr. R. Hobson, president of the Steel Company of Canada, Hamilton, Ont.; Mr. R. A. Ross, consulting electrical engineer, Montreal; Arthur Surveyor, consulting engineer, Montreal; and Tancrede Bienvenu, manager of La Banque Provinciale, Montreal. The question of co-operation between the scientific men of the country and industrial concerns, with a view of solving the problems raised by the war and of placing the industrial resources of the country in a position to meet the conditions that will arise after the war, has been under consideration by the Canadian Government and by representatives of science and industry for some time, as it was felt to be desirable to follow the example of the British Government in this matter. In a memorandum Sir George E. Foster, Minister of Trade and Commerce, pointed out "the urgent need of organising, mobilising, and economising the existing resources of scientific and industrial research in Canada with the purpose of utilising waste products, discovering new processes—mechanical, chemical, and metallurgical—and developing into useful adjuncts to industry and commerce the unused natural resources of Canada." A beginning has been made by the establishment of a Research Bureau at Montreal.

So far as we know, nothing has yet been done in this direction in South Africa, but Prof. J. A. Wilkinson, in his presidential address to Section B

of the South African Association for the Advancement of Science in July last, gave the following draft of a programme :—

1. *Preliminary*.—(a) A complete census of existing laboratories and workers; (b) a complete census of facilities for the education of scientific workers of all kinds and classes; (c) a complete census of all manufactures, their location, methods, raw materials, and output; (d) a complete census of all known existing raw materials of South Africa, which might be put to use for manufacturing or other purposes; (e) the collection of information from, and reciprocity with, organisations having similar objects throughout the Empire, and in Allied or friendly States.

2. *Standardisation*.—(a) Of scientific instruments of all kinds, whether used in laboratories or works; (b) and scientific control of apparatus and materials required in research.

3. *Initiation*.—The appointment of a central council which shall (a) receive and suggest problems for research; (b) by the organisation of manufacturers of the same or similar products, ascertain what is necessary for the progress; (c) keep in close touch with all the universities and scientific societies in the country.

4. *Assistance*.—(a) By endowments to laboratories and workers; (b) by the collection, publication, and dissemination of information; (c) by the establishment and endowment of libraries; (d) by the advancement of scientific education in schools, colleges and universities; (e) by increasing the equipment, etc., of existing laboratories, and the establishment of new ones; (f) by the provision of laboratories for the carrying out of suggested industrial processes on a small commercial scale with the sanction and approval of the central council.

5. *Co-ordination*.—(a) By annual reports from all laboratories; (b) by bringing all workers in the same branch together; (c) by the dissemination of information respecting similar work done elsewhere; (d) by annual congresses of all scientific societies; (e) by annual congresses of manufacturers and trade interests.

#### THE U.S. NATIONAL RESEARCH COUNCIL.

In the United States, in response to a request from the President, the National Academy of Sciences has organised a National Research Council.

The purpose of the Council is to bring into co-operation existing Governmental, educational, industrial, and other research organisations, with the object of encouraging the investigation of natural phenomena, the increased use of scientific research in the development of American industries, the employment of scientific methods in strengthening the national defence, and such other applications of science as will promote the national security and welfare.

The Council is composed of leading American investigators and engineers, representing the Army, Navy, Smithsonian Institution, and various scientific bureaux of the Government; educational institutions and

research endowments; and the research divisions of industrial and manufacturing establishments.

In order to secure a thoroughly representative body, the members of the Council have been chosen in consultation with the presidents of the American Association for the Advancement of Science, the American Philosophical Society, the American Academy of Arts and Sciences, the American Association of University Professors, and the Association of American Universities, and with the advice of a special committee representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Electrical Engineers, and the American Chemical Society.

Research committees of two classes have been appointed: central committees, representing various departments of science, comprised of leading authorities in each field, selected in consultation with the president of the corresponding national society; local committees in universities, colleges, and other co-operating institutions engaged in scientific research.

The preliminary plan of procedure recommended by the National Research Council, and approved by the council of the National Academy, is as follows:—

(1) The preparation of a national census of equipment for research, of the men engaged in it, and of the lines of investigation pursued in co-operating Government bureaux, education institutions, research foundations, and industrial research laboratories; this census to be prepared in harmony with any general plan adopted by the proposed Government Council of National Defence.

(2) The preparation of reports by special committees, suggesting important research problems and favourable opportunities for research in various departments of science.

(3) The promotion of co-operation in research, with the object of securing increased efficiency; but with careful avoidance of any hampering control or interference with individual freedom and initiative.

(4) Co-operation with educational institutions, by supporting their efforts to secure larger funds and more favourable conditions for the pursuit of research and the training of students in the methods and spirit of investigation.

(5) Co-operation with research foundations and other agencies desiring to secure a more effective use of funds available for investigation.

(6) The encouragement in co-operating laboratories of researches designed to strengthen the national defence and to render the United States independent of foreign resources of supply liable to be affected by the war.

The National Research Council has shown much interest in the work of the British Science Guild and has distributed to organisations and individuals in the United States copies of the memorandum on the Relations which should exist between the State and Science, presented to the Reconstruction Committee, and published in the Journal of the Guild for November, 1916.

## NATIONAL RESEARCH LABORATORIES.

Engineering experiment stations have been established at several of the universities in the United States. These stations have special staffs of officers who are free from ordinary instructional work. The engineering experiment station at the University of Illinois, which may be taken as typical of the best organised and most highly developed of these stations, was organised in 1903 for the purpose of conducting investigations of importance to professional engineers and to the manufacturing, railway, mining, and building interests of the State. The cost of maintenance of the station is about £10,000 a year.

A Bill, having for its object the establishment of engineering experiment stations in the State colleges of the United States, was introduced into the Senate of the United States a few months ago. The Bill provides that "in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with engineering and other branches of the mechanic arts, and to promote the scientific investigation and experiment respecting the principles and applications of the mechanic arts," there shall be established under the direction of the State college in each State a department to be known as an "engineering" or a "mechanic arts" experiment station. The Bill provides also for a grant of £3,000 a year to each State for the purposes of such an experiment station. It is worthy of note in this connection that these State, or land grant, colleges and the institutions of which they are part received in 1914, from the United States, £500,000; from the States and from other sources, more than £6,000,000.

The question of national laboratories of scientific research was the subject of a report by a committee to the Paris Academy of Sciences in November last. The Committee pointed out that all the great industrial nations possess national laboratories of scientific research, systematically directed towards the study of technical problems. The National Physical Laboratory in England, the Bureau of Standards and the Carnegie Institution of the United States, the Physikälische Reichsanstalt and the institutes founded by the Wilhelm Gesellschaft in Germany are given as examples. France has no corresponding institution, and after a full discussion of the questions of control, staff, and work to be done, the following resolution was unanimously carried:— "The Academy of Sciences, convinced of the necessity of organising in France, in a systematic manner, certain scientific researches, expresses its wish that a National Physical Laboratory should be started, for the prosecution of scientific researches useful to the progress of industry. As in other countries, this laboratory would be placed under the control and direction of the Academy of Sciences." It is suggested that the general direction of the laboratory shall be entrusted to a council, one-half of the members nominated by the academy, one-quarter representatives of the State departments, and the remaining quarter delegated by the principal industrial interests.

## WORK OF THE GUILD COMMITTEES.

EXECUTIVE COMMITTEE, 1916-17.

*The President of the Guild:*

RT. HON. SIR WILLIAM MATHER, P.C., LL.D.

*The Chairman of Committees:*

SIR NORMAN LOCKYER, K.C.B., F.R.S.

*The Vice-Chairmen of Committees:*

SIR HUGH BELL, BART.

HON. SIR JOHN COCKBURN, K.C.M.G.

*The Deputy Chairman:*

SIR BOVERTON REDWOOD, BT., D.Sc.

*The Hon. Treasurer:*

RT. HON. LORD AVEBURY.

*The Hon. Assistant Treasurer:*

LADY LOCKYER.

*Other Members:*

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SIR WILLIAM BEALE, BT., K.C., M.P. (Vice-President).

SIR GEORGE BEILBY, F.R.S.

W. H. COWAN, Esq., M.P.

PROFESSOR R. A. GREGORY.

SIR ROBERT HADFIELD, F.R.S.

SURGEON-GENERAL SIR A. KEOGH, G.C.B., LL.D. (Vice-President).

PROFESSOR A. LIVERSIDGE, F.R.S.

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DR. T. A. MATTHEWS.

ROBERT MOND, Esq., M.A.

MAJOR O'MEARA, R.E., C.M.G. (Vice-President).

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LADY NAPIER SHAW.

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F.R.S. (Vice-President).

CARMICHAEL THOMAS, Esq.

DR. R. M. WALMSLEY.

DR. HOWARD S. WILLSON.

COLONEL SIR JOHN S. YOUNG, C.V.O.,

and the Officers of the Guild.

Under the direction of the Executive Committee, the Memorandum on the Relations of Science to Industry and Education was widely circulated, receiving many important signatures. It was then sent in to the Reconstruction Committee of the Government, and was published in full in the November issue of the Journal.

In this connection it may be mentioned that a Government Committee on the Civil Service Examinations has recently been appointed, which it is hoped will be able favourably to consider the Guild's recommendations with regard to the reorganisation of the Examinations for the higher branches of the Service. In the interests of the Nation the Committee should secure for the future a Civil Service which will be fully alive to the necessity for the application of science and scientific research.

The question of the composition of Food Parcels for our Prisoners in Germany was brought before the Executive Committee in the early summer, and a special committee, composed mainly of experts on foodstuffs, was appointed to consider this very important matter. The report of the Committee will be found on pp. 21-22.

In December last the Committee appointed a small special committee to consider the question of the Introduction of a Metric System of Weights and Measures and a Decimal System of Coinage into this country, and the report of the work of the Committee is printed on pp. 17, 18, 19.

Owing to the increasing claims of his private work and his moving to another part of London, Dr. F. Mollwo Perkin resigned the position of one of the Hon. Secretaries of the Guild at the end of 1916. The Executive Committee are greatly indebted to Dr. Perkin for the services which he rendered the Guild during nearly eight years.

Many applications for copies of the Journal have been received from outside sources. Four issues of the Journal have now appeared. One copy of each issue is sent *gratis* to every member of the Guild, and back numbers, price sixpence each, may always be obtained on application to the Secretary of the Guild at 199, Piccadilly, London, W.

It having been brought to the notice of the Guild that His Majesty the King had conferred the honour of the "G.C.B." on Sir Alfred Keogh, for services rendered to the State during the War, and that in the present Government Captain C. Bathurst had been appointed "Parliamentary Secretary to the Minister of Food," and as both these gentlemen are members of the Executive, it was resolved to send them the hearty congratulations of the Guild.

The following replies were received from Sir Alfred Keogh and Captain Bathurst :—

WAR OFFICE,  
5th February, 1917.

DEAR SIR WILLIAM MATHER,

The letter which you have written to me, in which you have informed me of the Resolution which has been passed by the Executive Committee, has touched me very deeply, and I would ask you to be so kind as to convey to the Chairman and Members of the Committee my warmest thanks for

their congratulations on the honour which the King has conferred upon me. I have received that honour as a testimony that His Majesty recognises the work of the Medical Corps on all fronts. I hope, when we come to sum up the effects which modern science has had upon military problems, that it will be agreed that all those principles for which the British Science Guild stands, have been completely vindicated, and that the importance of Science to Administration will be more fully recognised in the future

Believe me, yours sincerely,

ALFRED KEOGH.

MINISTRY OF FOOD,

GROSVENOR HOUSE, W.,

4th February, 1917.

DEAR SIR WILLIAM,

I desire to thank you and the members of the Executive Committee of the British Science Guild for their cordial message of congratulation on my appointment as Parliamentary Secretary to the Ministry of Food, contained in your kind letter of the 2nd inst.

In the execution of my present duties I will certainly strive to merit the confidence of my colleagues on the Committee, the expression of which you so gracefully convey.

Yours sincerely,

CHARLES BATHURST.

The Rt. Hon. Sir WILLIAM MATHER, P.C.

#### GENERAL PURPOSES COMMITTEE.

*Members:*—Professor R. A. Gregory (Chairman), Sir William Phipson Beale, Bt., K.C., M.P., Professor A. Liversidge, F.R.S., Sir Norman Lockyer, K.C.B., F.R.S., Lady Lockyer, The Rt. Hon. Sir William Mather, P.C., LL.D., Major O'Meara, R.E., C.M.G., Sir Boverton Redwood, Bt., D.Sc., A. A. Campbell Swinton, Esq., M.Inst.C.E., F.R.S., Carmichael Thomas, Esq., Colonel Sir John S. Young, C.V.O., and the Officers of the Guild.

The General Purposes Committee have met frequently during the year, and have dealt with matters concerning the administration of the Guild generally, the arrangements for the Annual Meeting, etc.; and have also from time to time recommended courses of action to the Executive in regard to various subjects.

#### MEDICAL COMMITTEE.

*Members:*—Lt.-Col. Sir Ronald Ross, K.C.B., F.R.S. (Chairman), Surgeon-General Sir Alfred Keogh, G.C.B. (Deputy Chairman), Dr. F. W. Andrewes, F.R.S., Sir Thos. Barlow, Bt., K.C.V.O., F.R.S., Sir J. Rose Bradford, K.C.M.G., F.R.S., The Hon. Sir John Cockburn, K.C.M.G., Dr. James Cantlié, F.R.C.S., Dr. James Collier, F.R.C.P., Professor Crossley, F.R.S., Professor J. Bretland Farmer, F.R.S.,



Dr. F. E. Fremantle, F.R.C.P., Sir Archibald Geikie, K.C.B., F.R.S., Professor Liversidge, F.R.S., Dr. Chas. Martin, F.R.S., Dr. Clifford Morson, F.R.C.S., Sir William Osler, F.R.S., Prof. C. S. Sherrington, F.R.S., Professor Starling, F.R.S., Dr. D. Sommerville, Dr. Halliday Sutherland, the Rt. Hon. Lord Sydenham, G.C.M.G., F.R.S., Dr. A. D. Waller, F.R.S., Dr. Howard S. Willson, and the Officers of the Guild.

The work of the Medical Committee is still somewhat impeded owing to so many of its members being on war service, but several meetings have been held and several questions dealt with. The principal points discussed are alluded to in the following paragraphs.

*Feeding of Infants in Institutions ; Feeding of Boys at the Public Schools, etc.*

In the autumn of 1916 the following letter, dealing with the subjects mentioned in this heading, was sent to the Editors of the *British Medical Journal* and the *Lancet*:—

DEAR SIR,

At a recent meeting of the Medical Committee of the British Science Guild I was instructed to communicate with you upon the following points :—

(1). A letter received from Sir Lauder Brunton shortly before his death. (I enclose copy).

With regard to paragraphs 11 to 14 inclusive, I am to say that the questions therein mentioned—remuneration of the medical profession generally, difference between fees commanded by surgeons and doctors, etc.—are of particular interest to the Medical Committee of the Guild, who would invite correspondence upon them through your columns if you are good enough to publish the letter, or portions of it.

(2). A letter from the Local Government Board, a copy of which I enclose.

Some months ago the Medical Committee of the Guild were informed that there existed in certain Poor Law Institutions in England and Wales an objectionable method of feeding a number of young children with the same spoon, a practice calculated greatly to spread infectious and contagious diseases. The Committee communicated with the Local Government Board, suggesting the appointment of voluntary lady inspectors, who should visit the institutions and see the children fed. The Local Government Board were, however, unable to agree to this suggestion, but stated that the question should be brought to the notice of their ordinary Inspectors. It has now been finally stated by the Board that the practice does not exist in Poor Law Institutions in England and Wales.

(3). *Feeding of Boys in the Public Schools.*—A letter was recently addressed to the Medical Committee of the Guild, dealing with the following points :—

(1). That boys are sent to the Public Schools at the most critical stage of their development, and it is therefore most important for the future welfare of the race that they shall have plenty of good, nourishing food.

(2) That under the prevailing system, the catering for each house is in the hands of the housemaster, who to a great extent makes his living out of the boarding fees.

(3). That in the majority of cases the food provided is not of a sufficiently nourishing character, canned foods and twice-cooked meat figuring largely on the menus, to the exclusion of fresh meat and vegetables.

The Medical Committee sent a copy of this letter to an eminent food expert, and his reply is as follows :—

“ With reference to your communication on the Feeding of Boys in the Public Schools, I think the facts as stated are true, and call for correction. The system of housemasters living on the profits of their catering also seems to me to merit the condemnation passed on it. The remedy for the evils enumerated is not, perhaps, to be obtained easily, but it ought to be within the powers of the Medical Committee of the British Science Guild to lead public opinion on the matter.”

The Committee also sent a copy of the letter to the Hon. Secretary of the Incorporated Association of Head Masters, and his reply is as follows :—

“ I am much obliged for the letter enclosed. The difficulty is that schools vary very much; some of what is said would be quite unfair if applied to a good many. If the British Science Guild would produce some specimen dietaries—programmes for a month at a time, so as to shew how a wholesome variety could be secured—I think it might be a very useful piece of work.”

In the original letter received by the Committee, the suggestion is made that the catering at each Public School should be taken out of the hands of the Housemasters, and put into the hands of an *ad hoc* committee.

I am to state that the Medical Committee are in general agreement with the above proposal, and would be glad to receive correspondence on the subject, if you are good enough to publish the above facts.

Very truly yours,

RONALD ROSS,

*Chairman of the Medical Committee,  
for the British Science Guild.*

*Extracts from Sir Lauder Brunton's Letter.*

*The whole question of the remuneration of the medical profession and of its various branches will naturally give rise to much discussion.*

*For example, I have of late years frequently been consulted in regard to abdominal operations. The question shall an operation be performed or not? has been left entirely in my hands, and on the correctness of my answer the life of the patient has depended. Yet for my advice I received the fee of three guineas. If an operation was necessary, the surgeon received 100 guineas.*

*This enormous disproportion between the values of mere mechanical skill and trained brain work holds in other branches also.*

*These high surgical fees are one of the causes why some kind of co-operative hospital is becoming so urgently needed.*

*Before the war began I was working with Lady Henry at the establishment of some kind of insurance for officers' families against sickness or operation. The officer himself was insured, but if one of his family got appendicitis the operation and incidental expenses might run away with the united income of the officer and his wife for a whole year.*

With regard to the question of the wide disproportion existing between the fees commanded by physicians and surgeons respectively, the Medical Committee have received considerable correspondence. Copies of the letters have, with the consent of the writers, been sent to the Royal Colleges of Physicians and Surgeons, and to the General Medical Council, together with a covering letter asking if the various Councils will consider the facts put forward, and whether they think it desirable to take any action upon them.

*Copy of Letter from Local Government Board.*

17th July, 1916.

The Hon. Secretary,  
Medical Committee,  
British Science Guild.

SIR,

In reply to your letter of the 5th inst., I am directed by the President of the Local Government Board to state that the feeding of a number of children with the same spoon is not a practice adopted in Poor Law Institutions in England and Wales.

I am, Sir, your obedient servant,  
(Signed) H. W. S. FRANCIS.

The Medical Committee also circulated the following Resolutions, signed by Sir Ronald Ross, the Chairman of the Medical Committee, to the Medical Press in the summer of last year :—

*Watering of the Streets.*

The Medical Committee of the British Science Guild views with disfavour the suggestion that has been made by certain District Councils to cease watering the streets as a war economy, and is convinced that such a step would be prejudicial to the Public Health.

*Pollution of the Streets by Dogs.*

The Medical Committee also views with great disfavour the pollution of the streets of London, and of most cities and big towns, by dogs, and considers that the attention of the Government and of municipalities should be called to the possibility of reducing the evil by increasing the tax on dogs and by enforcing bye-laws.

The Committee considers that in towns the tax on one dog should be doubled, and a large progressive increase imposed on each additional dog.

With regard to the latter subject, the Committee have also been considering the advisability of holding a Conference on the Dog Nuisance.

*Disposal of Manure at Camps.*

The attention of the Medical Committee was directed during the early summer to the problem of the disposal of manure at the various camps in this country, and the following Resolutions were submitted to the War Office :—

1. The Committee has carefully considered the terms of the letter from Captain Bathurst, M.P., and the information on the subject which the Chairman collected from the War Office and the Board of Agriculture, in pursuance of the request of the Executive Committee. The Committee is of opinion—
  - (1) That if means can be found by which manure can be retained within a short distance of military camps and distributed from them for sale, without tending in any way to increase flies, or to spread disease, or to produce conditions likely to spread disease, these requirements being conformed with to the complete satisfaction of the military sanitary authorities; then it is quite permissible from a sanitary point of view to sell or use such manure for the benefit of agriculture.
  - (2) That four or five different methods may be suggested which will enable the military authorities to conform to the conditions laid down above, such as :—
    - (a) Burying in pits for a length of time under a coating of soil and grass.
    - (b) Storing in fly-proof barns, with a properly regulated method of draining fluids from beneath the manure and with preservation from rain.
    - (c) Immediate removal in a raw state in open carts from the proximity of the camps.
    - (d) Immediate storing in fly-proof barrels, with or without mixture with chemicals.
    - (e) Methods of dessication and compression confidentially communicated by the Chairman.
  - (3) If none of these methods is ultimately found to be practicable, the manure can be burned once or twice a week, in such a manner as to preserve most of the potash in the ash; but this method wastes a large amount of the agricultural value of the original manure.
  - (4) In order to give effect to these requirements and to make the best possible profit out of the manure, special arrangements for supervision, instruction, and management will obviously be needed.

- (5) As the value of the manure is likely to increase very largely in October, the Committee thinks that the military authorities should proceed with the matter at once, with the assistance of the Board of Agriculture, both for the benefit which will result to agriculture and for the revenue which the properly treated manure will bring in; but the Committee also considers that a number of experiments will certainly have to be made before the manure can be put on the market with due safeguards for preserving the health of the troops.

