

fact of which many of us have been painfully aware for a good many years, and one which through the stern teaching of the war is gradually being brought home to the bulk of the nation. This, however, is a matter which is intimately bound up with our whole system of education, and until that system has been thoroughly reformed it is hopeless to expect that chemistry and the other experimental sciences will take their proper position.

So far as our colleges are concerned, I feel very strongly that a more thorough training in analytical chemistry is desirable, and I would, in addition, venture to suggest that the present curriculum of those chemical students who intend to become professional chemists should, whenever possible, be amplified so as to include a further year of study. During this post-graduate year, the student should be trained by thoroughly competent and specially selected teachers under conditions approximating more to those of the technical than to those of the academic laboratory.

Whilst words fail to express the indignation which one sometimes feels at the miserable wages (the word "salary" would be out of place) offered to men who have devoted several years and a not inconsiderable sum of money to their training, yet, on the other hand, the young chemist seeking a position should remember that his future lies very largely in his own hands. The manufacturer on his side must understand that in engaging the services of a young chemist from one of our universities he is getting the partly-manufactured material, and not the finished product. He should be told that his future employee is merely a well-trained apprentice who knows how to use the tools of his craft, but will have to be given time in which to find his feet and to learn something of the new conditions under which he will have to work. It is here that our university professors can do much to prevent misunderstanding and disappointment by pointing out to manufacturers the limitations of the men whom they may be recommending.

A good many manufacturers (I am not, of course, referring to the heads of large concerns where many chemists are employed, and where their functions are thoroughly well understood and appreciated) do not always know very clearly what they want. They have a vague idea that some sort of chemical assistance is necessary in a modern factory, and they consequently go to one of our colleges and state that they want "a chemist." As one of the objects of our colleges is very properly to find employment for the men they have trained, he is offered the services of a man who has perhaps just finished his chemical course, but knows little or nothing of the nature of industrial chemistry or the requirements of the factory.

It is at this point, however, that the trouble to which I have alluded commences, for the young man in question is offered to the manufacturer labelled "chemist" without any qualification at all. As a very general rule no intimation is given to the manufacturer that his prospective employee is little more than a senior student, and, in the absence of any statement to the contrary, there is some justification for regarding him as thoroughly competent not only to carry out the routine work of the factory, but also to undertake industrial research, to cheapen production, and to effect improvements in the manufacturing processes concerned. At the end of the year, in many cases, nothing very definite has resulted, no additional profit has been made, and there is no obvious improvement in the factory working, and the manufacturer is very apt to give emphatic expression to his disappointment, and to inveigh against science in general and chemistry in particular.

I wish it to be understood that my remarks apply especially to the general works chemists, to whom is

entrusted the testing of the raw materials and finished products, and the exercise of a general scientific supervision. With the more important question of industrial chemical research it is quite impossible to deal within the limits of an annual address. I would only say that chemists competent to initiate and to carry through to a successful issue the kind of investigations which are of importance to manufacturers are, comparatively speaking, few in number, and that the chemical investigator, like the poet, must be born. He may be shaped, but he certainly cannot be made, and it would save not a little disappointment if it were recognised more generally on the industrial side that men possessing all the special qualities of intellect and of character which go to make a successful chemical investigator are not very frequently combined in any one man, and that the chances of obtaining the services of such a man in a more or less haphazard way, and at a salary which would be rejected with scorn by many an artisan, are not very great.

Summarising the points on which I have briefly touched in this address, I would appeal for—

(1) Greater sympathy, freer intercourse, and closer co-operation between the two great branches of the chemical profession—the teachers and the practitioners.

(2) The establishment of chairs of analytical chemistry in our universities and colleges as a practical step towards securing the more adequate treatment of that important branch of our science.

(3) The more general provision in our universities and colleges of post-graduate facilities for acquiring a good general knowledge of certain subjects which form an indispensable part of the professional equipment of every technical chemist.

SCIENCE AND BRITISH TRADE.¹

WE were appointed on July 13, 1915, to be a Sub-Committee to prepare and submit a Report showing what steps should be taken to secure the position, after the war, of firms who have undertaken industries in consequence of the Exchange meetings leading up to the British Industries Fair, held under the auspices of the Board of Trade.