The following reply was received from the War Office :—

21st July, 1917.

The Secretary,  
British Science Guild.

MADAM,

With reference to your letter of the 10th June last and correspondence concerning the disposal of manure in mounted camps, etc., I am commanded by the Army Council to state for the information of the Medical Committee of the British Science Guild that, in conjunction with the Board of Agriculture, the Department has considered the several Resolutions passed at a meeting of the Medical Committee on 1st June last, and it has been decided to take no steps so far as the several methods (b), (d), and (e) are concerned. As regards (a) and (c), action is proceeding on lines similar to those mentioned.

2. In conveying an expression of the Army Council's appreciation of the interest taken in this subject by the British Science Guild, the Council would mention that both this Department and the Board of Agriculture have been much concerned as to the best means of regulating the disposal of manure, not only from the point of view of the health of the troops, but from an agricultural and commercial standpoint, and the methods now in force are the result of experience based on the circumstances obtaining at the various military centres and camps.

I am, Madam,

Your obedient servant,

B. B. CUBITT.

#### METRIC SYSTEM COMMITTEE.

*Representing the Guild.*—Sir William Phipson Beale, Bt., K.C., M.P. (*Chairman*), Harry Allcock, Esq., M.I.E.E., The Hon. Sir John Cockburn, K.C.M.G., W. H. Cowan, Esq., M.P., Professor R. A. Gregory, The Rt. Hon. Sir William Mather, P.C., LL.D., Sir Alexander Pedler, C.I.E., F.R.S., and Frank Warner, Esq.

*Representing the Decimal Association.*—Sir Richard Burbidge, Bt., Edward C. Barton, Esq., M.I.E.E., F.R.G.S., and A. J. Naughton, Esq.

The introduction of a metric system of weights and measures into this country has from time to time engaged the attention of members of the Guild as a matter of paramount importance calling for any possible action

on suitable occasions on the part of the Guild to create, or assist in creating, a public appreciation of its urgency as affecting our national trades and industries and international dealings.

Although the Weights and Measures Act, 1878, made lawful the use of a metric system substantially identical with that in use in France, it did not come into general use in this country on account of the practical difficulties which manufacturers and traders willing to adopt it met with in the unwillingness of others (including railway companies, shippers, and public bodies) to make the necessary modifications in, or additions to, their methods and means of doing business. The conviction grew among its advocates that some measure of compulsion was absolutely necessary, but an opening for such a measure was not easy to find. A resolution in Parliament failed some ten years ago through the opposition of the representatives of manufacturers and traders, who contended that the exertion, expense, and interim inconvenience which the changes must involve would outweigh any advantages which they could appreciate. The present war conditions, and the contemplation of the probable nature of the industrial exertions which will be required in the future, in order that Great Britain may obtain and retain an adequate share in the markets of the world seemed, however, to afford an opportunity for urging a re-consideration of the subject in a less insular spirit, and in February, 1917, the Executive of the Guild passed a resolution as follows:—

“That a small committee be appointed to prepare a statement for publication by the Guild on the opening which post-war conditions would afford for the introduction of a Metric System of Weights and Measures.”

The Committee, following a practice encouraged by the constitution and procedure of the Guild, invited three members of the Decimal Association to join their deliberations, and received their cordial co-operation.

In the course of their deliberations two draft Bills, prepared for the Association of Chambers of Commerce of the United Kingdom, were brought to the notice of the Committee so constituted. The one Bill referred to the Metric System, and is hereafter referred to as “the Metric Bill.” The other referred to the decimalisation of the coinage, and is hereafter referred to as “the Coinage Bill.”

In order that the whole subject might be dealt with the Executive of the Guild added the words “and a decimal system of coinage” after the word “measures” in the resolution above quoted.

The consideration of the draft Bills of the Association of Chambers of Commerce was not looked upon by the Committee of the Guild as exhausting their mandate under the resolutions of the Executive, or even as the primary object thereof, but was taken up as a practical way of facilitating a solution of the special difficulties attending compulsory legislation. The Committee bear in mind for constant and further consideration the view that by such means as greater attention to the metric system as part of education, by the adoption of the metric system in all government contracts, and by other ways

of clothing it with practical advantages, a great deal may be done without legislation, and that convenience may operate to a considerable extent in lieu of compulsion to lead to its general adoption and displacement of other systems of weights and measures. The committee in considering and making suggestions for alteration in the above-mentioned draft Bills, have especially addressed themselves to the inexpediency of drastic enactment which would seek wholly to prevent people from making, and honestly carrying out, their contracts and conducting their business in their own language, or to impose penalties of a serious nature on persons acting in good faith recoverable by a common informer. The Committee have suggested alternative provisions intended gradually to bring about universal adoption by rendering it obligatory to express all contracts in the metric system (and decimal coinage), for the purpose of getting relief in law, with reasonable penalties enforceable only by the Courts in proper cases.

These views of the Committee are, however, at present put forward merely for the consideration of the Association of Chambers of Commerce, who will be guided by their own draftsmen. It would be premature to regard them as decisions of the Committee or as forming part of an interim report to the Executive. The detailed views of different members of the Committee are still under discussion, and they will welcome any help or suggestion with a view to their ultimate report to the Executive under the resolution.

A question has been raised whether the standard metre as expressed by giving its equivalent in standard inches under the Weights and Measures Act, 1878, and stated in the Schedule to that Act to be equivalent to 39.3708 inches, is correct. The standard laid down in the Act of 1878 is at present adopted for the Metric Bill of the Association of Chambers of Commerce. The Committee have been in communication with the Bureau International des Poids et Mesures at Sevres on this subject, and have received much information from Monsieur C. E. Guillaume, the Director of that Bureau. The subject is not free from difficulty, but it may be enough to say that, whatever definitions of the metre have heretofore prevailed, there would appear to be no real obstacle to the adoption of an international standard, "étalon international," and framing the definition in any future British legislation by reference to that, or to its equivalent in standard inches as ascertained by the Act of 1878.

#### " SCIENCE AND THE STATE " COMMITTEE.

*Members*:—Sir Norman Lockyer, K.C.B., F.R.S. (Chairman), Sir Wm. Phipson Beale, Bt., K.C., M.P., The Hon. Sir John Cockburn, K.C.M.G., W. H. Cowan, Esq., M.P., Prof. F. G. Donnan, F.R.S., Prof. Alexander Findlay, D.Sc., Prof. R. A. Gregory, Prof. Arthur Keith, LL.D., F.R.S., J. E. Marsh, Esq., F.R.S., Prof. G. T. Morgan, F.R.S., Major O'Meara, R.E., C.M.G., Sir Boverton Redwood, Bt., D.Sc., Lieut.-Colonel Sir Ronald Ross, K.C.B., F.R.S., Edwin O. Sachs, Esq.

This Committee formed part of the special Committees responsible for the Memoranda on the Relations between Science and Industry, and the Position

of Scientific Teaching and Research in British Universities, published in the JOURNAL of the Guild for November, 1916. At the request of the Guild, Sir Ronald Ross represented the views expressed in the latter Memorandum before the Royal Commission on University Education in Wales.

#### EDUCATION COMMITTEE AND TECHNICAL EDUCATION COMMITTEE.

*Members of Joint Committee:*—Rt. Hon. Sir William Mather (Chairman), John Wilson, Esq., M.Sc. (Hon. Secretary), Captain Bathurst, M.P., : Sir G. T. Beilby, F.R.S., Fred. Charles, Esq., B.A., Hon. Sir John Cockburn, K.C.M.G., J. Easterbrook, Esq., E. Gray, Esq., Prof. R. A. Gregory, E. G. A. Holmes, Esq., M.A., T. C. Horsfall, Esq., Sir Alfred Keogh, G.C.B., Prof. A. Liversidge, F.R.S., Sir Philip Magnus, M.P., C. T. Millis, Esq., Prof. Perry, F.R.S., A. T. Pollard, Esq., Prof. T. Raymont, J. H. Reynolds, Esq., M.Sc., J. J. Robinson, Esq., Dr. A. Shadwell, M.A., LL.D., Lady Napier Shaw, Dr. R. M. Walmsley, Sidney Webb, Esq., LL.B., Prof. J. Wertheimer, Sir James Yoxall, M.P., and the Officers of the Guild.

The Report prepared by this Joint Committee before the opening of the War has been sent to the Secretary of the Prime Minister's Reconstruction Committee. It was printed in the JOURNAL of the Guild for November, 1916, and anticipated in its recommendations the Memoranda issued during the past few months by a number of educational and other organisations. The Education Committee is preparing a Memorandum on Science Teaching in General Education, which it is proposed to send to the Government Committee on the Teaching of Science, and is also dealing with the important subject of the establishment of a national register of schools.

#### AGRICULTURAL COMMITTEE.

*Members:*—Captain Charles Bathurst, M.P. (Chairman), H. R. Beeton, Esq., Prof. R. H. Biffen, F.R.S., The Rt. Hon. Lord Blyth, The Hon. Sir J. Cockburn, K.C.M.G., Prof F. W. Gamble, F.R.S., A. D. Hall, Esq., F.R.S., W. Heape, Esq., F.R.S., Dr. Augustine Henry, Prof. Bryner Jones, Sir Herbert Matthews, Prof. John Penberthy, F.R.C.V.S., Prof. J. Percival, Dr. E. J. Russell, Christopher H. Turnor, Esq., and the Officers of the Guild.

A Memorandum emphasising the need of greater home production of food was circulated to the Press last year at the suggestion of the Agricultural Committee. It was signed by Captain Bathurst, the Chairman of the Committee, who has since been appointed Parliamentary Secretary to the Ministry of Food. The Memorandum was printed in the JOURNAL of the Guild for November, 1916.

#### MICROSCOPE COMMITTEE.

*Members:*—Dr. R. M. Walmsley (Chairman), C. O. Bannister, Esq., J. E. Barnard, Esq., Dr. E. H. Barton, F.R.S., Sir George Beilby, F.R.S., F. J. Cheshire, Esq., Professor Cullis, Dr. Desch, Dr. J. W. Evans,



J. W. Gordon, Esq., K.C., Professor A. Harker, F.R.S., Dr. Hutchinson, Professor Herbert Jackson, Professor Martin Lowry, F.R.S., Robert Mond, Esq., Dr. Rosenhain, F.R.S., Dr. J. E. Stead, Sir J. J. H. Teall, F.R.S., H. H. Thomas, Esq., and the Officers of the Guild.

Draft specifications of Petrological, Chemical and Metallurgical Microscopes have been prepared by the Committee, and were published in the JOURNAL of the Guild for November, 1916. The specifications have met with the approval of leading manufacturers, who are, however, prevented from undertaking the construction of the instruments until the pressure of war work has been relieved.

#### TECHNICAL OPTICS COMMITTEE.

*Members:*—Dr. R. M. Walmsley (Hon. Sec.), T. H. Blakesley, Esq., Conrad Beck, Esq., F. J. Cheshire, Esq., Sir F. W. Dyson, F.R.S., Lieut.-Colonel J. W. Gifford, J. W. Gordon, Esq., K.C., Sir Howard Grubb, F.R.S., S. Lamb, Esq., W. H. Maw, Esq., LL.D., Sir Boverton Redwood, Bt., D.Sc., Dennis Taylor, Esq., and the Officers of the Guild.

It will be remembered that much attention has been paid by the Guild to the subject of Technical Optics, and that it was dealt with at the last Annual Meeting.

The report, printed in Appendix VI., which is the first report issued by the Board of Scientific Societies organised by the Royal Society, marks a distinct forward step in the setting forth of considered proposals for dealing with the very important subject of "National Instruction in Technical Optics." It embodies the deliberate opinion of the foremost scientific, trade and educational experts upon the question dealt with and its criticisms of preceding reports cannot be ignored. It is to be hoped that these criticisms will have due weight with the authorities who are dealing with the matter, and that they may lead to effective action in the near future along lines which are likely to be successful. It is to be specially desired that the "serious defects" which are so cogently referred to as existing in the scheme of the London County Council, published last August, will be amended in the direction indicated by such competent authorities.

#### COMMITTEE ON PARCELS OF FOOD TO PRISONERS IN GERMANY.

*Members:*—Prof. E. P. Cathcart, D.Sc., Miss Mary Marsden, Sir Alexander Pedler, C.I.E., F.R.S., Lady Napier Shaw, Dr. D. Sommerville, Carmichael Thomas, Esq., Prof. W. H. Thompson, D.Sc., Colonel Sir John S. Young, C.V.O.

In the autumn the question of the feeding of our Prisoners of War in Germany was brought to the notice of the Guild, and this Committee was appointed to deal with it.

Subsequently the Central Prisoners of War Committee sent in to the Committee of the Guild a list of their "standard parcels," asking the opinion of the Committee of the Guild as to whether the contents of the parcels were considered sufficiently nourishing in view of the fact that the prisoners received little other food.

A detailed statement was supplied, giving the approximate "energy value" of each article contained in the parcels, and at a later date the Committee—bearing in mind that a soldier leading the life of one of our prisoners in Germany requires roundly 100 grammes of protein, 50 grammes of fat, and 400 grammes of carbo-hydrates per day—sent in various suggestions with regard to the composition of the parcels.

Ultimately the following memorandum was drawn up, and circulated to the Press and to the Regimental Associations, dealing with the sending of parcels to "Prisoners of War":—

*Memorandum.*

Some time ago the British Science Guild was asked for advice as to the most suitable and nourishing foodstuffs to send to Prisoners.

In view of the great importance of really nourishing foods being supplied, and as economically as possible, the British Science Guild appointed a Committee composed mainly of experts on foodstuffs, to deal with the question.

Subsequently the Central Prisoners of War Committee, recently appointed by the Government to control the supply of Food Parcels for Prisoners of War, approached the British Science Guild for suggestions from the Guild's Food Parcels Committee.

Suggestions were promptly submitted.

In making such suggestions the Committee of the British Science Guild laid great stress, in view of the undoubted adulteration and inferior quality of many articles of food now on the market, on the selection of foods being under the supervision of a scientific expert accustomed to deal with foodstuffs; and it has been arranged that samples of various articles for Food Parcels sent out by the Central Prisoners of War Committee shall be analysed from time to time under the direction of a member of the British Science Guild's Committee.

As no doubt there are many Regimental and other local Associations throughout the Kingdom purchasing supplies for Food Parcels for Prisoners of War, the British Science Guild's Committee make the following recommendations in regard to the composition of parcels:—

1. That as tinning adds from 10 per cent. to 20 per cent. to the cost of any article, tinned foods should, wherever possible, be replaced by dried foodstuffs such as smoked herrings.
2. That where the Prisoners are supplied with bread from Switzerland or elsewhere, toffee might replace biscuits in parcels, a good toffee being nourishing and much appreciated by the men.
3. That only rich fruit cakes, and not light cakes, should be sent.

4. That stewed mutton, or beef rations, should be sent in preference to other preserved meats.
5. That condensed or dried milk should be included in every parcel.
6. That raisins and dates are preferable to other dried fruits such as prunes.

*Note.*

The work of the Committee suggests a question, viz., How far has the nation generally yet profited by physiological research on foodstuffs? Probably not at all, or only to an infinitesimal degree.

It was assumed as a general working basis that a prisoner resting in camp could subsist on a diet yielding 2,500 calories daily, and that such diet might be conveniently composed of 100 grammes of protein, 400 of carbohydrate, and 50 of fat.

But when these materials are collected, and it is ascertained that they are good, fresh, and free from adulteration, only half the story is told. The prisoner may be incapable of dealing with his ration—he may not be able to digest one or more of the stuffs. Assimilation and oxidation, with the consequent liberation of energy are dependent on digestion—putting the stuffs in solution.

Can the Guild do anything in assisting the nation in the important matter of digesting its food? This way lies increased physical fitness—increased efficiency.

D. SOMMERVILLE.

EXECUTIVE COMMITTEE FOR 1917-18.

Under the resolution passed at the Third Annual Meeting, five of the members of the Executive Committee retire each year and a new Committee is elected. In accordance with the resolution passed at the First Annual Meeting, the Executive consists of not more than thirty members. Usually one or two places are not filled up in view of possible requirements during the year.

The Executive Committee for the year 1917-18 is constituted as follows :

*The President :*

THE RT. HON. LORD SYDENHAM G.C.S.I., G.C.M.G., G.C.I.E.,  
F.R.S.

*The Chairman of Committees :*

SIR NORMAN LOCKYER, K.C.B., F.R.S.

*The Vice-Chairmen of Committees :*

SIR HUGH BELL, Bt.

THE HON. SIR JOHN COCKBURN, K.C.M.G.

*The Honorary Treasurer :*

THE RIGHT HON. LORD AVEBURY.

*The Assistant Hon. Treasurer :*

LADY LOCKYER.

*The Deputy Chairman:*

SIR BOVERTON REDWOOD, Bt., D.Sc.

*The following Vice-Presidents:*

CAPTAIN CHARLES BATHURST, M.P.

SIR WILLIAM PHIPSON BEALE, Bart., K.C., M.P.

SURGEON-GENERAL SIR ALFRED KEOGH, G.C.B., LL.D.

THE RIGHT HON. SIR WILLIAM MATHER, P.C., LL.D.

*The Hon. Secretary:*

SIR ALEXANDER PEDLER, C.I.E., F.R.S.

*Other Members:*

SIR GEORGE BEILBY, F.R.S.

W. H. COWAN, Esq., M.P.

PROFESSOR R. A. GREGORY.

SIR ROBERT HADFIELD, F.R.S.

PROFESSOR A. LIVERSIDGE, F.R.S.

SIR PHILIP MAGNUS, M.P.

ROBERT MOND, Esq., M.A.

MAJOR O'MEARA, R.E., C.M.G.

DR. F. MOLLWO PERKIN.

PROFESSOR JOHN PERRY, F.R.S.

LT.-COLONEL SIR RONALD ROSS, K.C.B., F.R.S.

ALAN A. CAMPBELL SWINTON, Esq., M.Inst.C.E., F.R.S.

LADY NAPIER SHAW.

CARMICHAEL THOMAS, Esq.

DR. R. MULLINEUX WALMSLEY.

DR. HOWARD S. WILLSON.

COLONEL SIR JOHN S. YOUNG, C.V.O.

## APPENDICES.

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Many important matters are dealt with in the Appendices to the Report. Prof. Barnes records the establishment of an Advisory Council for Scientific and Industrial Research in Canada, and other lines of advance in the Dominion. Mr. R. Finlayson and Mr. W. Rutt, the Hon. Secretaries of the South Australian Branch, state that the Guild's Report has been submitted to the Commonwealth Council of Science and Industry for consideration. Prof. A. F. Barker states clearly the position of the Textile industries as regards the adoption of the Metric System in this country. Prof. Gregory has prepared a list of the numerous Committees appointed by the Government to consider scientific and related problems, and has also compiled a list of endowments and gifts to education and research announced since the annual meeting last year. The Guild is also indebted to Prof. Gregory for the account of action as to scientific and industrial research given in the introductory pages of this Report. The Memorandum upon National Instruction in Technical Optics issued by the Board of Scientific Societies of the Royal Society follows so closely the views expressed by the Technical Optics Committee of the Guild that it is reprinted for the information of members. It is hoped that action will be taken in the directions indicated.

## APPENDIX I.

SEVENTH ANNUAL REPORT OF THE COMMITTEE OF THE  
CANADIAN BRANCH OF THE BRITISH SCIENCE GUILD.

By Professor H. T. BARNES, F.R.S., *Hon. Secretary.*

In our report of last year we referred to the conference of the representatives of Canadian Universities with Sir George E. Foster, K.C.M.G., Minister of Trade and Commerce, at which the question of the establishment of a Commission on Industrial Research was considered. As a result of this conference and the most careful deliberation the Government of Canada established the Honorary Advisory Council for Scientific and Industrial Research in Canada.

The memo published by the Government setting forth the origin and objects of the Council fully explains the importance of the work intrusted to it. It states: On June 6th, 1916, a committee of the Privy Council of Canada, consisting of the Right Honourable the Minister of Trade and Commerce (Chairman); the Honourable the Ministers of the Interior, Agriculture, Mines, Inland Revenue, and Labour, was formed by the Privy Council to have charge of all measures to foster the scientific development of Canadian industries in order that during and after the present war, they may be in a position to supply all Canadian needs and to extend Canadian trade abroad.

Under this committee of the Privy Council there was constituted, on the 29th of November, an Honorary Advisory Council for Scientific and Industrial Research, composed of eleven members representative of the scientific, technical and industrial interests of Canada.

This Advisory Council, by direction of the Chairman of the Committee of the Privy Council, has been charged with the following duties:—

(a) To ascertain and tabulate the various agencies in Canada which are now carrying on scientific and industrial research in the Universities and colleges, in the various laboratories of the Government, in business organizations and industries, in scientific associations, or by private or associated investigators.

(b) To note and schedule the lines of research or investigation that are being pursued by each such agency, their facilities and equipment therefor, the possibilities of extension and expansion, and particularly to ascertain the scientific man power available for research and the necessity of adding thereto.

(c) To co-ordinate these agencies so as to prevent overlapping of effort, to induce co-operation and team work, and to bring up a community of interest, knowledge, and mutual helpfulness between each other.

(d) To make themselves acquainted with the problems of a technical and scientific nature that are met with by our productive and industrial interests, and to bring them into contact with the proper research agencies for solving **these problems**, and thus link up the resources of science with the labour and capital employed in production so as to bring about the best possible economic results.

(e) To make a scientific study of our common unused resources, the waste and by-products of our farms, forests, fisheries and industries, with a view to their utilization in new or subsidiary processes of manufacture, thus contributing to the wealth and employment of our people.

(f) To study the ways and means by which the present small number of competent and trained men can be added to from the students and graduates of science in our universities and colleges, and to bring about in the common interest a more complete co-operation between the industrial and productive interests of the country, and the teaching centres and forces of science and research.