The following were the branches of industry to which it appeared that our inquiries could most usefully be directed, having regard to our terms of reference:—(i) Paper manufacture; (ii) the printing trade (including colour printing); (iii) the stationery trade; (iv) the jewellers' and silversmiths' trade; (v) cutlery; (vi) fancy leather goods; (vii) glassware, including table glass, laboratory ware, and glass bottles; (viii) china and earthenware; (ix) toys; (x) electrical apparatus; (xi) brush, etc., trade; (xii) hardware.

The value of the imports into the United Kingdom of goods of the kinds included within the scope of our inquiry may be taken as approximately 16,000,000*l.*, and of this total nearly 7,700,000*l.* represented goods of German origin, and 500,000*l.* goods of Austro-Hungarian origin. But it has to be remembered that there is also a large German and Austro-Hungarian export of these classes of goods into other parts of the British Dominions. In the absence of strictly comparable statistics, no absolutely definite figures can be given, but we estimate that the total value of such goods imported into the five self-governing Dominions and India in 1913 cannot have been less than 3,000,000*l.* Austro-Hungarian competition is noteworthy only in the case of jewelry and glassware. As regards German competition in the branches of trade under review, it is limited, as a rule, to certain special lines of goods

¹ Abridged from the Report of a Sub-Committee of the Advisory Committee to the Board of Trade on Commercial Intelligence with respect to measures for securing the position, after the war, of certain branches of British industry. (London: Wyman and Sons, Ltd.) [Cd. 8181.] Price 2*d.*

and does not extend to the whole range of articles included in the class; and in a number of cases the exports of United Kingdom manufactures included under the same general heading are larger than, or nearly as large as, the foreign imports. This is so as regards paper for printing and writing; printed paper hangings; stationery (other than paper); cutlery, china, and earthenware; telegraph and telephone apparatus; unenumerated electrical goods and apparatus; and electrical machinery. The only cases in which the values of the imports of foreign-made goods are largely in excess of those of the exports of United Kingdom manufactures included under the same general headings are—paper for packing and wrapping; jewelry; fancy leather manufactures; flint glass and manufactures thereof; toys and games; and magnetos, which have been practically a German monopoly.

We proceed to the consideration of the detailed representations as to the ways in which Government assistance might be given to the various branches of industry which have been under our examination.

The value of scientific research in industry and the desirability of Government assistance in the promotion thereof, was generally recognised both in the memoranda furnished to us and by the witnesses who appeared before us, though it was admitted that British manufacturers and workmen have not always shown themselves in the past sufficiently appreciative of the value of scientific investigation into industrial problems, or of technical training. In a number of cases reference was made to the valuable assistance given by technical institutions to German industry, and, though no very definite evidence on the point was adduced, we see no reason to doubt the validity of the opinions expressed. As regards the particular British industries with which we are now concerned, very valuable work is being done in respect of glass by the University of Sheffield and the Institute of Chemistry (by the latter body especially as regards chemical glassware and optical glass); in respect of hard porcelain, and china and earthenware generally, by the School of Pottery at Stoke-on-Trent, which is an interesting example of combined trade enterprise; and in respect of paper, by the Manchester Institute of Technology, which, however, though fully equipped, is stated to exercise only a local influence and not to be utilised by the trade generally. All these institutions are said to be handicapped by inadequate financial resources. The representatives of the paper-making industry expressed a strong desire for Government assistance towards scientific investigation as to substitutes for resin size and aniline dyes, and for paper-coating materials hitherto imported, and also in the manufacture of parchment, grease-proof and other special papers. In the case of the printing trade we were informed that much assistance could be given by research work in respect of colour-printing and the application of photography to printing and lithography, whilst as regards the Birmingham jewelry trade it was stated that research into certain metallurgical problems and into the production of semi-precious stones would be advantageous. The electrical industry, of course, provides a very wide field for scientific industrial research.

At an early stage of the inquiry our attention was directed to the fact that an extensive scheme of State-aid for industrial research had recently been established by a committee of the Privy Council, and, in we understand, to be carried out by that Department in close communication with the Board of Trade. We are informed that a strong advisory council has been appointed, and that a number of applications (including requests for assistance from the Sheffield University, the Institute of Chemistry, the Stoke Pottery School, and the British Electrical and Allied

Manufacturers' Association) are already before that body, and that the first grants are being made. We were accordingly able to refer to the new council and the funds at its disposal those witnesses who expressed the desire for State assistance in this direction, and to point out to them that the council in its consideration of any applications for help to any particular trade would no doubt be largely influenced by the extent to which the trade had already shown or would show a disposition to help itself. The new scheme is necessarily experimental, but it is capable of much enlargement, and we have no doubt that if British manufacturers are ready to co-operate with the Government in this matter and to avail themselves of the facilities put at their disposal, the operation of the scheme will be of very great value to British industry.

The Electrical Trades' Association urged that a Government inquiry should be instituted into the desirability of adopting decimal coinage and the metric system, both for this country and in the Dominions. The use of the metric system is, of course, already permissible; as to any Government action beyond that we are aware that opinion is divided; and we content ourselves with recording the suggestions.

The representatives of the stationery, silversmiths', fancy leather goods, mechanical and other toys, glass and magneto industries all urged upon us that many manufacturers, in putting down plant and finding capital for lines of manufacture which hitherto had been mainly or entirely German or Austrian, either to supply the home deficiencies caused by the cutting-off of the foreign supplies or to endeavour to supplant German trade abroad, were reasonably entitled to expect that the Government would safeguard them from the effects of unrestricted foreign (especially German and Austrian) competition after the war, especially as their action had been undertaken with direct Government encouragement, and in some instances (notably chemical glassware and magnetos) had been of substantial service in the conduct of the war.

In this connection we desire to direct special attention to the case of magnetos. Briefly, the facts are that prior to the outbreak of the war the trade in magnetos, which are of great importance for all forms of motor-cars and aircraft, as well as for other purposes, was virtually monopolised by the Bosch Company of Stuttgart, a very powerful organisation with great resources. The result was that at the sudden commencement of the war there were no manufacturers in this country where the normal demand was about 5000 magnetos per week; since then it has substantially increased, especially for military and naval purposes. A number of British firms took up the manufacture, and with the assistance of Sheffield in respect of the production of magnet steel, they have succeeded in making magnetos which have passed the Government tests and are asserted to be as good as the Bosch products. The firms are receiving large Government contracts, and there seems to be no doubt that in this instance (which is specially important as being one of a "key" industry) a considerable British manufacture could be built up which *inter alia* would guard against a repetition of the serious difficulties caused in the early stages of the war by our dependence on foreign supplies. The one obstacle is the reluctance of the firms concerned to commit themselves to further capital outlay, and the unwillingness of outside capital to come to their assistance, unless assured of some security against the strenuous efforts which the powerful Bosch concern will undoubtedly make after the war to break down the new British enterprise.

The representatives of this industry asked that Government assistance might be afforded them in the

shape of (1) an undertaking that the Government Departments concerned in motor transport and the air services would undertake to make use only of British magnetos made (so far as practicable) only of British parts—such undertaking to be for a term of years after the conclusion of the war; and (2) the extension to all magnetos of the import duty of 33½ per cent. imposed upon magnetos imported as parts of motor-cars. We reported to the President of the Board of Trade that, in view of the importance of the manufacture of magnetos for military and naval purposes, its position as a "key industry," the efforts which the manufacturers have made, and the undoubtedly severe competition from the powerful Bosch interests which they will have to encounter after the war, we were unanimously of opinion that Government assistance might be given in the two forms desired by the industry.

Apart from proposals for the imposition of import duties on foreign goods, other suggestions put before us for the protection of British manufactures in other ways included the restriction of British Government contracts to British goods, or a preference to such goods in respect of price. The reasonableness of this claim was strongly urged upon us by representatives of the new magneto industry, and also in the case of table glassware. In this connection we were informed that at the instance of the British Science Guild a large number of educational institutions and authorities have already undertaken not to purchase any chemical glassware of foreign manufacture for a period of three years after the war, provided that an adequate supply of British manufacture is forthcoming.