(g) To inform and stimulate the public mind in regard to the importance and utility of applying the results of scientific and industrial research to the processes of production by means of addresses to business and industrial bodies, by the publication of bulletins and monographs, and such other methods as may seem advisable.

The Honorary Advisory Council hopes to render valuable assistance to a movement, the success of which is not only vital to the proper development of the resources of the Dominion, but which is absolutely necessary in order to enable Canada to compete with progressive countries in the great race of national expansion.

The Members of the Council are as follows:—

*Administrative Chairman:—*

A. B. Macallum, M.D., Ph.D., D.Sc., LL.D., F.R.S., Ottawa.

*Members:—*

F. D. Adams, Ph.D., D.Sc., LL.D., F.R.S., Dean, Faculty of Applied Science, McGill University, Montreal.

T. Bienvenu, Vice-President and General Manager, La Banque Provinciale du Canada, Montreal.

R. Hobson, President, Steel Company of Canada, Hamilton, Ont.

S. F. Kirkpatrick, M.Sc., Professor of Metallurgy, Queen's University, Kingston, Ontario.

J. C. McLennan, Ph.D., F.R.S., Professor of Physics and Director of the Physics Laboratory, University of Toronto, Toronto.

A. S. Mackenzie, Ph.D., D.C.L., President, Dalhousie University, Halifax, N.S.

W. C. Murray, M.A., LL.D., President, University of Saskatchewan, Saskatoon, Saskatchewan.

R. A. Ross, E.E. (Tor.), M.Can.Soc.C.E., Consulting Engineer, 80, St. Francois Xavier Street, Montreal.

R. F. Ruttan, M.A., M.D., D.Sc., Professor of Chemistry and Director of the Chemical Laboratories, McGill University, Montreal.

Arthur Surveyor, B.A.Sc., M.Can.Soc.C.E., Consulting Engineer, 274, Beaver Hall Hill, Montreal.

*Secretary:—*

J. B. Challies, C.E. (Tor.) M.Can.Soc.C.E., Superintendent, Dominion Water Power Branch, Ottawa.

The work so far accomplished by the Council is chiefly that of organisation. It is thus stated in the "Canadian Engineer" for March, 1917:—

The Advisory Council for Scientific and Industrial Research, of which Dr. A. B. Macallum is chairman, has just issued a very important review of the subject, following a conference which was recently held in Ottawa. Some forty projects, each bearing on vital phases of scientific conservation and development of Canada's natural resources, have been submitted to the council.

Some of the larger projects now in view include a comprehensive industrial census, the training and utilization in industrial establishments of "efficiency experts," the creation of technical laboratories under State co-operation at the great industrial centres, to give free help to manufacturers in solving their problems, the utilization and development of the latent fuel resources, particularly of the Prairie Provinces, and the preservation of the diminishing timber resources of Eastern Canada.

The council will issue questionnaires to the manufacturers, the technical societies, the various Government Departments, and the universities of the Dominion, asking for information with reference to the laboratories and various other agencies of research now in operation in the Dominion; the men now engaged in or available for research work; the raw materials required for our industries; the by-products produced but not at present utilized; and other matters required in the development of its work. In securing this information the council will work in close co-operation with the manufacturers' associations and the various technical societies of the Dominion. It is expected that the replies to the questionnaires will show many lines upon which the council may assist in the development of Canadian industries.

The council will recommend the establishment of twenty or more studentships and fellowships in our universities and technical schools, which will be given to men who have completed their regular course of study and have displayed a special aptitude for scientific research. These will enable such men to pursue a course of advanced work at college for a further period. Arrangements will also be made by which men after graduation will be placed in one or other of the great manufacturing establishments of the Dominion, where they will continue their training under the conditions of actual commercial practice.

In order to furnish direct assistance to the manufacturing industries of Canada at once, the council is recommending the establishment at certain of the great industrial centres of the Dominion, such as Toronto, Montreal, and Winnipeg, in co-operation with the Provincial Government or other bodies, of Industrial Research Bureaux, where a complete set of technical magazines and trade journals will be found, and where technical staffs, provided with suitable and properly equipped laboratories, will assist the manufacturers of the district in solving problems which present themselves in their factories or works.

In addition to these broad general movements for the advancement of



the industries of the Dominion, the Council has decided to examine carefully a number of specific projects which have been submitted to it, and which appear to give promise of yielding valuable results. Among these one may be mentioned.

This has for its object the provision of an adequate supply of good fuel for the western plains, more especially in the provinces of Saskatchewan and Manitoba. There are in the former province large supplies of lignite. This is an inferior fuel, possessing a relatively low heating power, and which, furthermore, will not stand shipment and storage. It is, therefore, of comparatively little value for domestic or manufacturing purposes. The Council, however, believes that by a special treatment there may be produced from this lignite two grades of high-class briquetted fuel, one similar to anthracite or hard coal in character, and the other resembling soft coal in general character; and at the same time certain very valuable by-products may be secured. The Department of Mines and the Commission of Conservation have already carried out a good deal of investigation in connection with this problem, and the former department is now making some further studies for the Council. If they give satisfactory results, the Council will advise that an experimental plant to turn out this high-grade fuel on a commercial scale be erected, and the possibility of producing this fuel at a cost considerably lower than that at which coal from the United States is now laid down in Manitoba and Saskatchewan be demonstrated on a large scale and the coal actually placed on the market. With an abundant supply of good cheap fuel the conditions of life on the great plains in winter will be much improved.

#### *Forestry Service.*

The Canadian Forestry Association is doing most important work. Their journal is full of valuable information and helpful advice, and is of very great interest to the general reader.

The Association publishes from time to time valuable books and leaflets dealing with forestry, both in French and English. These books are in great demand, and the edition is soon exhausted.

The terrible forest fires of Ontario which caused the loss of many lives this year are an object lesson which cannot fail to result in more adequate forest protection.

#### *Agricultural Education and Research.*

The excessively high cost of food during the past year has brought before the people clearly the need for greater production. The unfavourable weather last summer together with the scarcity of workers has resulted in almost a famine in some kinds of vegetables.

To meet this difficult and serious situation the public is being advised to cultivate as much as possible for individual use.

The larger question of improving agricultural conditions is being considered by the Government and experts.

As an example of this, several free public lectures on Gardening were given in McGill University by experts from the Agricultural Faculty at

MacDonald College. The attendance and interest exceeded all expectation, and much valuable information was given.

Dr. Frank T. Shutt, Chief Chemist of the Dominion Experimental Farms, advocated the establishment of a Canadian Institute of Agricultural Research, wherein the more difficult problems of agriculture could be studied. He suggested the joint control of this institute by the Government and the Universities.

*Conservation Commission.*

This Commission continues to do most important work. The Seventh Annual Report contains 260 pages, and includes important papers dealing with Fire Protection, Conservation of Northern Mammals, Forestry, Bird Conservation, Fisheries, Fur Farming, Minerals, Town Planning, Illustration Farms and Water Powers. The last forms the subject of several separate reports of over 300 pages.

McGill University,  
March 9th, 1917.

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## APPENDIX II.

SOUTH AUSTRALIAN BRANCH OF THE BRITISH SCIENCE  
GUILD.

REPORT FOR THE YEAR 1915-16.

In presenting their report for the year 1915-16 your Committee cannot record any great activity on the part of the Guild as a body, the war continuing to absorb the attention of the public to the exclusion of most other subjects. Many of the most active members are, however, serving in their individual capacities on boards, or in official positions, under the Government, where their expert knowledge is being utilised in connection with the various questions arising from the present war conditions and their probable future results.

*Puericulture.*—A deputation, consisting of your Committee and the Puericulture Sub-Committee, waited upon the Premier (the Hon. Crawford Vaughan) on October 5, 1915, to impress upon him the importance of the suggestions made in the report adopted by the Guild in February, 1914. The Premier expressed his sympathy with the recommendations made, and his readiness to receive any suggestions from the Guild as to the best way to carry them into effect. This question will not be allowed to drop, and it is hoped that when the present financial strain is eased practical results may ensue. While on this subject, it may be stated that the School for Mothers, an institution established and maintained by private persons on philanthropic lines, being about to hold in August an exhibition in connection with Child Welfare, has asked the Guild to co-operate by arranging for a lecture on a suitable subject by one of its members.

*Federal Institute for Original Research.*—It is gratifying to know that definite action has been taken by the Federal Government in the direction advocated in the report on this subject adopted by the Guild in 1914, they having appointed an Advisory Council of Science and Industry, and referred the Guild's report to it for consideration.

*Botanic Garden Management.*—Proposals for a modification in the management and work of the Adelaide Botanic Garden with a view to extending its scientific and economic usefulness having been submitted to the Government by a member of the Guild, a letter endorsing the same was forwarded to the Hon. Commissioner of Crown Lands, pointing out that the retirement of the present Director from superannuation made it possible to carry out many of the proposals at once without entailing any present increase to the annual expenditure. The proposals have also been approved by the Council of the Adelaide University and by the Royal Society of South Australia. Negotiations are in progress between the Government and the Board of Governors, and it is hoped that the present exceptional opportunity for a useful advance may not be lost.

*General Interest in the Guild's Work.*—That the work of the Guild, although carried on quietly and without ostentation, is not without interest to the general public, is evidenced by the fact that one of the leading Adelaide papers (*The Mail*) has re-published from week to week those of its reports which bear upon the physical, intellectual, and moral improvement of childhood, and its development into a healthy and useful manhood and womanhood.

ROBERT FINLAYSON,

WALTER RUTT,

*Hon. Secretaries.*

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## APPENDIX III.

*In previous attempts which have been made to introduce the Metric System into this country, considerable opposition has come from those engaged in the Textile Trades. In the following paper, Mr. ALDRED F. BARKER, M.Sc., Professor of Textile Industries, Leeds University, discusses the advantages and disadvantages which would result to the Textile Industries if the Metric System were introduced.*

## THE METRIC SYSTEM AND THE TEXTILE INDUSTRIES.

Within the British Empire there are five divisions of the Textile Industries, each specially concerned with the manufacture of a particular fibre. These, in order of importance, are the Cotton, the Wool, the Flax, the Silk, and the Hemp and Jute industries.

The Cotton industry, drawing its raw material supplies principally from the greatest non-metric country in the world—the United States of America—and selling its productions largely to non-metric countries, is naturally the most conservative in its outlook, at least so far as its weights and measures are concerned. Further, being a comparatively recent creation of the mechanical genius of Lancashire, it is probably the most consistent in all its phases, and naturally cannot be expected to wax enthusiastic until the case for the adoption of the Metric System is placed beyond all question.

The Wool industry is very largely self-contained within the Empire, but the large supplies of wool now coming from South America—a Metric continent—along with the present demands for wool textiles from metric countries, have of late widened the outlook. An even more important consideration is the restrictive effect of the remarkable variation in the standards of measurement adopted in the various woollen centres. This variation is due to the fact that many districts both within and without the Empire had evolved their particular standards before the mechanical era, and these standards are often still most tenaciously guarded. Thus, Leeds speaks a foreign language to Bradford, and no British woollen centre speaks the wool language of the United States of America. The woollen industry is a greater sinner in this respect than the worsted, simply because the worsted industry—being to a greater extent the creation of the mechanical evolution than the woollen industry—in its present form is a much later development. The flax, hemp and jute industries are perhaps more nearly akin to the woollen industry owing to their comparatively recent development on to mechanical lines. The silk industry, in the case of “net” silks, exhibits the influence of France and Italy—being at least partially metric; while, on the other hand, it exhibits the effects of the inspiration it has received from the cotton industry in working up “wastes” into what are termed “spun” silks.

There is obviously no need to dwell upon the advantage which a common system of weights and measures would confer, unless the trade axiom, that in variation and change lie the financier's opportunity, be accepted. But surely the possible “world-service” of the financier under a more uniform

system of weights and measures would totally outweigh such "opportunism" as the medley of systems at present in vogue gives rise to.

*Natural Measures in the Textile Industries.*—Cotton, being, say,  $\frac{3}{4}$  in. to 2 in. long, must be treated with rollers of corresponding diameter. The short wools used in the woollen trade must be carded and spun with machines set according to the length of staple; while in the worsted trade the distance apart of the drafting rollers, or "ratch" as it is termed, must be based upon the lengths of the fibres under treatment. In the flax and spun silk trades the length of the fibres must be taken into account in the construction of such machines as the carder and the dressing frame.

But in all these cases, the yard and its divisions is no better as a basis than the metre and its divisions, and probably none of the scales of notation employed is uniformly as simple and useful as the decimal or denary scale—not excepting the binary or duo-decimal scales.

*Artificial Measures in the Textile Industries.*—The interesting fact that we received our more artistic and complex textile industries from the Continent is shewn by the survival of the Flemish ell (27 in.) as a width in the carpet trade; and, conversely, that the Continent received its mechanical inspiration from this country is in evidence in the employment of the English inch in certain of the French, German and Russian textile districts. That most of the present-day standards of measurement in the British industries may be regarded as being based upon accidental conveniences is illustrated by the fact that the Bradford worsted comber, spinner and manufacturer indicates the weights and thicknesses of his "tops" in ozs. per 10 yards, of his "rovings" in drams per 40 yards, and of his yarns in yards (or hanks) per lb.; while his woollen neighbour more often indicates both his rovings (or condensed slivers) and yarns in yards per oz., or yards per dram. Sometimes, moreover, the worsted spinner adds to the trade difficulties by selling his yarns by the gross of hanks—the hank being 560 yards.

The system of indicating yarn counts by the yards (or hanks) to which 1 lb. of wool is extended, is, possibly not accidentally, convenient inasmuch as the square root of the yards per lb. gives approximately the yarn diameter as the reciprocal of the fraction of an inch. On the metric system the calculation stands—square root of metres per kilogram  $\times$  2.5 gives the yarn diameter as the reciprocal of the fraction of a decimetre. Both systems are equally useful in cloth structure calculations.

One other convenient relationship should be noted, viz., that as a gallon of water weighs approximately 10 lbs., 1 lb. say, of soap per gallon gives approximately a 10% solution. But the practical British manufacturer has hardly discovered this relationship and comparatively rarely uses it.

Again, with the tendency to introduce scientific method into the Textile Industries, the temperatures of the various scouring, dyeing, etc., baths are being more closely regulated. But the testing laboratory employs the Centigrade scale, while in the mill the Fahrenheit scale is employed, to the distraction of the works chemist and the mill manager alike. For example, quite recently certain controllers of industry, in discussing the temperatures

at which wool should be carbonized, were bewildered with the apparent differences of temperatures employed until, fortunately, it was discovered that some were working on the Centigrade and others on the Fahrenheit scale. With the marked development of works laboratories in the hands of men of science, how can such divergencies of scales be allowed to exist?

All these differences stand in the way of a larger view of the world service of the British Empire. If there were a British system, then the question, British v. Metric System, might be debated. But the truth is there is no British system. There is, rather, a wonderfully interesting medley of British and semi-British systems. The word "avoirdupois" indicates a French origin for our best recognised system of weights. But why not be up-to-date? The Metric System, whole-heartedly introduced, appears to be the only possible solution.

*Mechanical Difficulties.*—Among the many varieties of machines employed in the Textile Industries, tooth-gearing and leverage mechanisms reign supreme. In tooth gearing we already employ a decimal notation; and in leverage, relative lengths rather than the absolute measures of the levers are the dominating factors.

Then the Textile engineers have given away their whole case against the Metric System in that the several firms making similar machines or parts of a machine have purposely adopted a slightly different pitch to prevent interchange of parts between similar machines made by different firms. And if the truth must be told, it is that accuracy of pitch has so often in the past been noticeable by its absence that many of the best firms are or will soon be revising their models and gauges.\* And why should not this re-gauging be on the metric basis?

There is one machine, however, which does really present a difficulty, and that is the Noble Comb. The 72 boxes with which it is equipped is probably based upon the half-gross. In view of the possibilities of increasing the small circles from the usual number two to three, a comb of 100 boxes might well be constructed. Or perhaps a reduction to 50 boxes with the two small circles retained would meet the requirements of the case.

So far as loom-gearing is concerned, as this is changed at least every year, there would be little difficulty in running it all on to a metric basis easily within two years.

There may be disadvantages in changing on to the Metric System throughout the engineering trades—the financing of such a change in such a case obviously demanding serious consideration. But so far as the Textile industries are concerned there is no such serious difficulty to be encountered.

*Financial Difficulties.*—One of the great obstacles in the way of the adoption of the Metric System in the cotton trade is the confusion which would apparently ensue in re-adjusting the wage lists—but just really efficiently worked out. It has been proved elsewhere,† however, that in such a matter as the introduction of the Northrop loom, necessitating a change in the rate

\*See "Metric System in the Textile Industries," issued by the Decimal Association.

†This is not so true of the Cotton machinery makers as of the Wool machinery makers.

and method of payment, there has been little difficulty in making the adjustment; and it is feasible to suppose that the necessary wage list conversions on to a metric basis, with the necessary adjustments, could readily be prepared and would speedily be accepted.

The Metric System being a decimal system, particularly lends itself to the calculating machine, and if the English vagaries of 36in., 37in., 54in., 56in., and 58in. widths of fabric, with their respective weights, can be brought down to a square metre basis, a decimalized monetary system adopted, and rates of exchange standardized, then our merchanting system will undoubtedly attain much nearer to the condition so strongly urged, for example, by Ruskin, in "Unto this Last," than can ever be possible under the present chaotic, and indirectly enervating, conditions. As an Empire our interests lie with, not against, the change; that is, if we are prepared to take our place in industrial world-service with clear brain and unfettered energy of purpose. Of course, if we wish merely to drift and snatch as much of the good things of this world as we can, then equally our course is clear—it may even pay us to play the "dog-in-the-manger" game.

*Staffing Difficulties.*—This brief survey of the problems would not be complete without some reference to the problems of the staffing of our mills and warehouses when the change comes. In one case coming within the knowledge of the writer, a Yorkshire manufacturer was deterred from adopting the system throughout his works by the difficulty of training every fresh hand he would naturally have to engage as he lost the trained members of his staff. This is a very real difficulty which, fortunately, would be overcome easily within two years were the Metric System definitely adopted, and were our schools and colleges energetically to prepare for the change. There would certainly be a weeding out of "old-stager inefficients"; but would the men who could not face the change be really worthy of any commanding position in the industry? Certainly not if the world's competition is to be faced with efficient brains and efficient organisation. The revitalizing of the industry in this way would be one of the great advantages which would follow the change. That there are difficulties which cannot be ignored and which must not be minimized, all will admit; but in view of the new light which is breaking upon us as a world-wide Empire destined to lead the nations of the world in a broad, beneficent service to mankind, can we hesitate? May not this be our crucial test? How we respond to the test may not decide our fate, but it will almost certainly decide the fate of our children and of our children's children. The question is urgent and possibly more important—much more important—than it appears to be on the surface.

ALDRED F. BARKER.



## APPENDIX IV.

## GOVERNMENT COMMITTEES.

In March, 1916, Mr. Asquith, then Prime Minister, appointed a Committee of the Cabinet to consider and advise upon the problems that will arise at the conclusion of peace, and to co-ordinate the work done by various Departments of the Government in this direction. This Reconstruction Committee has been reconstituted by the new Government, and Mr. Lloyd George is now chairman of it, with Mr. Edwin S. Montague as Vice-Chairman. The other members of the Committee are:—Prof. W. G. S. Adams, Mr. J. R. Clynes, Sir A. M. Duckham, Mr. R. Hazleton, Major J. W. Hills, Mr. T. Jones, Mr. O. H. Kerr, Dr. Marion Phillips, Mr. R. Seebohm Rowntree, the Marquis of Salisbury, Mr. Leslie Scott, Sir J. Stevenson, Mr. J. H. Thomas, and Mrs. Sidney Webb. Mr. Vaughan Nash is the chief secretary of the Committee. Several sub-Committees have been appointed to report to the Reconstruction Committee, among them being the following:—

*Review of Education.*—To consider the system of education as a whole; to review and formulate from that point of view proposals for developing it, particularly in directions indicated as desirable or necessary by experience gained during the war, and with special reference to:—

- (a) Proposals prepared before the war for the development of the national system of education;
- (b) The memoranda already submitted by the Education Departments for the consideration of the Reconstruction Committee;
- (c) Any proposals submitted hereafter from the Departments, or from special Committees, or from other responsible organisations.

*Teaching of Science.*—To inquire into the position occupied by natural science in the educational systems of Great Britain, especially in secondary schools and universities; and to advise what measures are needed to promote its study, regard being had to the requirements of a liberal education, to the advancement of pure science, and to the interests of the trades, industries, and professions which particularly depend upon applied science.

In considering the provision of scholarships, bursaries, etc., the Committee will take into account the report of the Consultative Committee of the Board of Education on this subject.

*Members:* Sir J. J. Thomson (Chairman), the Right Hon. F. D. Acland, Prof. H. B. Baker, Mr. Graham Balfour, Sir W. Beardmore, Bart., Sir G. H. Cloughton, Bart., Mr. C. W. Crook, Miss E. R. Gwatkin, Mr. A. D. Hall, Sir H. Hibbert, Mr. D. H. Nagel, Mr. W. Neagle, Dr. F. G. Ogilvie, Dr. Michael Sadler, Prof. E. H. Starling, Mr. W. W. Vaughan, Mr. F. B. Stead, Inspector (Board of Education) (Secretary).

*Teaching of Modern Languages.*—To inquire into the position occupied by the study of modern languages in the educational systems of Great Britain, especially in secondary schools and universities, and to advise what measures are required to promote their study, regard being had to the require-

ments of a liberal education, including an appreciation of the history, literature, and civilisation of other countries, and to the interests of commerce and public service.

In considering the provision of scholarships, bursaries, etc., the Committee will take into account the report of the Consultative Committee of the Board of Education on this subject.

*Members:* Mr. Stanley Leathes (Chairman), Mr. C. A. Montague, Mr. E. Bullough, Mr. A. C. Coffin, the Right Hon. Sir Maurice de Bunsen, Dr. H. A. L. Fisher, Miss Margaret Gilliland, Mr. H. C. Gooch, Mr. J. W. Headlam, Mr. Laurence D. Holt, Dr. Walter Leaf, Dr. George Macdonald, Mr. Albert Mansbridge, Mr. Nowell Smith, Miss M. J. Tuke, Sir James Yoxall, Mr. A. E. Twentyman, Board of Education (Secretary).

*Juvenile Education in Relation to Employment after the War.*—To consider what steps should be taken to make provision for the education and instruction of children and young persons after the war, regard being paid particularly to the interests of those—

- (1) Who have been abnormally employed during the war;
- (2) Who cannot immediately find advantageous employment;
- (3) Who require special training for employment.

*Members:* The Right Hon. J. Herbert Lewis (Chairman), Mr. W. A. Appleton, Mr. R. A. Bray, Mr. F. W. Goldstone, Mr. Spurley Hey, Alderman Hinchliffe, Miss C. Martineau, Mr. J. F. P. Rawlinson, Lady Edmund Talbot, Mr. H. M. Thompson, Mr. Christopher H. Turnor, together with the following representatives of the Government Departments concerned:—Mr. A. B. Bruce, of the Board of Agriculture; Mr. E. K. Chambers, C.B., of the Board of Education; Mr. F. Lavington, of the Board of Trade; Mr. F. Pullinger, C.B., of the Board of Education; Mr. C. E. B. Russell, of the Home Office; Mr. J. Owen, Board of Education (Secretary); Mr. G. McFarlane, Board of Education (Assistant Secretary).

*Commercial and Industrial Policy.*—To consider the commercial and industrial policy to be adopted after the war, with special reference to the conclusions reached at the Economic Conference of the Allies, and to the following questions:—

- (a) What industries are essential to the future safety of the nation, and what steps should be taken to maintain or establish them;
- (b) What steps should be taken to recover home and foreign trade lost during the war, and to secure new markets;
- (c) To what extent, and by what means, the resources of the Empire should and can be developed.
- (d) To what extent, and by what means, the sources of supply within the Empire can be prevented from falling under foreign control.

*Members:* The Lord Balfour of Burleigh, K.T. (Chairman), Mr. Arthur Balfour, Mr. H. Gosling, Mr. Richard Hazleton, Mr. W. A. S. Hewins, Mr. A. H. Illingworth, Sir William McCormick, Mr. A. McDowell, Sir J. P. Maclay, Bart., the Rt. Hon. Sir A. Mond, Bart., M.P., Mr. John O'Neill,

Mr. Arthur Pease, Mr. R. E. Prothero, Sir Frederick H. Smith, Bart., Mr. G. J. Wardle, together with the following gentlemen, who are presiding over Board of Trade committees on the position of important industries after the war :—Sir H. Birchenough, Sir A. A. Booth, Bart., the Lord Faringdon, Sir Clarendon Golding Hyde, Sir Gerard A. Muntz, Bart., the Hon. Sir C. A. Parsons, the Lord Rhondda, Mr. G. Scoby-Smith; Secretaries, Mr. Percy Ashley, Board of Trade, and Mr. G. C. Upcott, Treasury.

In reply to a suggestion made by the Guild, Mr. Percy Ashley, one of the Secretaries of this Committee, stated on April 20th that Sir William Pearce, M.P., had been appointed to be a member, and that Sir William McCormick had been specially added to the Committee in order to form a link between its work and that of the Department of Industrial and Scientific Research.

The Committee is now considering the subject of the position and claims of the metric system.

#### BOARD OF TRADE COMMITTEES.

In last year's Report particulars were given of a number of Government and other committees appointed to consider national scientific problems. In addition to these committees and the sub-committees of the Reconstruction Committee, the following have been appointed in connection with the Board of Trade "to consider the position of" the various trades in question "after the war, with special reference to international competition, and to report what measures, if any, are necessary or desirable to safeguard that position."

*Electrical.*—The Hon. Sir Charles A. Parsons, Mr. J. Annan Bryce, M.P., Mr. T. O. Callender, Mr. J. Devonshire, Sir John Snell, Mr. P. Ashley, Prof. S. J. Chapman, Mr. B. M. Drake.

*Textile Industries.*—Sir Henry Birchenough, Sir Frank Forbes Adam, Mr. J. Beattie, Mr. T. Craig-Brown, Mr. E. B. Fielden, Mr. J. W. Hill, Mr. A. H. Illingworth, M.P., Mr. J. H. Kaye, Mr. E. H. Langdon, Mr. J. W. McConnel, Mr. H. Norman Rae, Sir Fredk. H. Smith, Bart., Mr. T. C. Taylor, the Rt. Hon. Robert Thompson, Mr. C. T. Smith, Mr. Frank Warner, Mr. T. M. Ainscough (Secretary).

*Shipping and Shipbuilding Industries.*—Sir Alfred A. Booth, Bart., Sir Archibald Denny, Bart., Prof. W. S. Abell, Sir Edward Hain, Capt. H. B. Hooper, Mr. Summers Hunter, Sir Joseph Maclay, Bart., Mr. J. Readhead, Mr. O. Sanderson, Mr. J. Brown.

*Non-Ferrous Metals.*—Sir Gerard Albert Muntz, Bart. (Chairman), Mr. C. L. Budd, Mr. C. Cookson, Mr. C. W. Fielding, Lieut.-Col. A. J. Foster, Mr. A. W. Tait, Mr. A. H. Wiggin.

*Coal Trade.*—Messrs. Cory Brothers and Co., Ltd., Messrs. Mann, George, and Co., Messrs. Hull, Blyth and Co., Messrs. William Mathwin and Son, Messrs. Mackenzie and Phylson, Ltd., Messrs. Pyman, Bell and Co., Mr. T. E. Watson, Sir Richard Mackie, Mr. A. E. Bowen, Mr. N. Dunn, Mr. F. J. Jones, Mr. A. Nimmo, Mr. A. F. Pease, Sir Daniel M. Stevenson, Bart., Mr. R. Warham, the Rt. Hon. Lord Rhondda.

*Engineering.*—Sir Clarendon Hyde (Chairman), Mr. Arthur Balfour, Mr. A. J. Hobson, Mr. W. B. Lang, Sir Hallewell Rogers, Mr. H. B. Rowell, Mr. Douglas Vickers.

*Iron and Steel Industries.*—Mr. G. Scoby Smith (Chairman), Sir Hugh Bell, Bart., Mr. A. Colville, Mr. J. E. Davidson, Mr. J. Gavin, Mr. J. Hodge, Mr. J. King, Mr. G. Mure Ritchie, Mr. H. Summers, Mr. B. Talbot, Mr. C. R. Woods (Secretary).

In addition to these the following Board of Trade Committees have been announced during the year :—

A Committee to investigate the principal causes which have led to the increase of prices of commodities of general consumption since the beginning of the war, and to recommend such steps, if any, with the view of ameliorating the situation as appear practicable and expedient, having regard to the necessity of maintaining adequate supplies. *Members:*—Rt. Hon. J. M. Robertson (Chairman), Mrs. Pember Reeves, Mr. W. C. Anderson, Prof. W. J. Ashley, Mr. John Boland, Mr. T. Brodrick, Sir Gilbert Claughton, Bart., Mr. J. R. Clynes, Mr. R. E. Prothero, Mr. T. Shaw, and Sir W. Capel Slaughter, Mr. E. C. Ramsbottom, of the Board of Trade, is Secretary.

A Committee to consider and report what steps should be taken, whether by legislation or otherwise, to ensure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development. *Members:*—Mr. F. Huth-Jackson (Chairman), Mr. H. Booth, Mr. J. Devonshire, Mr. J. Falconer, Mr. G. H. Hume, Mr. J. Kemp, Mr. H. H. Law, Mr. C. H. Merz, Sir Charles Parsons, Sir John Snell, Alderman C. F. Spencer, and Mr. A. J. Walter. Secretary, Mr. M. J. Collins.

An inter-departmental Committee, presided over by Mr. Harcourt, has arranged the respective spheres of work and co-operation, in dealing with commercial inquiries, of the new Commercial Intelligence Department of the Board of Trade and the Imperial Institute, which in recent years has become a central department for information and investigation respecting the sources and uses of the raw materials of the Empire. In future the Technical Information Bureau of the Imperial Institute will answer all commercial inquiries respecting the sources of supply, technical uses, and value of raw materials within the Empire, and will be responsible for supplying all information required in order to bring the producer overseas in touch with the manufacturer at home. Inquiries as to immediate supplies may be addressed either to the Board or to the Institute, as may be most convenient, but the Commercial Intelligence Department of the Board of Trade will as a rule be prepared to deal with inquiries for immediate supplies of well-known raw materials which can be obtained at once through ordinary trade channels. In answering those inquiries in which special statistical or trade information is required in addition to technical information, the Board and the Institute have arranged to co-operate. Investigations of the possible industrial uses

of raw materials will, as heretofore, be dealt with by the Imperial Institute. The arrangement proposed by the Committee has now been accepted by the Secretary of State for the Colonies, the President of the Board of Trade, and the Executive Council of the Imperial Institute.

#### ROYAL COMMISSION.

To inquire into the supply of wheat and flour in the United Kingdom; to purchase, sell, and control the delivery of wheat and flour on behalf of his Majesty's Government; and generally to take such steps as may seem desirable for maintaining the supply. *Members*:—The Earl of Crawford (Chairman), Alan Garratt Anderson (Vice-Chairman), Sir Henry Rew, Sir George Saltmarsh, Mr. H. W. Patrick, Mr. Hugh Rathbone, Mr. Oswald Robinson, Mr. J. F. Beale, and Mr. T. B. Royden.

#### TREASURY.

A Committee to consider and report upon the existing scheme of examination for Class I. of the Home Civil Service. The terms of reference are:—To submit for the consideration of the Lords Commissioners of his Majesty's Treasury a revised scheme such as they may judge to be best adapted for the selection of the type of officer required for that class of the Civil Service, and at the same time most advantageous to the higher education of this country; and, in framing such a scheme, to take into account, so far as possible, the various other purposes which the scheme in question has hitherto served, and to consult the India Office, the Foreign Office, and the Colonial Office as to their requirements, in so far as they differ from those of the Home Civil Service. *Members*:—Mr. Stanley Leathes (Chairman), Sir Alfred Ewing, Sir Henry A. Miers, Principal W. H. Gadow, and Prof. W. G. Adams. Secretary, Mr. D. B. Mair.

#### INDIA OFFICE.

The Secretary of State for India has authorised the Indian Committee of the Imperial Institute to inquire into and report on the possibilities of extending further the industrial and commercial utilisation of Indian raw materials in this country and elsewhere in the Empire. The Committee has already commenced its work and has appointed a number of sub-committees to deal with the more important groups of materials, to consider the results of investigations and inquiries already conducted by the Imperial Institute, and to obtain the views of leading merchants, manufacturers, and other users of the raw products of India. One of the important aspects of the Committee's work will be to suggest openings for the employment of those Indian materials which before the war went to enemy countries. The Indian Committee of the Imperial Institute includes Lord Islington (Under-Secretary of State for India), Sir Marshall Reid (member of the India Council), Prof. Wyndham Dunstan (Director of the Imperial Institute), Mr. L. J. Kershaw (Secretary, Revenue and Statistical Department, India Office), Sir John

Hewett (formerly Lieutenant-Governor of the United Provinces), Mr. G. B. Allen (of Messrs. Allen Bros. and Co. and Messrs. Cooper Allen, Cawnpore), Mr. Yusaf Ali (late Indian Civil Service), Sir R. W. Carlyle (lately member of the Viceroy's Council), and Sir J. Dunlop Smith. Mr. C. C. McLeod, Chairman of the London Jute Association, is Chairman of the Committee, and the Secretary is Mr. A. J. Hedgeland, of the Imperial Institute.

#### BOARD OF AGRICULTURE AND FISHERIES.

A Committee of representative agriculturists to advise on questions arising in connection with the increased production of food. *Members*:—The Right Hon. R. E. Prothero (Chairman), the Right Hon. Sir Ailwyn E. Fellowes (Vice-Chairman), the Right Hon. F. D. Acland, the Right Hon. Henry Hobhouse, the Hon. Edward G. Strutt, Sir Sydney Olivier (Board of Agriculture), Mr. W. W. Berry (Development Commissioner), Mr. S. W. Farmer, Mr. F. L. C. Floud (Board of Agriculture), Mr. A. D. Hall (Development Commissioner), Mr. S. Kidner, Mr. T. H. Middleton (Board of Agriculture), Mr. A. Moscrop, Mr. H. Padwick (National Farmers' Union), Mr. R. G. Paterson, Mr. G. G. Rea, Mr. E. Savill, Mr. Leslie Scott, and Prof. W. Somerville. Mr. E. M. Konstam is the Secretary of the Committee.

A Committee to consider practical means for increasing the supplies of sea-fish for the home markets and for encouraging the consumption of such fish, whether cured or fresh, in substitution for other foods. The Committee has received a grant from the Development Fund, with authority to expend the grant, subject to limitations and conditions recommended by the Development Commissioners and approved by the Treasury, at their discretion for the increase of the fishing power of vessels other than steam fishing vessels. In general their expenditure will be confined to assisting fishermen who are owners of their own boats to develop their fishing power and to secure greater quantities of fish. *Members*:—Mr. Cecil Harmsworth (Chairman), Mr. H. S. M. Blundell, of the Admiralty War Staff (Trade Division), Mr. H. G. Maurice, of the Board of Agriculture and Fisheries; Mr. E. H. Collingwood, of the Board of Agriculture and Fisheries; Mr. Stephen Reynolds, representing the Development Commissioners; Mr. A. Towle, representing the Food Controller. Secretary and Manager, Mr. G. K. Hext.

A Committee to consider whether any considerable addition to the home food supplies of fish could be provided from the rivers, lakes, and ponds of England and Wales. The Committee is requested to have special regard to considerations affecting the practicability of any scheme for bringing fresh-water fish supplies into consumption, such as the machinery and labour required to make the supplies available, facilities for their transport to market, the food value of the different kinds of fish, the probability of its proving acceptable to the consumer, the necessity for interference with private rights, and the risk of damage to more valuable fisheries. Further, the Committee will consider and report upon measures which might be taken for securing a greater output of eels from the waters of the United Kingdom for home consumption. *Members*:—Lord Desborough (Chairman), Mr. R. B.

Marston, Mr. A. R. Peart, Mr. F. G. Richmond, Mr. H. T. Sheringham, Mr. C. Tate Regan, and Sir John Wrench Towse. Secretary, Hon. A. S. Northcote.

#### FOOD CONTROLLER'S DEPARTMENT.

A Committee of manufacturers of sulphate of ammonia to advise on questions affecting its production and distribution, and to give effect to an approved scheme for regulating the distribution of supplies to farmers in all parts of the United Kingdom. *Members*:—Mr. D. Milne Watson (Chairman), Mr. W. Fraser, Mr. E. J. George, Mr. W. R. Hann, Mr. N. N. Holden, Mr. A. K. McCosh, Alderman F. S. Phillips, Mr. A. Stanley, and Mr. F. C. O. Speyer (Secretary).

A Committee to make such arrangements as may be necessary and expedient for the increase of supplies of fertilisers in the United Kingdom and for controlling, so far as may be necessary, their output and distribution. *Members*:—Captain C. Bathurst (Chairman), Mr. H. R. Campbell, Sir James J. Dobbie, Mr. R. R. Enfield, Captain R. B. Greig, Mr. T. H. Middleton, Mr. W. Anker Simmons, Prof. W. Somerville, Mr. G. J. Stanley, Mr. R. J. Thompson, Prof. T. B. Wood, and Mr. H. Chambers (Secretary).

#### MINISTRY OF MUNITIONS.

A Petroleum Branch of the Ministry of Munitions has been formed, and the Minister has appointed Sir Boverton Redwood as Director of Petroleum Research, to conduct the investigation and development of hitherto unproved home sources of supply of mineral oils.

Two Committees—an owners' committee and a workmen's committee—to deal with certain problems connected with the Scottish shale industry. Prof. John Cadman represents the Ministry, and acts as Chairman of the two committees when they meet in joint session, Mr. J. C. Clarke representing the Admiralty, and Mr. H. Walker, H.M. Divisional Inspector of Mines, will serve on both the owners' and the workmen's committees. Sir George Beilby has been appointed to act as technical adviser, and Mr. Hugh Johnstone is a member of the Committee and acts as Secretary.

A new branch of the Ministry of Munitions has been established under Sir Lionel Phillips as Controller, to deal with the examination and development of such mineral properties (other than coal or iron ore) in the United Kingdom as are considered likely to be of special value for the purposes of the war. The Minister of Munitions has appointed the following to act as an advisory committee on the development of mineral resources:—Sir Lionel Phillips, Bt. (Chairman), Mr. F. J. Allan, Mr. C. W. Fielding, Mr. R. J. Frecheville, Prof. F. W. Harbord, Mr. F. Merricks, Sir Harry Ross Skinner, Dr. A. Strahan, and Mr. Edgar Taylor, together with a representative to be nominated by the Board of Trade.

#### ADVISORY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

A Standing Committee on Metallurgy consisting as to one-half of members nominated by the professional societies concerned, the other half being

appointed direct by the Advisory Council. The Committee has been constituted with a view to the representation of both the scientific and the industrial sides of the industries. *Members*:—Prof. J. O. Arnold, Mr. Arthur Balfour, Prof. H. C. H. Carpenter, Dr. C. H. Desch, Sir Robert Hadfield, Mr. F. W. Harbord, Mr. J. Rossiter Hoyle, Prof. Huntington, Mr. W. Murray Morrison, Sir Gerard Muntz, Bt., Mr. G. Ritchie, Dr. J. E. Stead, Mr. H. L. Sulman, and Mr. F. Tomlinson. Sir Gerard Muntz is the Chairman of the full Committee and of the Non-ferrous Sub-Committee, and Sir Robert Hadfield is the Chairman of the Ferrous Sub-Committee.

A Standing Committee on Engineering so constituted as to represent both the scientific and the industrial sides of engineering, and including the following members nominated by the professional associations:—Institution of Civil Engineers, Sir Maurice Fitzmaurice; Institution of Electrical Engineers, Mr. J. S. Highfield; Institution of Mechanical Engineers, Dr. Dugald Clerk; Institution of Naval Architects, Sir Archibald Denny, Bart.; N.E. Coast Institution of Engineers and Shipbuilders, Mr. Herbert Rowell; Manchester Association of Engineers, Mr. Alfred Saxon; Institution of Engineers and Shipbuilders in Scotland, Mr. James Brown; and the following members appointed directly by the Advisory Council:—Mr. F. R. Davenport, Mr. Alfred Herbert, Prof. Bertram Hopkinson, Mr. C. H. Merz, Mr. V. L. Raven, Mr. A. A. Remington, Mr. G. Gerald Stoney, Mr. Douglas Vickers, and Prof. Miles Walker. Sir Maurice Fitzmaurice is Chairman of the Committee.

A Standing Committee on Mining constituted so as to represent both the scientific and industrial sides. The Committee includes the following members nominated by professional associations:—Institution of Mining Engineers: Sir William Garforth, Dr. John Haldane, Dr. R. T. Moore, Mr. Wallace Thorneycroft; Institution of Mining and Metallurgy: Mr. Edward Hooper, Mr. Edgar Taylor; Iron and Steel Institute: Prof. H. Louis; the South Wales Institute of Engineers: Mr. W. Gascoyne Dalziel; and the following members appointed directly by the Advisory Council:—Sir Hugh Bell, Bart., Mr. Hugh Bramwell, Lieut.-Colonel W. C. Blackett, Prof. Cadman, Prof. Frecheville, Mr. Bedford McNeill, Mr. Hugh F. Marriott, Sir Boverton Redwood, Bart., Mr. C. E. Rhodes. The Advisory Council has appointed Sir William Garforth to be chairman. The Committee is divided into two sections, as follows:—*Section on\*the Mining of Iron, Coal and Hydrocarbons*: Sir William Garforth (Chairman), Sir Hugh Bell, Bart., Mr. Hugh Bramwell, Lieut.-Col. W. C. Blackett, Prof. Cadman, Mr. W. Gascoyne Dalziel, Dr. John Haldane, Prof. Louis, Dr. R. T. Moore, Sir Boverton Redwood, Bart., Mr. C. E. Rhodes, Mr. Wallace Thorneycroft. *Section on the Mining of Minerals other than Iron, Coal, and Hydrocarbons*: Mr. Edgar Taylor (Chairman), Sir Hugh Bell, Bart., Prof. Frecheville, Mr. Edward Hooper, Prof. Louis, Mr. Bedford McNeill, Mr. Hugh Marriott.

A Standing Committee on Glass and Optical Instruments. *Members*:—Prof. H. Jackson (Chairman), Mr. Conrad Beck, Prof. C. V. Boys, Mr. F. J. Cheshire, Mr. A. E. Conrady, Mr. A. S. Esslemont, Mr. J. W. French, Dr. R. T. Glazebrook, Sir Howard Grubb, Mr. E. B. Knobel, Dr. T. R. Merton,



Prof. W. J. Nicholson, Capt. Creagh Osborne, Mr. H. J. Stobart, Mr. J. Stuart, Mr. M. P. Swift, Mr. W. Taylor, Mr. F. Twyman, Lieut.-Col. A. C. Williams, and Mr. W. F. J. Wood. The Committee, having regard to the urgency of the problems requiring investigation in respect of these essential industries, has appointed a series of sub-committees to which various special problems have been referred. Among these problems the more important are : (a) Raw material for glass and glassmaking. (b) Optical properties of a large range of glasses. (c) General physical and chemical properties of glass and glassware for scientific and industrial purposes. (d) Testing and standardising of glassware. (e) Workshop technique. (f) X-ray glass apparatus. (g) Optical calculations and lens designing. (h) Optical instruments.. (i) Translation of foreign works on optics. The Standing Committee does not propose to limit itself to these subjects, but is prepared to consider and report upon the necessity for investigation in other directions relevant to its terms of reference.