RECOMMENDATIONS.

Scientific Industrial Research and Training.—(a) Larger funds should be placed at the disposal of the new Committee of the Privy Council, and also of the Board of Education, for the promotion of scientific and industrial research and training.

(b) The universities should be encouraged to maintain and extend research work devoted to the needs of the main industry or industries located in their respective districts; and the manufacturers engaged in those industries should be encouraged to co-operate with the universities in such work, either through their existing trade associations or through associations specially formed for the purpose. Such associations should bring to the knowledge of the universities the difficulties and needs of the industries, and give financial and other assistance in addition to that afforded by the State.

In the case of non-localised industries, trade associations should be advised to seek, in respect of centres for research, the guidance of the Advisory Council of the Committee of Privy Council for Scientific and Industrial Research.

(c) An authoritative record of consultant men of science, chemists, and engineers, and of persons engaged in industrial research, should be established and maintained by some suitable Government Department, for the use of manufacturers only.

Copyright.—The United Kingdom copyright law should be brought into line with that of the United States.

Patents.—(a) The efforts which have been made to secure uniformity of Patent Law throughout the Empire should be continued. (b) The provisions of the law as to the compulsory working of patents in the United Kingdom should be more rigorously enforced, and inspectors should be appointed to secure that such working is complete and not (as has frequently been the case) only partial. (c) The fullest possible information as to enemy patents should be given to

British firms during the war, and every practicable assistance for their use.

Trade Marks.—All German and Austrian goods imported into the United Kingdom should be required to be marked with an indelible mark, "Made in Germany" or "Made in Austria-Hungary," and goods imported from other foreign countries should be similarly marked either with the country of origin or with the words "Foreign Made" or "Not British." Such marking should be in all cases on the actual goods and not merely on the package.

Transport.—A definite policy for the improvement and extension of the canal system of the United Kingdom should be formulated, with a view to its being carried out so soon as the national finances shall permit.

Financial Assistance.—(a) The joint stock banks should be invited by his Majesty's Government, so soon as opportunity offers, to consider the possibility of affording a greater measure of assistance to British industrial enterprise. (b) All Government Departments, local authorities, and statutory bodies entrusted with the control of moneys raised by taxes or rates, should be under legal obligation to purchase, so far as possible, only goods produced within the British Empire.

Trade Exhibitions.—The following broad principles should be adopted in respect of future trade exhibitions:—(a) Trade exhibitions should be held under the control of the Board of Trade; (b) exhibitions should be exhibitions of manufacturers' wares for traders, and should not be organised with the view of attracting the general public; (c) exhibitions should not be too general in scope, but should be for a limited number of branches of industry at a time, according to the importance and dimensions of each particular industry in this country; (d) at least one year's notice of the intention to hold any particular exhibition should be given to manufacturers.

Establishment of a Ministry of Commerce.—His Majesty's Government should be urged to consider anew the advisability of establishing a separate Ministry charged solely with the safeguarding and extension of British industry and trade, and freed from the regulative duties in respect of railways, shipping, and harbours, and the duties in respect of labour, which at present devolve upon the Board of Trade.

Extension of the System of Trade Commissioners.—The appointment of Trade Commissioners, responsible, and reporting directly, to the Board of Trade, should be extended to the principal foreign countries.

The Consular Service.—The organisation of the Consular Service should be dealt with so soon as possible after the completion of the report of the Royal Commission on the Civil Service, with a view to the increase of its commercial utility.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ABERDEEN.—At the recent meeting of the University Court, intimation was received of a munificent benefaction to the University by Sir Alexander McRobert, Cawnpore, India, and of Douneside Lodge, Tarland, Aberdeenshire. Ten years ago Sir Alexander instituted a research fellowship in the University for the purpose of encouraging the investigation of the cause, prevention, and treatment of cancer. An annual sum was placed at the disposal of the University to meet the salary of the fellow and necessary working expenses. The fellowship has been held in succession by Drs. Bertie R. G. Russell, Alex. Greig Anderson, and Harold A. Haig, and some important investigations