A Board of Fuel Research. Sir George Beilby is Director of the new organisation, and is assisted by the Hon. Sir C. Parsons, Mr. R. Threlfall, and Sir R. Redmayne, as members of the Board. By arrangement with the Governors of the Imperial College of Science and Technology, Prof. W. A. Bone is retained as consultant to the Board of Fuel Research under the Department of Scientific and Industrial Research, continuing to hold his chair at the Imperial College.

#### ADVISORY COMMITTEE FOR AERONAUTICS.

A Light Alloys Sub-committee, to advise Government Departments on questions relating to light alloys, to institute research for the development and improvement of such alloys and the methods of working them, and to assist in the removal of difficulties which may arise in their production and use. *Members* :—Mr. Henry Fowler, Superintendent of the Royal Aircraft Factory, Chairman; Lieutenant-Commander C. F. Jenkin, and Prof. F. C. Lea, representing the Air Board; and Captain H. P. Philpot, Mr. A. W. Johns, and Dr. W. Rosenhain, representing respectively the Aeronautical Inspection Department, the Director of Naval Construction, Admiralty, and the National Physical Laboratory; together with the Chairman of the Advisory Committee for Aeronautics, *ex officio*.

## APPENDIX V.

## ENDOWMENT OF EDUCATION AND RESEARCH.

*United States.*

The sub-committee on research funds of the Committee of One Hundred of the American Association for the Advancement of Science has prepared a report on research funds in the United States, particularly such as are available without substantial limitations as to the residence and so on of the person receiving the grant. A list of the more important endowments to which no restrictions are attached, with the exception of those devoted to medical research, has been published, and it shews that the total capital value of these endowments is £4,603,150. Those funds where the endowment reaches £5,000 or more are as follows:—The Carnegie Institution, £4,400,000; the Smithsonian Institution, £50,000; the Engineering Foundation Board, New York City, £40,000; the National Academy of Sciences, £30,640—including the Bache Fund, £11,200, and the Watson Fund, £5,000; the American Association for the Advancement of Science, £20,000, made up of the Colburn Fund of £15,000 and the General Research Fund of £5,000; the American Academy of Arts and Sciences, £15,760, made up of the Rumford Fund of £13,260 and the C. M. Warren Fund of £2,500; the California Academy of Sciences, £13,000; Harvard College Observatory Advancement of Astronomical Science Fund, £8,000; the National Geographic Society Fund for Exploration and Geographical Research, £7,000; the Elizabeth Thompson Science Fund, £5,200; and the Archæological Institute of America, Washington, £5,000.

The General Education Board of the United States, founded by John D. Rockefeller “to promote Education within the United States,” without distinction of race, sex, or creed, has, since its organisation in 1902, made grants amounting to £3,677,400. This amount was either appropriated outright or towards total funds to be raised amounting in all to £12,897,400. Of the grants made during this period, about £600,000 was for medical schools, £2,500,000 for universities and colleges, £20,000 for further prosecution of educational researches, £180,000 for colleges and schools for negroes, £60,000 for professors of secondary education, and £20,000 for farm demonstration work.

Among gifts and bequests to higher education in the United States announced in *Science* and *Nature* since the last Report, the following are noteworthy:—Yale University, £137,000, from the estate of the late Mr. J. S. Hotchkiss.—Under the will of Mr. W. W. Lawrence, of Pittsburgh, Princeton University will ultimately receive £125,000.—Under the will of the late President of the University of Pennsylvania Museum, Mr. E. B. Coxe, Junior, £100,000, as an endowment of the museum, and £20,000 towards increasing the salaries of professors.—Columbia University, £20,000 from Mr. J. N. Jarvie for the new dental school; and the University of California, £14,000 from Prof. G. H. Howison and his wife.—£200,000 by the Billings family of Chicago to the University of Chicago towards the

endowment of the medical school.—£10,000 by Mr. J. H. Schiff to New York University for the division of public affairs in the school of commerce.—A bequest by Mr. J. D. Archbold to Syracuse University amounting to £100,000.—Under the will of the late Mr. C. W. Harkness, Yale University to receive £100,000, and the Harkness Fund for scientific and educational work £50,000.—A bequest of £30,000 to John Hopkins University by Miss Jessie Gillender for the purpose of instituting organised research into the problem of epilepsy.—A sum of not less than £50,000 to Lafayette College as the residuary legatee of the late Mr. A. N. Seip, of Washington, D.C.—Harvard University, £10,300 from the estate of Mr. J. A. Beebe, and of £10,000 from the estate of Mrs. F. W. Matchett, the income of both to be used for general purposes.—By the will of the late Dr. J. W. White, and Prof. J. R. Barton, £30,000 is bequeathed in trust to the University of Pennsylvania as a permanent endowment fund, the income to be used for establishing a professorship of surgical research in the medical department of the university.—Washington University Medical School, £100,000.—To the American Association for the Study and Prevention of Tuberculosis, from the Metropolitan Life Insurance Co., £20,000 for a “community experiment,” with the idea of proving that tuberculosis can be controlled.

#### *British Isles.*

University College of Wales, Aberystwyth, from friends of the College, £100,000 to the funds of the College, subject to a reservation of their right to make such proposals as they may deem expedient to the Council, either as to the capital or as to the income therefrom.—The late Mr. D. M. Forbes, to the University of Edinburgh, the residue of his property, which will amount, it is understood, to about £100,000, for the purposes of education.—By the will of Sir George Franklin, in the event of his adopted daughter leaving no issue, £25,000 to the University of Sheffield, to be applied for founding such chairs as the Council may decide, and £5,000 to the Corporation of Sheffield, the income to be applied by the local education committee in providing scholarships tenable at Sheffield University for boys and girls educated at the Central Secondary School.—Mr. Joseph Constantine, a guarantee of £40,000 for the erection of a technical college on a piece of ground which had already been purchased by the Middlesbrough Town Council for such a purpose.—The University of Sheffield, £32,000 under the will of Mr. Edgar Allen, the greater part of the money to be devoted to the provision of scholarships, half of them for sons of working men. Five thousand pounds is to go to the Applied Science Department, and Sir Joseph Jones has added a similar sum, making £10,000, which will be devoted to the provision of a material testing laboratory. The Council has also received from Mr. Sydney Jones a gift of £8,000 to endow a Chair of Classical Archæology to be associated with the name of his late father, C. W. Jones.—Prof. W. A. Herdman and Mrs. Herdman, the sum of £10,000 to the University of Liverpool, for the endowment of a Chair of Geology in the University, as a memorial to their son, George Andrew Herdman, who was killed in action on the Somme.—Mr. H. Laming, £10,000 to Queen’s College, Oxford, to

establish four scholarships of £100 per annum, tenable for either three or four years, one to be offered each year. The scholars will, as a rule, be expected to take the Russian language for the honours degree.—Mrs. Streatfeild, £10,000 in Consols, to be held in trust jointly by the Royal College of Physicians of London and the Royal College of Surgeons in England, for the promotion of research.—Sir James Roberts, £10,000 to the University of Leeds for the foundation and maintenance of a Professorship of the Russian Language and Literature.—Anonymous donors to the University of Cambridge £10,000, for the endowment of a school of Spanish.—Lord and Lady Cowdray, £10,000 for the endowment of a Chair of Spanish Language and Literature in the University of Leeds.—Mr. Henry Musgrave, £10,000 to Queen's University, Belfast, to endow a chair in connection with Russian Language and Literature.—To the National Museum of Wales, £10,000, from Captain W. R. Smith, towards the building fund of the new museum.—The late Sir James Sivewright, £5,000 to Milne's Institution, Fochabers, and £10,000 to the University of Aberdeen.—Messrs. Baldwins, Ltd., £10,000 to the Swansea Technical College for the endowment of a chair of metallurgy.—Miss C. E. Beckwith, one-half of the residue of her estate, which amounts to about £8,000, to the Victoria University of Manchester in aid of the "John Henry Beckwith Scholarship," founded by her mother.—Miss E. G. Everest, of Chippens Bank, Hever, Kent, bequeathed her house to the National Trust to be used as a home of rest for tired brain-workers, particularly writers and artists; and the land round the house to the National Trust to be used as a public park for the use of the nation, and as a bird sanctuary, where bird-life shall be encouraged, together with £8,000 for the maintenance of the estate.—The late Lady Kelvin of Largs, widow of Lord Kelvin, bequeathed to the University of Glasgow a legacy of £5,000, free of duty, to be applied by the Senate for promoting research and teaching of physical science in connection with the natural philosophy chair.—The Weardale Lead Company, two mining scholarships, each of the annual value of £60, in connection respectively with the Royal School of Mines and Armstrong College, Newcastle-upon-Tyne, with the object of combining university training with a year's practical work calculated to advance a student in the knowledge of mining engineering.

#### *India.*

In his presidential address delivered before the Indian Science Congress, Bangalore, in January, 1917, Sir Alfred G. Bourne gave the following particulars of amounts allocated to research in India and institutions having that purpose. The Government of India supports a Forest Research Institute and College at Dehra Dun, and devotes about 4 lakhs a year to it; it contributes 5 lakhs a year to the Indian Research Fund, about 5½ lakhs to the Agricultural Research Institute at Pusa, and a lakh to the Central Research Institute at Kasauli. Some of the local Governments have entertained, or propose to entertain, what they call in the Budget forest research officers. The Agricultural College in the Madras Presidency has for part of its title that of

Research Institute. The Government of Bengal gives research scholarships. The Punjab Government enters a small portion of its contribution to Government colleges as a research grant. In Burma a small sum is devoted to what are called leprosy researches. The Budgets, however, provide for many other forms of scientific activity in connection with which the word "research" does not happen to have been used, such as : further experimental work in connection with agriculture, bacteriological work in connection with agriculture, bacteriological work as affecting man and animals, other investigations of a medical nature, and work relating to fisheries and other industries. Further, various Governments support museums, in some of which, at any rate, scientific work is carried on, and the Institute at Bangalore receives an annual grant of Rs.87,500 from the Government of India, which has promised, should any private individual be willing to subscribe, to provide a like amount so long as its total grant does not exceed Rs.150,000. There are also the various Imperial surveys; in some of these the expenditure is, of course, mainly debited to administrative work, but in the majority of them the funds do something towards the progress of science. Without taking the surveys into account, the annual expenditure from public funds on scientific work in British India is somewhere in the neighbourhood of Rs.70-80 lakhs—that is to say, £500,000—and to this must, of course, be added large capital sums invested in buildings. This expenditure is supplemented to some extent by the more progressive of the native States.

#### *Other Countries.*

The intention of Mme. Mittag-Leffler, and her husband, Professor G. Mittag-Leffler, the eminent mathematician, to bequeath the whole of their property to the promotion of pure mathematics, was announced in last year's Report. The bequest includes their freehold villa with its contents, among which is a fine mathematical library; and an endowment to provide for its upkeep, salary of its curator, and other specified purposes. To encourage the study of pure mathematics in Sweden, Denmark, Finland, and Norway there are to be bursaries tenable by young people of both sexes belonging to these countries. There is to be a gold medal for pure mathematics belonging to these countries, and a prize for pure mathematics, to be awarded, if possible, at least once in every six years, to be open to the whole world.—From an anonymous donor, the sum of £20,000, to the Higher Institute of Medicine for Women at Petrograd for the foundation of scholarships.—The late Mr. J. Forte, his plantation "Bennetts," and the residue of his estate in Barbados, to Codrington College in that island. The value of the bequest is expected to be not less than £10,000.—The University of Stockholm, from Mrs. Amanda Ruben, the sum of 50,000 kroner (*circa* £2,700) to found a readership in experimental zoology.

## APPENDIX VI.

## NATIONAL INSTRUCTION IN TECHNICAL OPTICS.

At a meeting of the Board of Scientific Societies, held on 12th October, 1916, the Board approved the appointment of the following Sub-Committee to consider and report upon National Instruction in Technical Optics :—

Mr. Conrad Beck, Mr. F. J. Cheshire, Mr. E. B. Knobel, Sir Philip Magnus, Prof. H. Jackson, Prof. A. Schuster.

This Sub-Committee, having given careful consideration to the subject referred to them, reported as follows :—

## REPORT OF COMMITTEE APPOINTED TO CONSIDER AND REPORT ON NATIONAL INSTRUCTION IN TECHNICAL OPTICS.

Several attempts have been made during recent years to provide systematic training in Technical Optics, and a scheme prepared by the London County Council will be referred to in this Report. But, before discussing the details of any proposals, it is advisable to form a clear conception of the requirements of the Optical Trade, and of the organisation of the teaching best adapted to promote the interests of that trade without regard to existing conditions, which no doubt will place some difficulties in the way of the immediate adoption of a thorough-going and satisfactory scheme.

It is necessary at the outset to emphasize one point which is of vital importance. If a perfect organisation for instruction and research in Optics could instantaneously be called into being, some years would necessarily elapse before the trade would appreciably benefit by it, because that trade requires above everything a sufficient supply of men thoroughly trained in the scientific principles underlying the proper construction of optical appliances. Such men are not obtainable at the present moment; they will have to be trained, and this requires time. But the next few years are the years which will determine the future of the industries of the country. To avoid a delay which might prove fatal, it is essential that provision should be made at once to give the trade such assistance and advice as will ultimately be supplied by the body of trained men which, it is hoped, will be available in a few years.

This leads us to our first recommendation. Whatever scheme should be adopted, it is essential that it should include the appointment of a highly qualified scientific man, who will be charged with the organization and direction of the whole of the teaching. This man, to whom we shall refer as the "Director"—whatever title he may subsequently receive—ought to be appointed at once. Among the duties specially assigned to him in the preliminary period should be that of advising the trade in any difficulties they may encounter. A sufficient staff should be assigned to him for the purpose. The Director should not be attached exclusively to any of the existing institutions.

A further need, which is urgent, is the supply of standard text books dealing with those parts of Optics which at present are greatly neglected in this country; this includes practically the whole of Geometrical Optics and a

large part of Technical Optics. In our opinion, the quickest and most effective manner of dealing with this requirement is by publishing translations of existing foreign books and abstracts of important papers on the subject.

In defining the range of teaching to be provided, and forming an estimate of the number and type of the students who may avail themselves of the opportunities offered, we must keep in mind that the use of a knowledge of Optics is not confined to those intending to enter the optical trade. The Army, the Navy, the Patent Office, and other Government Departments employ optical experts. We are informed that the Royal Naval College habitually send some of their ablest young officers to an optical firm, to be instructed in the principles and designs of range-finders, gunsights, and other optical instruments. Medical men, bacteriologists, surveyors, and nautical men would, also, in many cases, welcome instruction in special branches of Optics. We may here refer to the School of Economics, an institution mainly devoted, as its name implies, to a highly specialized branch of knowledge, which derives its practical importance from its connexion with matters affecting the welfare of the country. In these respects, it presents a certain analogy with the proposed School of Optics. Experience in this case shows that the instruction given has attracted, from much wider circles than was originally contemplated, students desiring instruction in special departments of economics. It is, therefore, well not to take too narrow a view, but to look upon the practical application of Optics as being one of the many points of contact between the industries and pure science. Any advance in its study will hence react beneficially on the advance of science on which it is based.

We therefore look forward to the establishment of an Optical Institute which would concentrate the efforts of all who are concerned with the manufacture or use of optical instruments. It would bring together the several Optical Societies, who might find a home within its building; it would be the centre for the co-operation of the trade with students and teachers; it should contain a library with periodicals and books on optics.

The general direction of the courses of study should—as is the case in the scheme of the London County Council—be vested in an Advisory Council on which the trade, as well as the optical and learned Societies are represented. It has already been insisted upon that there should be a Principal or Director who is highly qualified both on the theoretical and practical side, and who would be responsible to the Advisory Council. Full courses of instruction, both in day and evening classes, will be required. The day departments would consist mainly of youths between the ages of fifteen and twenty, who would receive general and technical instruction, including mathematics, physics, chemistry, and practical optical work.

The evening work would be adapted to the requirements—

- (1) of students engaged in the trade during the daytime,
- (2) of advanced students, some of whom would have graduated in science, and would be preparing to occupy the position of managers in optical works,

- (3) of other persons interested in learning the scientific construction or use of optical instruments.

Provision should be made for research work not requiring a highly specialized or expensive plant. Special investigations might be referred to the National Physical Laboratory, or any other laboratory suitable for the purpose.

It is also worth considering whether a good journal or paper should not be published, devoted to scientific instruments and other matters concerned with Optics.

We are aware of the difficulties which stand in the way of putting into immediate operation a scheme which would satisfy in a comprehensive manner all the above conditions. It will therefore be necessary to contemplate a transitional period leading up to what we ultimately hope to obtain.

In considering the provisional arrangements, regard must be had to the fact that already some very good work in the training of operatives of different classes is being done at the Northampton Polytechnic Institute, where a certain amount of modern machinery and apparatus has been provided, and young men and women are receiving useful training, the value of which has been recognised by the Government. We may also draw attention to the valuable research work being carried out in King's College, London, under the Glass Research Committee of the Institute of Chemistry. The instruction given at the Northampton Institute should, however, at once be supplemented by more advanced teaching in some convenient institution of University rank. Stress has already been laid on the immediate appointment of a Principal or Director, and there is no reason for delaying the formation of the Advisory Council. So soon as the preliminary work of organisation permits, plans should be prepared for a new building, which, in our opinion, is essential.

The scheme of the London County Council represents a carefully considered attempt to utilize and extend the teaching given in existing institutions, and to reconcile conflicting interests. Its object is, therefore, the same as that which we contemplate in the transitional period, and in its main features it seems to differ little from our proposals. It is not with the object of making any captious criticism, but merely to prevent possible misunderstanding, that we desire to point out what seem to us to be serious defects in the details of the scheme.

It is provided that the Imperial College of Science should institute a separate Department of Technical Optics, with a Head who is also to exercise some undefined powers of general supervision over the whole scheme. Being a member of the staff of the Imperial College, he would presumably be appointed to the governing body of that Institution, and primarily be responsible to it. He would have at the same time powers over the course of instruction at another institution that had no voice in his appointment. His relationship to the Advisory Council is not defined, and the proposal in its present form does not seem to us to be conducive to harmonious working. It also seems to perpetuate what, in our opinion, should only be a transitional stage. Our own proposal contemplates that the appointment of the Director



of Studies should be primarily vested in whatever body is constituted as the main governing body.

Another fundamental defect of the scheme is implied in the wording defining the distribution of the work between the Imperial College and the Northampton Institute. Stress appears to be laid on post-graduate work conducted at the Imperial College, and research work is confined to that Institution. If it be meant that the normal course of instruction should begin with a degree course in pure science, and the higher technical teaching should only begin after such a course is completed, we must express our dissent from that view. There may be some cases, no doubt, where a graduate in science will turn his mind towards Technical Optics, and provision should be made for him; but the centre of gravity of the institution must be a course extending over two or three years, in which teaching in science is, *ab initio*, directed towards the necessities of its optical applications. As regards research work, the teachers in any institution which may be built, or during the transitional period at the Northampton Institute, should be of sufficient standing to be able to conduct research work, and though no expensive or elaborate plant need be supplied, and such research work need not form a prominent part of the activity of the Institute, it is not advisable to lay down any hard or fast lines as to where researches are to be carried out. Special investigations, as has already been said, will probably be largely concentrated at the National Physical Laboratory, but they also should not necessarily be confined to any one place.

In conclusion, we may sum up the requirements which appear to us to require immediate attention :—

- (1) The appointment of a supervising representative Council.
- (2) The appointment, under the proposed supervising Council, of an administering Director, with special duties during the transitional period, which will include advice to the trade and the organisation of the different parts of the curriculum.
- (3) The translation of suitable works and the abstracting of other important publications on Technical Optics.
- (4) Pending the erection of a suitable building, the organisation of day and evening courses at the Northampton Institute, and arrangements for higher instruction at some other institution of University rank.

The term " Technical Optics " throughout the Report is intended to include the chemical composition and manufacture of glass.

The Committee is willing to give further advice with respect to the selection of books for translating or abstracting, and any other matters connected with subjects referred to in the Report.

(Signed) ARTHUR SCHUSTER, *Chairman*

This Report was received and approved by the Board at a meeting on 24th January, 1917.

(Signed) J. J. THOMSON, *Chairman*.

## FINANCE.

The Annual Statement of Accounts for the year ending 31st December, 1916, will be found on page 56. In this connection the Executive Committee desire to convey their thanks to Sir Alexander Pedler, C.I.E., F.R.S., who has kindly acted as auditor for the past year.

The revised list of donations is given on page 57.

The outstanding feature in the financial history of the Guild for the year has been the decision to increase the rates of subscription for any new members. It was found that the former rate of yearly subscription of two shillings and sixpence for members was really worked at a loss, as this sum was insufficient to pay printing and postage charges for the issue of the numbers of the Journal, notices, invitation cards to the Annual Meeting, to say nothing of any payment for office rent, salaries, etc. The annual rate of subscription for members joining the Guild in future was therefore raised to ten shillings, and the compounding fee for such members to five pounds instead of the previous two guineas. Also, as stated previously, further efforts were made to increase the membership of the Guild, and during the year 116 new members and fellows joined.

At the same time, on the change in the rates of subscription being brought to the notice of the old members of the Guild, many of them converted their life membership into life fellowship, or into life membership on the new terms, and some increased their previous annual subscriptions. From these two causes the amount received by the Guild during 1916 on account of "compounding fees, subscriptions, entrance fees," etc., was £642 3s. od., an increase of £545 over the amount received from similar sources in 1915. It must not be thought, however, that the whole of this is an increase in the *annual income* of the Guild. The greater part (probably about four-fifths of this sum of £545) represents the amounts which were received in 1916 in payment of life compositions, etc., and therefore will not occur again. The *annual income* of the Guild from the subscriptions of the present number of fellows and members, together with the income from the investments of the Guild, will only come to about £220 a year, which is considerably less than the annual expenditure. It is therefore clearly necessary that continued efforts should be made to increase the membership of the Guild.

In previous years the generous help of the President has enabled the Guild to carry on its work and increase its scope of action, even though the usual sources of income are rather limited. Indeed, as will be seen from the accounts of 1916, Sir William Mather has continued his generous assistance.

In the year under review the increased receipts have placed the Executive in a better position, and although further help had been very kindly offered for the beginning of 1917 by Sir William Mather, it was found not to be required. It must also be placed on record that during the year another generous offer of financial help, if needed, was received by the Executive from Mr. Robert Mond.

Further steps have also been taken to reduce the rent paid by the Guild for its office from the beginning of 1917. Formerly the Guild shared with Dr. F. M. Perkin the use of a second room, and on his removal elsewhere this room was given up, and the Executive have to thank Dr. Perkin for the consideration which he shewed toward the financial position of the Guild.

A reference to the balance sheet of the Guild for the year 1916 will shew that for this period its financial position is quite satisfactory. The increased receipts have already been alluded to, but of course, owing to the greater activity of the Guild and the larger membership, there has been a corresponding increase in such items as printing, stationery, and postage.

STATEMENT OF RECEIPTS AND EXPENDITURE, JANUARY 1ST—DECEMBER 31ST, 1916.

| To BALANCE IN HAND, Jan. 1st, 1916—  | £   | s. | d. | £      | s. | d.      |
|--|-----|----|----|--------|----|---------|
| General Account ... ..   | 180 | 8  | 9  |        |    |         |
| Telephone Deposit ... ..   | 1   | 0  | 0  |        |    |         |
| Cash in Secretary's hands ... ..   | 2   | 15 | 10 | 184    | 4  | 7       |
| RECEIPTS:—   |     |    |    |        |    |         |
| Fellows' Compounding Fees ... ..   | 94  | 10 | 0  |        |    |         |
| Fees on Conversion of Life Subscriptions (already paid) from £2.2.0 to £10.10.0 as Life Fellows, 8 @ £8.8.0 ... .. | 67  | 4  | 0  |        |    |         |
| Fellows' Subscriptions ... ..  | 90  | 6  | 0  |        |    |         |
| Members' Compounding Fees ... ..   | 103 | 18 | 0  |        |    |         |
| Fees on Conversion of Life Subscriptions (already paid) from £2.2.0 to £5.76 @ £2.18.0 ... ..                      | 220 | 8  | 0  |        |    |         |
| Members' Entrance Fees ... ..  | 1   | 2  | 6  |        |    |         |
| Subscriptions ... ..   | 54  | 8  | 6  |        |    |         |
| Donations to General Funds ... ..  | 10  | 6  | 0  | 642    | 3  | 0       |
| Donations from Sir William Mather for Office Establishment ... ..  |     |    |    | 433    | 0  | 0       |
| Canadian Branch (1915) ... ..  |     |    |    | 1      | 4  | 11      |
| Sale of Publications ... ..  |     |    |    | 3      | 6  | 1       |
| Dividends from Investments in £1,100 L.C.C. 3½ % Stock ... ..  |     |    |    | 30     | 6  | 6       |
| Interest on Deposit of £400, May 1—Dec. 20 ... ..  |     |    |    | 11     | 19 | 4       |
|  |     |    |    | £1,306 | 4  | 5       |
| By EXPENDITURE:—   |     |    |    |        |    |         |
| Printing and Stationery ... ..   |     |    |    | 165    | 13 | 2       |
| Expenses of Annual Meeting ... ..  |     |    |    | 8      | 5  | 6       |
| Postage ... ..   |     |    |    | 49     | 12 | 11      |
| Petty Cash ... ..  |     |    |    | 7      | 6  | 6       |
| Bank Charges, Cheque Books, &c. ... ..   |     |    |    | 0      | 14 | 5       |
| Clerical Help ... ..   |     |    |    | 19     | 6  | 6       |
| Salaries ... ..  |     |    |    | 145    | 0  | 0       |
| Rent and Office Expenses ... ..  |     |    |    | 168    | 5  | 11      |
| Telephone ... ..   |     |    |    | 9      | 0  | 0       |
| Insurances ... ..  |     |    |    | 0      | 14 | 10      |
| Investment — £600 Exchequer Bonds, 6 % ... ..  |     |    |    |        |    | 600 0 0 |
| Balance in hand, Dec. 31, 1916 ... ..  |     |    |    | 128    | 15 | 11      |
| Telephone Deposit ... ..   |     |    |    | 1      | 0  | 0       |
| Cash in Secretary's hands ... ..   |     |    |    | 2      | 8  | 9       |
|  |     |    |    | £1,306 | 4  | 5       |

The invested Funds of the Guild at 31st December, 1916, consisted of £1,100 L.C.C. 3½ % Consolidated Stock, and £600 of the 6 % Exchequer Bonds.

Examined and found correct with vouchers,

April 4, 1917.

ALEX. PEDLER.

## LIST OF DONATIONS TO THE GUILD.

|  | £     | s  | d. |
|--|-------|----|----|
| Mather, The Right Hon. Sir William   | 1,408 | 18 | 0  |
| The Worshipful Company of Drapers  | 105   | 0  | 0  |
| The Worshipful Company of Clothworkers   | 100   | 0  | 0  |
| Strathcona and Mount Royal, The Right Hon. Lord, P.C., G.C.M.G., G.C.V.O.,<br>F.R.S. (the late)... | 100   | 0  | 0  |
| Blyth, The Right Hon. Lord   | 10    | 10 | 0  |
| Lockyer, Sir Norman, K.C.B., F.R.S.  | 10    | 10 | 0  |
| Longstaff, Lieut.-Colonel ...  | 10    | 10 | 0  |
| Gray, C. H., Esq.  | 10    | 10 | 0  |
| Gray, R. Kaye, Esq. (the late)   | 10    | 0  | 0  |
| Watts, Sir Philip, K.C.B., F.R.S.  | 10    | 0  | 0  |
| Beale, Sir William Phipson, Bart., K.C., M.P.  | 8     | 8  | 0  |
| Haldane, The Right Hon. Viscount, K.T., P.C., F.R.S.   | 8     | 8  | 0  |
| Caird, R. H., Esq.   | 7     | 18 | 0  |
| The Worshipful Company of Salters  | 5     | 5  | 0  |
| Duveen, Edward, Esq.   | 5     | 5  | 0  |
| Hannah, R., Esq. (the late)  | 5     | 5  | 0  |
| Hawksley, Charles, Esq.  | 5     | 5  | 0  |
| Seligman, Isaac, Esq.  | 5     | 5  | 0  |
| Thomas, Carmichael, Esq.   | 5     | 5  | 0  |
| Davis, Major (the late)  | 5     | 0  | 0  |
| Prance, Miss Edith   | 5     | 0  | 0  |
| Godman, F. Du Cane, Esq., F.R.S.   | 3     | 3  | 0  |
| Lindley, The Right Hon. Lord, P.C., F.R.S.   | 3     | 3  | 0  |
| Lockyer, Lady ...  | 3     | 3  | 0  |
| Morgan, S. Vaughan, Esq. (the late)  | 3     | 3  | 0  |
| Whitehead, Sir James, Bart.  | 3     | 3  | 0  |
| Priestley, Lady (the late)...  | 3     | 0  | 0  |
| Brassey, The Right Hon. Earl, G.C.B.   | 2     | 18 | 0  |
| Waring, S. J., Esq.,   | 2     | 18 | 0  |
| Aitken, Dr. John, F.R.S. ...   | 2     | 2  | 0  |
| Bevington, Colonel S. B. (the late)  | 2     | 2  | 0  |
| Bolitho, Mrs. Robins   | 2     | 2  | 0  |
| Jackson, Admiral Sir H. B., K.C.V.O., F.R.S.   | 2     | 2  | 0  |
| Mallet, R. T., Esq. (the late)   | 2     | 2  | 0  |
| Noble, Sir Andrew, Bart., K.C.B., F.R.S. (the late)  | 2     | 2  | 0  |
| Brabrook, Sir Edward, C.B.   | 1     | 1  | 0  |
| Heron, Francis, Esq.   | 1     | 1  | 0  |
| Ingham, C. B., Esq.  | 1     | 1  | 0  |
| Mathews, Professor G. B., F.R.S.   | 1     | 1  | 0  |
| Morgan, Alderman Sir Walter Vaughan, Bart. (the late)  | 1     | 1  | 0  |
| Scott, Miss Eva Russel   | 1     | 1  | 0  |
| Singleton, Mrs. E.   | 1     | 1  | 0  |
| Southall, John, Esq.   | 1     | 1  | 0  |
| Stebbing, The Rev. T. R. R., F.R.S.  | 1     | 1  | 0  |
| Douglas, James, Esq.   | 1     | 1  | 0  |
| Herbert, Miss J. C.  | 1     | 0  | 0  |
| Hunt, Wilfred, Esq.  | 1     | 0  | 0  |
| Melchers, C. E., Esq.  | 1     | 0  | 0  |
| Marconi, Senatore G., G.C.V.O.   | 0     | 16 | 0  |
| MacNicol, Mrs.   | 0     | 10 | 6  |
| Steers, W. E., Esq.  | 0     | 10 | 6  |
| Bovey, Mrs. ...  | 0     | 10 | 0  |
| Davidge, Professor   | 0     | 10 | 0  |

|   | £ | s. | d. |
|---|---|----|----|
| Plunkett, Count and Countess                    | 0 | 10 | 0  |
| Fairley, Thomas, Esq.                           | 0 | 6  | 6  |
| Petrie, Professor Flinders, F.R.S.              | 0 | 6  | 0  |
| "A Friend"                                      | 0 | 5  | 0  |
| "A Well-Wisher"                                 | 0 | 5  | 0  |
| Baillie, Miss Hunter                            | 0 | 5  | 0  |
| Banks, Arthur, Esq.                             | 0 | 5  | 0  |
| Bell, Dr. James, C.B., F.R.S. (the late)        | 0 | 5  | 0  |
| Buller, Sir Walter, K.C.M.G., F.R.S. (the late) | 0 | 5  | 0  |
| Creak, Captain, R.N., C.B., D.S.O.              | 0 | 5  | 0  |
| Eccles, W. McAdam, Esq., M.S., F.R.C.S.         | 0 | 5  | 0  |
| Gillespie, H. G., Esq.                          | 0 | 5  | 0  |
| Green, The Rev. Herbert W. H.                   | 0 | 5  | 0  |
| Griffiths, Dr. A. B.                            | 0 | 5  | 0  |
| Hambling, W. G. A., Esq.                        | 0 | 5  | 0  |
| Hobson, William, Esq.                           | 0 | 5  | 0  |
| Bagshawe, Mrs. Arthur G.                        | 0 | 2  | 6  |
| Benham, Professor Blaxland, F.R.S.              | 0 | 2  | 6  |
| Churchill, Miss C.                              | 0 | 2  | 6  |
| Craik, Mrs. G. L.                               | 0 | 2  | 6  |
| Dodds, P. A., Esq.                              | 0 | 2  | 6  |
| "A Friend"                                      | 0 | 2  | 6  |
| Hadfield, Lady                                  | 0 | 2  | 6  |
| Lawrence, Miss A. L.                            | 0 | 2  | 6  |
| Letcher, T. H., Esq.                            | 0 | 2  | 6  |
| Lowdell, S. P., Esq.                            | 0 | 2  | 6  |
| Lowe, E. E., Esq., B.Sc.                        | 0 | 2  | 6  |
| Taylor, William, Esq.                           | 0 | 2  | 6  |
| Wade, Mrs.                                      | 0 | 2  | 6  |

#### LIST OF NEW SUBSCRIBERS.

Names added since the last issue of the Journal (November, 1916).  
During the year 1916, 116 new members and fellows have joined.

##### *Life Fellow.*

Professor Archibald Barr, D.Sc., LL.D.

##### *Life Members.*

Richard Louis Carr, Esq., A.R.S.M.

J. B. Carrington, Esq.

Maurice Marcus, Esq.

Wilson Noble, Esq.

J. Q. Rowett, Esq.

##### *Fellows.*

Edward C. Barton, Esq.

Harry Baldwin, Esq., M.R.C.S.

A. R. Bayley, Esq., B.A.Oxon.

Douglas Berridge, Esq., M.A.

C. I. Bond, Esq., F.R.C.S., Hon. Colonel R.A.M.C.T.

Alexander Brémner, Esq.

Arthur W. Clayden, Esq.

Mrs. Stanton Coit.

Sir Alfred W. Croft, K.C.I.E.  
 John Furneaux, Esq.  
 Mrs. A. E. Llewelin.  
 H. R. Mill, Esq., D.Sc., LL.D.  
 C. G. Montefiore, Esq., M.A.  
 The Rev. E. O'Connor, S.J., M.A.  
 E. H. Rayner, Esq.  
 Leslie Skinner, Esq.  
 W. B. Statham, Esq.  
 Mrs. Symonds.  
 R. S. Taylor, Esq.  
 C. T. Trechermann, Esq.  
 Glynn Williams, Esq.

*Members.*

Maxwell Adams, Esq.  
 Prof. P. Phillips Bedson.  
 R. T. Coryndon, Esq.  
 Miss M. Blanche Cuthbertson.  
 Miss Margaret Frodsham, B.Sc.  
 Professor Ernest Glynn, M.D.  
 F. Hodson, Esq.  
 J. A. Mills, Esq.  
 Professor Arthur Ransome, F.R.S., M.D., F.R.C.P.  
 G. Scott Robertson, Esq.  
 Dr. E. H. Tripp.  
 A. C. Trotman, Esq.  
 Miss Maude Williams.

*Obituary.*

The Executive Committee greatly regret to announce that the following members of the Guild have died since the last issue of the Journal was published:—

The Rt. Hon. Lord Allerton, P.C., F.R.S., John Christie, Esq., Engineer Vice-Admiral Sir John Durston, K.C.B., Dr. Johnston, Sir Hiram S. Maxim, Alderman Sir Walter Vaughan Morgan, Bt., Sir S. W. Royle, Miss Katharine Williams, Professor A. M. Worthington, C.B., F.R.S.

## Annual Meeting at the Mansion House, 1917.

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The Eleventh Annual Meeting of the British Science Guild was held at the Mansion House on Monday, April 30, 1917. A large and distinguished company accepted the invitation of the Lord Mayor to attend, every chair in the Hall being filled.

The LORD MAYOR (Sir William Dunn), who presided, in taking the chair, remarked: Ladies and Gentlemen, it is a very pleasant duty I have to perform as Lord Mayor to-day—to bid you welcome to the Mansion House. I consider we could not make use of the Mansion House for a better purpose than in association with a meeting of the British Science Guild. I shall now call upon Sir William Mather to open the proceedings.

SIR WILLIAM MATHER said: My Lord Mayor, Ladies and Gentlemen,— Usually at this function the President of the Guild has had the pleasing duty of making some general observations on the objects of the Guild and its work during the past year. On this occasion we have novel and very attractive features, as you will have observed from your invitation cards, bearing the names of three gentlemen who have kindly undertaken to address the members and friends of the Guild. Therefore our business will be curtailed to the shortest possible time. I have only one matter I desire to mention to you which I think is of some importance, and may be of some interest to you. Since we last met the Guild has suffered a very severe loss, and the country a much greater loss, by the death of that eminent man of science, Sir William Ramsay. We had to deplore on the last occasion his very serious illness, which then threatened to terminate fatally, but when the death came we found we had lost one of the strongest pillars of the Guild, that the country had lost, if not the very ablest, one of its ablest, men of science—certainly of the science of chemistry—whose research work has conferred no end of good upon the nation, and one who, had he lived, would have saved the country many lives and millions of pounds through his remarkable knowledge of materials which ought to have been contraband of war, and his knowledge in regard to making the most satisfactory use of explosives in war. Sir William Ramsay has left a record of work that will never die among men of science. (Applause.) It is important that the British public should be reminded from time to time of what they owe to their men of science. We know soldiers, statesmen, men eminent in various walks of life, but scientific men are greatly neglected by the public. Their work is quiet and unseen; we get only the effect of it. Knowledge of the character and the lives of our distinguished scientific men is very scant, and rarely are they commemorated in any adequate way. The memorial to Sir William Ramsay for which we are seeking to collect funds has been decided upon by a committee, including presidents of various institutions,



men of eminence and teachers of science in London and throughout the country. The scheme is to invite the generous public, in spite of the many calls that are made upon them, to subscribe £100,000 in the course of a year or two, partly in order to establish Ramsay Fellowships for the encouragement of research work, tenable at any University or Technical College. These Fellowships are to be of the value of £200 a year and £50 a year for expenses. Another part of the scheme is that a laboratory shall be built at the University College of London, where Sir William Ramsay pursued his life's work with such remarkable success, in order to attract students to engineering chemistry. As engineering science has become absolutely essential to the carrying out of chemical discovery, it is important to have courses of study connected with the subject. That will be called the Ramsay Engineering and Chemical Laboratory. With £50,000 we could accomplish those two objects, and for the remaining £50,000 we could no doubt find ample use in doing something to encourage the work in which Sir William Ramsay lived, and from which he left so splendid a legacy for the benefit of his fellow-countrymen. (Applause.)

Now I should have liked to comment on the work done by the Guild since the beginning of the war, but you will find it described in the Report, which is printed and ready for publication. I have only a few minutes to live in the position which I have held for upwards of four years. My presidency of the Guild has, at my own request, come to an end, and I now introduce to you my noble friend, Lord Sydenham, who has kindly consented to occupy the office. I have known Lord Sydenham intimately for a number of years, and the longer I know him the more I respect and admire his qualities and his character. We met first on the Committee for the re-organisation of the War Office, in 1901, of which we were members, he as a soldier and I as a Member of Parliament. The Guild will be very fortunate if it can retain his services in the position of President for the next four years. Lord Sydenham is a very rare example of an Englishman who knows a good deal about everything, and he has filled offices of great trust and responsibility in relation to a great variety of interests. As a Royal Engineer, early in his career he attracted the attention of the War Office on account of his remarkable engineering and scientific gifts. These gifts were exercised for a long time in connection with fortifications and gunnery. He was elected a Fellow of the Royal Society. He has held an important office at the Woolwich Arsenal, where for years he performed great services and used his inventive powers largely in the interests of the Navy. Subsequently he was asked to take the office of Secretary of the National Defence Committee, which is, as you know, a very important Cabinet Committee, charged with looking forward and providing for the defence of our country and the Empire. Later he went to Victoria as Governor of that Colony, and several years afterwards he was made Governor of Bombay. I think that never in the annals of the British occupation of India has there been an Englishman who won so rapidly the admiration of his Legislative Council, and of all those who came into contact with him, as the Governor known at that time as Sir George Clarke. (Applause.) I was myself a witness of what he was doing in

Bombay, having been his guest at Government House, and I heard on all hands from members of the Legislative Council that they thought he was the ablest man who had filled that high office. I must apologise for speaking so frankly about him in his presence, but I have the temerity to stamp the character of our new President with such well-merited praise as that I have bestowed upon him. On coming home he received high honours. Lord Sydenham is a man who has been very much honoured in many ways, and I only wish he had been honoured in another way, by having an office in which his great talents could have been used for the successful prosecution of the war. One of his many gifts is displayed in letters in the public Press, exhibiting a quality of lucid, logical and terse expression, such as is very rare among our public men. I have now very great pleasure in vacating my office in favour of my noble friend, our future President. (Applause.)

The LORD MAYOR called upon Sir Boverton Redwood to move a resolution.

SIR BOVERTON REDWOOD, in moving the adoption of the Report, said: My Lord Mayor, Ladies and Gentlemen,—In view of the eminence of the speakers who are subsequently to address you, it would be unbecoming on my part, and I am sure distasteful to you, if I detained you for many minutes. But there are certain features of the Annual Report to which I beg leave to address myself very briefly. The most important of the announcements made in the Report is that which concerns the office of President. It has already been alluded to by Sir William Mather. Sir William was appointed to the Presidency in 1913 in succession to Lord Haldane. He has therefore held it for four years, and it is not too much to say that during the whole period of his tenure of the office he has devoted himself with unremitting zeal to fostering and encouraging the activities of the Guild. (Applause.) Previously he was Vice-President, and in that capacity also he rendered very valuable service. He was a member of the Technical Education Committee and he was Chairman of the Joint Technical Education and Education Committee, in which capacity he wrote an introduction to the report of that Committee on the necessary reforms in national education. Not only has Sir William given us the kind of help to which I have alluded, but he has from time to time afforded to the Guild very material, in addition to moral, support, and in the unanimous opinion of the Executive Committee, expressed in a recent resolution recording its high appreciation of his services, the greatly increased prosperity of the Guild has been very largely due to the interest which Sir William Mather has shown in its work and personal devotion which he has brought to bear upon it, as well as to the large amount of assistance which he has so generously given in forwarding its aims. It is now proposed that Sir William shall be elected one of the Vice-Presidents, and in that capacity we look forward to receiving from him for many years to come the wise counsel which he has given us in the past. (Applause.) I may here also allude to the gratifying circumstance that the Lord Mayor, besides having placed on the work of the Guild the civic hallmark by allowing us once again to hold our meeting at the Mansion House,

has kindly consented to become Vice-President, and has thus further shown his appreciation of the work the Guild is doing. (Applause.) Sir William Mather now desires, as he has told you, to divest himself of the responsibility of the office which he has held, and I think we shall all agree that of the many services which he has rendered, not the least has been that of inducing one so highly distinguished and eminently fitted as Lord Sydenham to succeed him. (Applause.)

During the past year there has been an alteration made in the scale of subscription rates, it having been found that the rate at which the minimum subscription was originally fixed was insufficient to cover out-of-pocket expenses. Concurrently, renewed effort has been made, to increase the membership, and it is highly gratifying to record that the action thus taken has been attended with substantial success. For the improvement in the financial position we are mainly indebted to the Honorary Assistant Treasurer, Lady Lockyer, who has, as in former years, administered the finances of the Guild with wisdom and efficiency. (Applause.) I hope, however, that these encouraging remarks may not be taken as indicating that there is any less need for effort in further increasing the membership, and strengthening in that way the pecuniary position of the Guild. The current income is still below annual expenditure, and although Mr. Robert Mond has relieved the Executive Committee of anxiety by a generous offer of financial help should it be needed, we naturally desire to place the Guild in the position of not having to avail itself of that aid. The routine work of the Guild has been actively carried on during the year, though that of the Medical Committee, under the chairmanship of Sir Ronald Ross, has been somewhat impeded, owing to the circumstance that many of the members, including the Deputy-Chairman, Sir Alfred Keogh, have been engaged on active war service. In regard to science propaganda, I feel sure I shall have the support of my colleagues in making reference to the very valuable services of the hard-working, painstaking and exceptionally able chairman of the General Purposes Committee, Professor Gregory—(hear, hear)—and I have also to include in this connection, Sir Alexander Pedler, to whom we all owe much. (Applause.) Early this year the Executive Committee appointed a small committee, under the chairmanship of Sir William Phipson Beale, to prepare a statement for publication on the opening which post-war conditions would afford for the introduction of a metric system of weights and measures and a decimal system of coinage. In their consideration of the subject the Committee have so far been largely guided by the view, or perhaps I should rather say the hope, that through greater attention to the metric system as part of education, by the adoption of that system in all Government contracts, and through such other action as will demonstrate the practical advantages of the system, a great deal may be done without legislation, and that convenience may ultimately operate to a considerable extent in lieu of compulsion in leading to its general adoption. This is not to be taken as necessarily a forecast of the report which in due time the Committee will present, and I should add that the Committee will meanwhile gladly welcome any help or suggestions in dealing

with this subject. It has been customary to give in the Annual Report information as to the various Government Committees appointed during the year. On the present occasion this information, as you will see from the Report, indicates greatly increased activity on the part of the Government in organising official effort in the application of science to industry and education, and it should gladden the heart of Sir Norman Lockyer, the Founder of the Guild, whom we are sorry not to have with us to-day, to note how very largely the action the Government has thus taken is that which he has consistently advocated for so many years. (Applause.) I have now, my Lord Mayor, Ladies and Gentlemen, to move the adoption of the Annual Report, the election of the Right Hon. Lord Sydenham as President, and of the Right Hon. The Lord Mayor, and the Right Hon. Sir William Mather, as Vice-Presidents, and the election of the Executive Committee. I therefore submit that motion to the meeting. (Applause.)

PROFESSOR R. A. GREGORY seconded, saying: My Lord, my Lord Mayor, Ladies and Gentlemen,—In seconding the motion I am not expected to make a speech. I think, however, that this year's Report of the Guild has such exceptional features, that two or three minutes may perhaps be given me to refer to them. One is the point, already mentioned by Sir Boverton Redwood, of the great activity recently shown by the State in the encouragement of interest in science and education and their application to national affairs. Those of you who were members of the Guild at the outset will know that the principles which are now accepted generally and are being taught by the Press and by our statesmen were those for which the Guild was originally founded. The Guild is now, and has been since the beginning of the war, coming to its own. (Applause.) It has taken much T.N.T. and other high explosives to awaken the nation to a sense of the importance of science and the results of the application of scientific knowledge to national life. At the beginning of 1915 we arrived at such a national awakening by the institution of the Ministry of Munitions, which represented the first organised attempt to mobilise the scientific knowledge of the country and to use it for our national advantage. The establishment of the Ministry, as you know, has turned the whole course of the war, and without the scientific work that it organised we could not be in the favourable position which we occupy to-day in this world-conflict. The Ministry of Munitions led to the formation by the Government of various Committees on which men of science are represented, and in this year's Report we have many more scientific Committees recorded for the first time than ever hitherto. The Report is indeed distinctive in this respect of the number of Committees appointed dealing with scientific problems and their relation to national affairs. The action of the Government and of our statesmen in these matters has also had other far-reaching effects. We have, for instance, the establishment of the Department of Scientific and Industrial Research, to which Parliament, without any hesitation, made a block grant of £1,000,000 to carry on its work. In a Memorandum issued in November by this Guild the work of such a board was outlined, and the department which has since been instituted represents the policy there referred to. Just as the trade follows the flag, so does the country follow the great

statesmen who will take the lead in such matters. The Commonwealth of Australia established an Institute of Science and Industry, as was referred to at last year's meeting of the Guild, and is prepared to provide half a million pounds for it. Following on what had been done by our own Government in establishing an Advisory Council of Scientific and Industrial Research, the Canadian Government has taken steps in the same direction, and the United States have formed a National Research Council of much the same character. The chairman of that Council, when he wished to know what the British people were thinking of the relation of science to industry, sent to the British Science Guild for its Memorandum to ascertain what should be advocated on the other side, and a number of copies were sent by our Secretary for distribution among individuals and institutions in the United States. Those two points are sufficient to give all members of the Guild some reason for congratulation that the principles they have held for some years are now beginning to bear fruit; that the seed they have sown has been dispersed very widely since the beginning of the Guild, twelve years ago. There is only one other point. The record this year of endowments of higher education and research contains more gifts, and larger gifts, than in any year previously. That also is another indication of how the country follows the lead taken by its great statesmen. With these remarks I have great pleasure in seconding the motion for the adoption of the Annual Report. (Applause.)

The Lord Mayor put the motion to the meeting, and it was carried unanimously.

THE LORD MAYOR : I have now the pleasure to call upon Lord Sydenham to deliver an address on National Reconstruction. (Applause.)

LORD SYDENHAM, whose address was frequently applauded, spoke as follows :—

The British Science Guild, during the twelve years of its existence, has earnestly endeavoured to promote the public and official recognition of scientific research and of scientific organisation and methods as essential factors in National progress. Our Journal and our Annual Reports show the matters to which we have striven to direct attention. It is not our object to secure the advancement of any particular branch of science: each has an association created for that purpose. We seek to provide what may be called a clearing house of progressive thought, in order that activities which are mutually dependent may be harmonized for the welfare of the State and the Empire, and that the application of scientific knowledge not only to industries, but also to every department of public life may become a reality. We believe that thus only can our future National advancement and the well-being of our people be placed upon a sound and an enduring foundation.

These are objects which in the past have powerfully appealed to men of science whose vision extended beyond the horizon of their labours to the conception of a State in which research was not only encouraged as a primary necessity of progress, but the results were quickly applied to the direction of energy, the prevention of waste, and the conservation of the forces on which the prosperity of mankind mainly depends.

Before the war, these were voices "crying in the wilderness." Governments and Parliament, which is supposed to control and inspire them, cared for none of these things. In our great public offices, Science was apt to be regarded as an abstruse mystery which possibly concerned business men and might sometimes obtrude itself inconveniently upon public attention, but had no part or lot in the administration. Speaking broadly, we have been ruled by men for whom scientific conceptions and scientific methods had little or no interest; and partly from this cause our industries were being stealthily undermined and were passing into the control of another people who had laboriously organised all their public and private activities, had been carefully trained quickly to turn scientific discoveries—largely borrowed—to material advantage, and had become obsessed with the mad ambition of imposing their theories of life and conduct by force upon the world.

It was the direction given to great national forces by an absolutely unscrupulous Government, acting in closest co-operation with Professors and Captains of commerce and industry, and deliberately adjusting education in all its branches to specific purposes, that brought about the greatest catastrophe that history records. We now see plainly that this was inevitable, though we shut our ears to the warnings. The exaltation of the State as a separate entity—the incarnation of force that could do no wrong and that must be blindly trusted and obeyed—destroyed the moral sense of the German people, and they now stand revealed as senselessly brutal barbarians. Their National organisation proved pernicious, because it created an overweening belief in the superiority of Germans and a self-centredness so extreme as not only to ignore the elementary rights of other peoples, but also to underestimate the forces which the violation of all laws, human and divine, must sooner or later call into play. The Germans, wrote Count Reventlow in the Christmas Number of the "Deutsche Tages Zeitung," "will fight until everything complies with their will—a will that vehemently and without scruple puts all means into its service by which it desires to reach its aims." That is the spirit in which the War was recklessly forced upon Europe and has since been conducted—the spirit which has inspired outrages that have disgraced civilisation, the spirit which is leading Germany straight to disaster. While there is much that we may well learn from German methods, and especially from German thoroughness and hard work, we have been provided with a terrible warning of what to avoid.

The War has had the effect of turning a strong searchlight upon the innermost workings of our national life. Our weakness and our potential strength stand plainly revealed. We can see how severely we have suffered and must still suffer from our neglect in the past; and if we strive to ascertain causes, we cannot fail to reach the conclusion that our lack of appreciation of all that science, using the term in the broadest sense, could have conferred upon us lies at the root of many present difficulties. When the question of contraband was being considered, science could have told us what was vital to the prosecution of war by an enemy, and what, therefore, we should use every effort to exclude from his territories. Sir William Ramsay, whose loss, as one of our greatest leaders of scientific thought, we deplore, pointed out

the gross fallacies which were permitted to mislead our policy in regard to cotton. Lard was assumed by one of our rulers to be innocuous, because he was unaware that its use for the manufacture of glycerine was an old discovery. The painful revelations of the Dardanelles Commission establish the facts that a fateful decision was arrived at by methods which flagrantly violated scientific principles, and that a complete misunderstanding as to some elementary artillery matters was allowed to exist. And now in the handling of the difficult question of man power there is an evident want of the grasp which sound scientific training can confer.

It would be easy to multiply instances of the ways in which the absence of scientific habits of thought have prejudiced the conduct of the War; but there is another side which must not be forgotten. If we have too often failed in foresight and in the application of orderly methods to the direction of policy, the national genius for improvisation has been strikingly manifested. On the basis of a small army, the best we ever possessed, we have built up, transported across the seas, equipped, and supplied vast national forces which have shown fighting power unrivalled in our military annals, and have determined the final victory of the cause of the Allies. And further, under the stress of war, we brought science to bear on military requirements in such a way as not only to overtake, but to surpass, German appliances laboriously prepared in years of peace. On a different plane, the War Savings propaganda is a good example of well-conceived and successful effort. Nothing can be more certain than that we possess organising capacity, which, if turned to full account, can perfectly respond to the future needs of the Empire.

Reconstruction is now beginning to occupy the minds of all thoughtful men and women. After-the-War problems are being widely discussed, and amid their baffling complexities some great principles stand out as signposts along the path which we must follow.

The material prosperity and the financial stability of the country can be restored only by an increase of production and interchange. This implies the creation of new industries and the economic development of those which exist, combined with a firm hold on old markets and the development of new ones. If our national resources were exhausted, we might well despair of the future; but the resources of the Empire are almost inexhaustible, and their utilization is only beginning. The Empire can produce all the great food staples—grain, meat, sugar and fats—sufficient for the supply of a far larger population than it now contains. The fish supply could be very largely increased from Ireland and the banks of Newfoundland. Raw materials of every kind, coal and mineral oil, abound. The Empire has almost a monopoly of some of the rarer metals and earths of which science is making more and more use. We have first to make certain that never again shall Germany obtain control of our raw materials and our key products, and then to ensure that our materials are, so far as possible, manufactured within the Empire. Before the War, almost the whole of the Imperial production of palm kernels went to Holland and Germany, and the oil expressed from them was exported to the United Kingdom as such, or in the form of margarine and other prepared

fats. The story of the Australian zinc concentrates is well known. They and the output of Australian copper were discovered to be in German hands when war broke out, as was a great part of the manganese and hides of India. The resources of the Empire amply suffice for the rebuilding of our national prosperity, if by the unstinted application of science in the laboratory, in the workshop, and in the superior direction of commerce and industry they are turned to the fullest account.

But more is necessary to the accomplishment of the gigantic task of national reconstruction. "In business," said Mr. T. C. Elder at Manchester not long ago, "we had only a mob of private adventurers" competing against powerful German organisations. The great engineering industry, states Mr. W. L. Hichens, "is a conspicuous example of bad organisation. Associations of all kinds and sorts exist within its borders; but . . . they have no ordered relations to each other or to the industry as a whole," and he recommends the formation of "one employers' Federation . . . including shipbuilding," which is vastly important, "to deal with the broader aspects of the Labour problem in relation to the whole." Other industries also stand isolated, competing with each other, and having no means of reaching a common policy in combination with allied or dependent industries. In business as in private life our individualistic tendencies sometimes weaken our action and check our progress. The result is a loss of economy in production and an ebb and flow of employment which disorganises the Labour market and imposes hardships on the workers. The grievances of which employers and employed complain can be removed by negotiation between their organisations conducted with mutual goodwill and directed to secure the interests of both. There is no insuperable difficulty in securing for the workers a fair share in the prosperity which they help to create.

Since 1875, the Germans have built up a huge "Central Verband," in which industries are federated in ten groups. This body became very powerful, and with the active assistance of Government it played a most important part in directing the far-reaching and aggressive measures by which German trade and commerce were advanced with rapid strides. I do not believe that such an organization would thrive on British soil; but the federation of allied and mutually dependent industries is essential for the framing of a common policy and to secure economic production. At the same time, it would not, like the great Trusts of America, crush out the smaller undertakings, which might even be strengthened. From the point of view of applied science, such federations would have many advantages. A great joint research laboratory must be far more efficient and less costly to maintain than a number of small institutions.

The handling of the great question of the supply of power cannot be left to piecemeal treatment. We now have a Board of Fuel Research, which in co-operation with the British Association is investigating economics, and already an annual saving of fifty million tons of coal is known to be possible. Mr. Newlands estimates that in Scotland more than 1,000,000 electrical horse power could be obtained from water, and he points out that, in Switzerland, one electrical horse-power obtained from water costs £1 19s. per annum, as



compared with £4 11s. 8d. in England from coal. The economic advantage of employing water power, wherever practicable, is manifest, and in parts of India, as elsewhere within the Empire, there are resources which need to be turned to account. In matters of such broad importance as power, lighting and heat, research on the widest scale is necessary, and when conclusions have been reached their application can be secured by the active co-operation of the interests involved assisted by intelligent legislation.

In trade, the first requisite is sound information kept up to date, to which the Germans owe much of their success. We now have four Trade Commissioners representing the Dominions, and India must be similarly provided; but the whole system of Consuls and commercial Attachés in foreign countries requires complete reorganization, which Government can carry out only by seeking and following the advice of experienced leaders of commerce.

The Dominions Commission has shown the immense resources of the Empire, and in their final report they direct attention to the importance of cheap, speedy and efficient transport between Imperial ports. Some years ago I proposed the establishment of an "Imperial Maritime Council," composed of 15 representatives of the various parts of the Empire and financed by a 1 per cent, *ad valorem* surtax upon all foreign imports into Imperial ports, which in 1904 would have provided an annual income exceeding  $4\frac{1}{2}$  millions. The Council was to deal with all matters relating to the Maritime Communications of the Empire, to build up inter-Imperial transport, and to ensure close study of the means of developing Imperial Trade as a whole. The Dominions Commission has now recommended the formation of an Imperial Development Board for these and other analagous purposes. This would be a great step in Imperial reconstruction leading to far-reaching results, provided that the Board was executive, amply provided with funds, and completely severed from politics at home and overseas.

If we are able at length to substitute collective effort, scientifically directed, for spasmodic enterprise which, however well conceived and carried out, may fail from the rational point of view for want of harmony, there will remain the fundamental necessity for hard and conscientious work by all classes. It is not by organisation alone that Germany quickly attained astonishing success in trade and manufacture. Her 67,000,000 of trained people were notably industrious, and whatever great political changes take place after the War, they will retain the qualities which make them formidable rivals in production. Our artizan class as a whole is second to none in skill. No better work is done than in some British factories; but, for various reasons, the output has been much below the powers of the workers. The relative production of women during the War has painfully proved that large numbers of men, acting on the false principles inculcated by Trades Unions, have systematically stunted their efforts, and British trade as well as the interests of the workers themselves, has suffered severely from this cause.

This is not the time or the place to consider the causes which led to a situation threatening disaster; but it must be said that, unless the relations of employer and employed can be placed on a basis of mutual trust and friendly co-operation, the rebuilding of our national prosperity will be impossible.

Happily, there are hopes, arising from the new outlook, which the War, with its shared sorrows and suffering, has brought to all classes. As Mr. J. A. Seddon has pointed out: "The War has broken down more class barriers than a generation of maxims and precepts. The co-mingling of classes and the fraternising with the Overseas forces is having a greater effect upon all sections of the community than any agency hitherto possible." There have been great faults on both sides, acting and re-acting upon each. Good wages, better labour conditions, proper housing, and greater expenditure upon public health are essential conditions of real national prosperity. Unless they can be fulfilled, reconstruction must fail. But only an increase of economic production, demanding organised and trained brain-power on the one hand and honest labour on the other, can create the funds required to sustain the heavy burden of war-debt, and at the same time to secure national progress. When peace comes, we shall possess a great increase of productive power, represented by more trained workers and by improved and enlarged plants, developed by the necessities of War; but many normal activities have been checked, and we must face a heavy loss of capital and the impoverishment of our foreign customers. We must not only re-create, but seek out new opportunities and establish new industries which research can indicate.

We have now a Department of Scientific and Industrial Research with a State endowment of one million, which will be able to exercise some of the functions of the Board of Science that the British Science Guild has strongly advocated. Each of the Dominions and India will require the same machinery, and Mr. Hughes has undertaken that Australia shall be thus provided, while the Canadian Government has appointed an advisory council to advise a committee of the Cabinet on all matters relating to scientific and industrial research. We have also a Board of Scientific Studies which is carefully investigating our requirements. Systematic and co-ordinated research on a large scale is a primary need, and waste or duplication of effort can be prevented only by such general direction as to ensure that problems are attacked in the localities most favourable to their solution. Special attention must be given to chemistry, which has many important secrets to yield. "The country," said Sir William Ramsay, "which is in advance in chemistry will also be foremost in wealth and general prosperity." We have certainly fallen behind Germany in this vitally important branch of science, not in the ability and insight of our chemists, but in numbers and in the application of chemical discoveries to industry. It is upon chemistry, the use of power, and co-operative methods that agriculture must mainly depend for advancement.

National reconstruction will require in the future the sustained stimulus which education alone can supply. In our public schools and colleges, science must take the place to which it has been long entitled. While trained specialists will always be relatively few, all who are destined to play a part in national affairs must receive such a grounding in the natural sciences as to ensure that physical laws and facts will appeal to them, and that scientific methods of thought will become habitual. For this reason, the British

Science Guild has strongly urged that a knowledge of science should be required of all candidates in examinations for the Civil Service. There need be no conflict with what are not well described as "humanistic studies." A broad general education is the best foundation for science training, and in so far as literary studies develop breadth of vision and clearness of style, they are valuable helps to the future specialist. Conversely, such subjects as history take new form when they are approached in a scientific spirit.

A Parliament or a Government composed of specialists would be unsuited to its duties; but both need an intelligent appreciation of the relation of science to national life which is now conspicuously lacking. "Mankind," writes Professor Dewey, of Columbia University, "so far has been ruled by things and by words, not by thought. . . . If ever we are to be governed by intelligence, not by things and by words, science must have something to say about *what* we do and not merely about *how* we may do it more easily and economically."

Apart from what we understand by science teaching, there is the technical training which is needed by foremen\* and workers in industries, which should be such as to help the abler man to rise. The Departmental Committee on Juvenile Education and Employment has recently reported, and its main proposals are the retention at school of all children up to the age of fourteen, with attendance at continuation classes of at least eight hours a week up to eighteen. These classes are "to include general, practical and technical education," and they will probably in many cases take the form of trade schools carrying on the education of young workers who have found employment. The advantages of manual training in primary schools are not sufficiently emphasised in the Report. Manual dexterity can be acquired at an early age, and boys might thus gain a truer conception of the dignity of hand labour, while experience shows that technical or elementary scientific knowledge, if attained by practical work, becomes a permanent possession. Greater differentiation between the work of rural and of urban schools is another pressing need.

No one can maintain that our system of primary education has been a failure. As the Minister of Education pointed out the other day in his admirable speech, we owe to it, in part at least, the new armies which have brilliantly upheld our national honour on many stricken fields. But we believe that education can do more in the future in developing moral strength and in inculcating the sense of duty and good citizenship. Mr. Fisher has laid down as the ideal of his office that it should build the foundation "for a patriotic and social education worthy of the genius of our people, and a fitting monument to the great impulse which is animating the whole people in the war." We all hope that he will be spared to realize that high ideal.

In the tremendous tasks which lie before the nation, Government can play an important part. Statesmanship worthy of the name must lead, inspire, direct and initiate. In guiding education, assigning defined functions to experts carefully selected for special purposes, exercising their enormous patronage with a single eye to knowledge and efficiency, as well

as in encouraging the progress of applied science, and guarding against legislation which may hamper trade and industrial activity, there is ample scope for the action of Governments. Interference in the management of business enterprises will usually be harmful, since for well-known reasons, the conduct of business affairs by officials in democratic countries is rarely efficient.

Some tariff adjustments may be found desirable; but the idea that national prosperity can, in the long run, be assured by fiscal devices is baseless. In so far as tariffs can stimulate the operation of natural laws, they may be beneficial. When they aim at producing artificial conditions in defiance of law, they usually defeat their ends. They may be used legitimately, and we have been told that they will be used, to further the development of the resources of the Empire, and the object having been attained, they can be dispensed with.

I have only dealt with reconstruction in the material sense, which cannot alone guarantee the purer and happier national life which we all earnestly desire. That can be reached only if the whole nation will, in the difficult times that lie before it, follow the shining example of duty, discipline and self-sacrifice which have been set by our heroes on the seas, in the field, and in the air. The men who have constantly faced death and shared in dangers and hardships will come back with a new outlook on life. In the trenches there have been no Party divisions, no attempts to set class against class, but only shared efforts which are bringing certain victory to a sacred common cause. May we not hope that the great lessons learned by our best manhood in the storm and stress of war, will re-act upon the nation as a whole and render the forms of politics to which we have grown accustomed impossible in the future? The strife of parties and of individuals contending for office and power, the intrigues which have not wholly ceased during this crisis in our fate, the machinery by which Party chests are filled and constituencies are manipulated, the false discipline which, by preventing men from voting according to their knowledge and conscience, vitiates the decisions of Parliament upon vital issues, the triumph of words over experience and powers of action—all these things and more have had their day, and we begin to realise the inevitable results.

Reconstruction in the highest and fullest sense can be achieved only by a great national party, seeking solely the welfare of the Commonwealth, viewing every public question from the standpoint of the interests of the community as a whole, and choosing leaders irrespective of class or party, who can be trusted to bring a lofty patriotism and trained intelligence to bear upon the vastly complex and far-reaching problems with which we are now confronted. If these are only visions, then I see no certain prospects of restoring the shaken fabric of the State, of rebuilding our prosperity on a broader and an enduring foundation, of healing the open wounds in our body politic, and of wresting lasting good from the gigantic evils of war.

THE LORD MAYOR then introduced Mr. Fisher, who was cordially received on rising.

MR. FISHER said: My Lord Mayor, Ladies and Gentlemen,—Lord

Sydenham has covered so wide an area of thought in his masterly discourse that you will pardon me if my observations are brief. I understand that it is the purpose of your Guild to promote the fruitful union of three valuable forms of human activity, Science, Industry and Education, and it is, as Lord Sydenham has pointed out, precisely in the co-operation of these three forms of activity and effort that we as a nation and an empire have to look for our economic reconstruction after the war. As to education, I believe that the practical teaching of Science in our schools is quite efficiently conducted, some experts tell me it is more efficiently conducted than it is in the schools of Germany and France. But it is, I think, no doubt the case that we have failed so far to find a form of scientific instruction which appeals to the imagination and the interest of the general mass of school children who are not destined for what I may call a specifically scientific career, and I hope that one of the results of the Government Committee which is sitting under the chairmanship of Sir Joseph Thomson to investigate scientific teaching in this country will be a series of fruitful suggestions as to the best method of improving the scientific education of the boys and girls of this country who are going out into ordinary life as citizens.

Lord Sydenham touched on the reorganisation of industry, and I feel sure that in doing so he raised an extremely important issue. We are an old country, an old country of old and small traditional businesses, businesses which are run mainly by flair with a very slight admixture of science and many palpable defects of organisation. We want to think in larger multiples. Our businesses ought to be organised on a larger scale and with more science, and at the same time when we are founding a new scientific institute or when we are developing a university upon its scientific side we ought to get into the habit of enlarging our scale to an extent which people in general do not realise in the least. In my attempts to develop a northern University I have been struck by a certain lack of imagination as to what the real scientific needs of a university are, as to what the cost of satisfying those needs is, and as to what is the minimum scale of requirements for adequate scientific development. Until we can get into the habit of thinking on a larger scale, both with respect to scientific equipment and with respect to the scale of businesses, we are not in a fair way to achieve any very great result in applied science.

It is a very satisfactory feature of the present situation that we have at last in the Imperial Trust for Scientific and Industrial Research a committee armed with a large and liberal fund which has been formed for the purpose of co-operating with industries and with associations of industries for the development of industrial research. Already a large number of important problems have been submitted for the consideration of the committee. Lord Sydenham has alluded to the important subject of fuel conservation. Another subject which the committee are taking up is the action of salt water on harbour works, a matter of the most vital importance for an Empire which is scattered all over the seas. It is sometimes thought that scientific development can only be achieved at the expense of what are called the humanities, and that there is an irreconcilable opposition, not only

between scientific teaching and the training of the humanities, but also between a general teaching in citizenship and technical training. Well, my Lord Mayor, I do not believe in these antitheses. I believe there is no unnecessary antagonism, in fact no antagonism at all, between those different aspects of national education. I believe it is possible to give to young people an industrial and a commercial training which at the same time may be a training for the whole man, and that a form of scientific training conceived upon broad, imaginative, fruitful lines may imprint upon the mind and character very much the same influence which we are accustomed to ascribe to the older discipline in the orators and the poets. No, Ladies and Gentlemen, there is no such antagonism, and I am glad to lay stress upon this because I notice, and it is a very promising symptom, that an important section of the working population, which is really in earnest about the progress of popular education, is inclined to condemn any form of technical training as a device of the employer intended to perpetuate the enslavement of the employed. It may be true that there are some forms of technical training which do not equip the whole man, but those are bad forms of technical training. I believe myself that there is no antagonism between a training in technique and a training in citizenship, and I remember the other day a great employer of labour said to me that in the first weeks of the war the volunteers who came forward to enlist from his works—no less than 2,000 in number—were all his best workmen. The technical training which they had received, the conscience and zeal which they had thrown into their work, had given them the true sense of civic values. (Applause.)

I will only make one further observation. Lord Sydenham said very truly that one of the essentials to national progress was that we should establish more harmonious relations between employers and employed. And he alluded to what has become a matter of very general comment, the limitation of output deliberately encouraged by Trades Unions. Now, in the early part of this war I was Vice-Chancellor of a northern University in a great armament city, and a number of members of the university who were unable to go into the Army went into the various munition works there. They came to me after three or four weeks full of impatience at the restrictions that had been placed upon their activity by their fellow-workmen. They said, "We were willing to work twice as hard but they would not let us." And I remember going to an experienced and skilled engineer who held a professorial chair in my university with this complaint, and I said to him, "Can anything be done?" And he said to me: "Well, you must remember that these university people are only going in for a few months, or perhaps for a year or two, and they can easily work a good deal harder, but you have got to consider that the workmen in the Unions are going to work until they are sixty-five: they are working against very great pressure in the way of speeding up of machinery, and it is quite possible that although their pace may appear to any newcomer to be slow, it is the most economic pace when you estimate it over a long period of time." I do not say that this is true in any particular instance, but I say that it is a consideration which must be borne in mind when you are criticising from the outside, with very little

knowledge, the action of the workers in a great industrial town. And I will say this for the workers in an armament town which I know, that many of them since the beginning of the war have worked full time and overtime, strenuously and devotedly, so much so that clergymen who move among them tell me they fall asleep over their meals, and many employers tell me that little industrial difficulties which arise are very largely due to overstrain and overwork. I think it is very important we should keep our minds open on this question, because I believe a good deal of harm is done by criticisms passed upon the working classes for slackness by persons who have not a first-hand acquaintance with their conditions. (Hear, hear.) At the same time, do not let it be supposed for a moment that I wish to encourage a policy of limitation of output, but I think it has been very largely the effect of the speeding up of machinery, and that it is to some extent a defensive weapon used, and often no doubt abused, by working people who have no other weapon to which they can conveniently resort. (Applause.)

Ladies and Gentlemen, may I finally say that I do think from a study of industrial conditions that the auguries are good, and that after the war we shall see a closer approximation of employer and employed and a greater and completer state of harmony than has previously existed. (Applause.)

THE LORD MAYOR next announced Mr. Wells, who was greeted with applause.

MR. H. G. WELLS said: My Lord Mayor, My Lord, Ladies and Gentlemen,—You have heard two speakers admirably equipped upon this question of National Reorganisation. The task for which the promotors of this meeting have commanded me is different from the one they have discharged. You have heard a great constructive, creative and administrative statesman, you have heard a great educational statesman. My rôle is to speak as an outsider with no administrative or constructive experience at all. My rôle is to give you some of the outside impressions of one of the governed. I am here to speak as the average intelligent man who looks at this and that from outside. I am a very bad speaker. Indeed, I dread public speaking. (Laughter.) But I have been so keenly interested in this question of reorganisation that I have snatched at the present opportunity in order to say one thing. I happen to be an old schoolmaster—I was a schoolmaster in those days when one takes up things with enthusiasm. I am a parent who has followed very closely the education of his boys and has attempted in one or two instances experiments with them. And finally I happen to be an Englishman who has a passion for his country, who is anxious to see it, not perhaps very wealthy or from the point of view of aggrandisement, but playing a great part in the great years that are ahead of us. (Applause.) All these things combine to make me a fanatic for education. It seems to me in all these questions of reconstruction you come round to education. When you talk of commercial prosperity, political organisation, national unity, military efficiency, it all finally brings you back again to this one cardinal question. It is the ring upon which all the keys of national greatness hang. (Applause.) If that is right, all is right. Now I have watched the case of education in England from the outside—and sometimes an outsider has a certain advantage

—for the last thirty years, and I want you to bear with me when I say that all is not well with education in this country and that it seems to me there is a specific cause, and a cause that is not so clearly understood as it should be, which lies at the root of all our educational deficiencies. If this cause is attended to all may be well. Its treatment opens the door, anyhow, for every other sort of possibility. If it is neglected, shirked—and in certain quarters I have seen signs of shirking at the present time—then nothing will be well, whatever you do. You who are members of the British Science Guild are exceptionally aware of the symptoms of the case of education in Great Britain. You are aware of the criticisms brought against the mentality of this country. First of all, we are told, there is a very wide neglect of science; there is a contempt for knowledge for its own sake, and arising out of that there is infinite waste, there is planlessness, there is habit of “muddling through,” which has at last brought us extraordinarily near to a crisis when it looks as though we should hardly muddle through at all. Many of you think the whole trouble is met by saying that what is the matter is “want of science”: that if we had more science teaching, more provision for endowments, more intelligent organisation of research and a more general interest in science in the country, then all would be well—that that is the trouble, and that is how it is to be met.

Now here is where my use as a teacher of experience, as a parent of experience who has been looking into the education of his boys, and as a journalist who is frequently getting into discussions, comes in. I do not think your diagnosis gets down to the roots of the case, or that your remedy meets the occasion. None of these things that you want can possibly be got by themselves under existing conditions. First, you cannot have more science teaching at present because the school time-table is full. Next, you cannot have much more or much better research than you have at the present time because the ablest boys in better-class schools are being steadily taken away to other things, and you have not got in the community enough understanding of the nature and needs of research to establish and endow it properly. Thirdly, you cannot get a more general interest in science at the present time since you have no class of persons to get the general mass of people in touch with contemporary scientific work; because scientific men are, generally speaking, scientific specialists, ignorant of philosophy and literature, and without any bridge between them and the man of ordinary education. (Laughter.) No, don't laugh. These are serious things. The ordinary man cannot reach over to the scientific specialist, and the scientific specialist cannot reach over to the ordinary man. There is a gap in our public mentality at the present time. It is by no means a comic gap.

Let me begin by saying a word or two about the first of these troubles, the one at the root, the crowded time-table. I was thrown into a violent rage the other day by a book called “Science and the Nation,” a compilation of essays by a number of Cambridge science teachers advocating an increase of scientific teaching in this country. What threw me into a rage was an unfortunate phrase in one of the articles. One of the contributors spoke of the “ample leisure of the schoolboy,” and expressed a hope that there would be plenty of



time for both classical and scientific men to get all they wanted into the education of our youth. Never was there a more unfortunate phrase. There is no time whatever to waste in the education of the young, no "leisure" at all. In no matter is economy more imperative in this country. For the first time we are really grasping the idea of economy. At present there is a shortage of bread, but that is only temporary. There is always a shortage of time for education. No year in a boy's life is like any other year in that life. Each year has its task and opportunities. If you don't teach a boy to walk before he is three, he will never walk; if you don't teach him to talk before he is five, to draw and read and sew before he is seven, he will have no gift for these things; he must begin mathematics before he is twelve or he will never get on; and if he has not got philosophy before he is twenty-one he will always think in a haphazard way. Each year opens opportunities. Each year closes opportunities. Think of the hours available. How much hard study can a boy do in a day? I doubt if he can do more than four; at the outside, five. That gives you, allowing for half-holidays, twenty-five hours a week, and with forty weeks in the school year you have a total of one thousand hours in a year. You are lucky if you get half that of steady work. Very well, in a case of boys who have been educated from seven to twenty-three—only the most fortunate have that period—the utmost you can hope for is the little sum of 16,000 hours, or if educated from 7 to 16, 9,000 hours. For the great majority of the population it comes to 4,000 to 5,000 at the utmost. Allow for wastage, for bad health, and for bad teaching—and in this country for the next thirty years it is plain common-sense to allow for bad teaching—you get for the most fortunate class in the community, between 5,000 and 8,000 hours of teaching. Now what have you got to do in that precious time? You have to make an educated man, a man equal to modern demands, because 5,000 to 8,000 is the maximum for the best class, the ruling class, the privileged people. They must have two or three modern languages, not a large order as far as French and German go, but now there is this matter of Russian. (Laughter.) No, I do not think it is at all funny that we have got to learn Russian. This community must get on terms of understanding with the great Russian community. Unless a number of our better-class boys talk and understand Russian, our relations with the Russian people will be conducted very largely by political exiles and friendly Germans. (Applause.) Then there is mathematics. In this mechanical age it is ridiculous that our ruling class should not have a good mathematical training. It is as necessary for the gentleman nowadays to understand a machine as it was in the old days for a knight to understand his horse. Next, the history of mankind, the history of the universe—you want your boy to know his place in regard to the world, mankind, and the past, in order to know his relation to the task in hand. Philosophy—you want social philosophy and a great deal of political philosophy, though for the great mass of our ruling class it does not enter into their education at all at present. There you have an explanation of the extraordinary difficulty of which we are constantly hearing complaints, the failure not of the workmen to understand the employer, but

of the employer to understand the workmen. Because there is no social political philosophy diffused through this country all these questions are dealt with in a petty spirit which brings you, before you have got far with them, to a bitter class personal dispute. . . . Lastly the Guild will not be pleased unless I include some experimental science for the sake of method also in this outline of a curriculum.

Now that is a good filling-up of the 5,000 to 8,000 hours of the boy's education. But let us look at the time-table of a reasonably clever boy of 14 or 15 at a public school. You find Latin, Latin, Latin, Greek, Greek, Greek. Because of the traditional ineptitude of the teacher—and it is a traditional subject—not one boy in ten who begins Latin will get to the mastery, and in the case of Greek not one boy in a thousand. (Applause.) There, I think, we come to the real sickness in British education. That classical teaching sticks like a cancer in the time-table, blocking it up, distorting all other teaching. It not only takes time, it takes other resources. It means you must staff your school with men with a highly specialised knowledge of Greek, and the expensive item of a Greek scholar too often means a cheap Science master. You may say there are two sides to a school, the Classical and the Modern; but as a matter of fact all boys are on the Classical side until they specialise. Only the other day I had to interfere with a boy destined in a year's time for the Modern side who was solemnly beginning Greek. What for? Even in the most modern public schools they are picking over the boys, and any boy who can possibly be saved from the Modern side and sent on to the Classical is taken. If you doubt this, read Lord Bryce in the April *Fortnightly Review* on classical studies. In these matters he is counted as a very moderate-minded man, yet he treats it as incontestable that the classical studies have the best claim upon the best boys—and also, if you read his paper, upon the best administrative posts in later life. (Laughter.) Read Mr. Livingstone's "Defence of the Classics," and you find the same thing, a calm assumption that before boys go on to science they must be picked over and the best ones taken for Classical work. You may say all this is going to pass away? It is not. The Classical people have got hold of the schools and the Universities. The whole country may feel the inconvenience of them, just as the whole body feels the inconvenience of a cancerous growth. But it won't cut itself out; it it has to be cut out. (Laughter.)

Now let me develop this one thing. I have to say a little more because this distortion of school work by Greek and by excessive masses of Latin is only the lower level of the evil. At present Greek is the shibboleth for admission to Oxford and Cambridge. I admit there is a war relaxation at present in Responsions and "Little-go," but we are not sure it is permanent. Suppose we get that barrier of compulsory Greek lifted and it becomes possible to go right away from the Modern side to a Science degree without Greek, is that all that is needed to set things right? I would like to point out to you that it is not. It is only the beginning of the cure, because a specialised education in Science is not a complete education for a man. Let there be a straight open course without Greek from the Modern side to the highest degrees in Science and to research, your man of science

will still remain a specialist out of touch with the general body of thought. And the men who go through the big schools of history and philosophy, and who will go on to politics, administration, writing, and public guidance generally, will still be out of touch with Science. Why? Because the Greek shibboleth will still bar the way to the study of either philosophy or history so far as the English universities are concerned. Consider the case of history schools at Oxford, or "Greats," the big philosophical school. In the first you must read, or pretend to read Aristotle's "Politics," in the latter Plato's "Republic" and Aristotle's "Ethics" in the original Greek. These are the sacred texts without which there is no salvation. You cannot do philosophy at Oxford or history at Oxford without this tribute of your time and life to the Greek language fetish. Now upon this matter I have been conducting a little experiment of my own, whenever I can get hold of a man who has done Greats. You may know Plato from end to end in English—that matters nothing unless you have done the Greek text of the "Republic." You may be ignorant of all the rest of Plato's writings; you may know only this one early experiment of the great experimentalist in political and social ideas, you may have failed to grasp even the nature of the general problems that exercised him, you may be blankly ignorant of the modern forms in which these perennial problems have re-stated themselves—but you suffice for Greats. On the other hand, while the Oxford and Cambridge mandarins insist upon this monstrous sacrifice of Plato to the language in which Plato wrote, they ignore altogether the tremendous bearing of biology upon the problems of individuation, those questions between unity and diversity, between the one and the many, that are at the very roots of philosophical discussion.

You see now the real inwardness of the attack I am making upon the Greek shibboleth. It splits and divides our national consciousness by setting up a barrier that cuts science off from philosophy and history. We cannot get along with our scientific men cut off from the general thought of the community, and the general ideas of the community cut off by a devotion to the dead languages from the stimulus of living science. The Greek barrier is even more mischievous at the upper levels of the University course than at the lower. It is far more important to free our philosophy and history schools from the Greek shibboleth so that philosophy and history can be brought into proper relations with science and scientific men than it is to free Responsions and the "Little-go" from compulsory Greek. Until you do that your man of science will still be an unphilosophical specialist and get as much respect as he does to-day, and your literary and political men will be unscientific, unprogressive and unenterprising, full of conceit about their "broader outlook," and secretly scornful of science.

That is my diagnosis. There is the fundamental disease from which British organisation—English more than British—is suffering. We have to get rid of this blackmail of the Greek language specialists upon our brains and time and educational resources. Until we free our schools from it, and our philosophical and historical schools from it, our British community, our English-speaking community, will remain intellectually divided and enfeebled,

and year by year the British Science Guild will lift its voice and bewail neglect of science, neglect of research, contempt for knowledge, failure of research to secure the best men, and the lack of public interest in and respect for science.

Before I sit down let me add a footnote. It is so very hard in this country to say anything without laying oneself open to the gravest misunderstanding. (Laughter.) I have not said a word, in all that I have been saying, against the beauty, the wisdom, and the wonder of the Greek literature. I do not want to rob the Heaven-sent classical scholar of his Greek. I want only to rob him of his monopoly, of his power of imposing upon modern philosophy and modern historical study an amount of Greek that is neither beautiful nor wise nor wonderful. I do not even want to force upon him the fate he thrusts so resolutely upon the scientific man, of specialisation and isolation. What I do want is this. Here let there be an educational course leading up to the fullest and completest knowledge of Greek and Latin literature. Here let us have another course leading up to scientific studies. Let these be the two pillars, the two ways to the arch of the whole system, the link and unifying structure of our imperial community, and that is philosophy and history in English. Let the classical man irradiate that crowning culture which is the light of other days; let the scientific man bring to it his inexhaustible new suggestions. That, I submit, in broad outline, is the higher education we need; that is the way to unify; that is the crown of any complete system of National Reconstruction. (Loud applause.)

SIR WILLIAM MATHER: Ladies and Gentlemen, in your name I have to express our cordial thanks to the speakers who have given us memorable addresses this afternoon and to the Lord Mayor for his kindness in placing the Mansion House at our disposal. In relation to the speech delivered by Mr. Wells, you all know that Mr. Wells is a research worker in many realms of knowledge. His imagination carries him to the heavens above and the earth beneath. He is capable of coming without much notice and speaking to scholars and men of science and commerce, giving them always something fresh derived from those realms in which he soars, and which he delights to reveal to us whether as readers or in public meeting assembled. We are very grateful to Lord Sydenham, Mr. Fisher, and Mr. Wells for their stimulating addresses, in which they have given us suggestions enough to last the rest of our lives. By the divers fields of thought into which they have taken us, the speeches on this occasion mark a high-water level of instruction in the annals of our annual meetings. I ask you to accord by acclamation your thanks to the Lord Mayor and to the speakers. (Applause.)

ALDERMAN SHERIFF NEWTON, replying in the absence of the Lord Mayor, who had been called away to another engagement, said: On my own behalf I feel certain this historical Mansion House could not be used to better purpose than for a meeting of the British Science Guild. As the afternoon is so advanced I shall not call upon the speakers to reply to this Vote, but acknowledge it on their behalf. But I would like to add for the Lord Mayor that he desires me to express his great regret at his inability to remain to the end of the meeting. (Applause.)

The proceedings then terminated.





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