

Our Bookshelf.

Bibliography of Industrial Efficiency and Factory Management. (Books, Magazine Articles, etc.) With many Annotations and Indexes of Authors and of Subjects. By H. G. T. Cannons. (Efficiency Books.) Pp. viii+167. (London: George Routledge and Sons, Ltd.; New York: E. P. Dutton and Co., 1920.) Price 10s. 6d. net.

CAN this country pay the interest on the money borrowed during the war without reducing large sections of the community to poverty? The answer to this question appears to be that only by increasing the annual production by at least as much as corresponds to the necessary increase in taxation can we provide enough for everybody. Industrial efficiency is thus seen to be of vital importance. Employers and employed alike should therefore welcome any book which helps to improve methods of production. It will be generally agreed that our manufacturers have still much to learn in this direction.

Mr. Cannons is to be congratulated on having collected no fewer than 3500 references in this bibliography. It would appear that more attention has been given to the subject in the United States than in Great Britain. For example, in a list of thirty-two periodicals dealing more or less specifically with industrial efficiency and factory management, we notice that twenty-three are published in America.

The bibliography is divided into sixty-four sub-sections. The titles of a few of these will serve to indicate the scope of the book: "Academic study and teaching," "Principles of industrial efficiency," "Factory and workshop management," "Scientific management applied to special branches of industry," "Fatigue study," "Hours of labour," "Personal factor in scientific management," and "Safety methods."

We wish Mr. Cannons had done more to indicate which among the articles referred to are more likely to be worth careful study. Some help in this direction is, however, given in brief notes of the contents of many of the books and papers indexed.

Aliments Sucrés. Sucres—Miels—Sirops—Confitures—Sucreries—Sucs et Réglisse. Par Dr. E. Roux et Dr. C.-F. Muttelet. Pp. vi+474. Paris and Liège: Ch. Béranger, 1914. Price 12 francs.

THE manual of Drs. Roux and Muttelet on the analysis of foodstuffs of which sugar is an important constituent is naturally of somewhat restricted interest. The first part deals with the general optical and chemical methods of determining sugars and various other substances, such as dyes and antiseptics, used in confectionery. In the second part these methods are applied to the examination of commercial products such as honey, sugar, syrups, and preserves. The French laws and regulations dealing with the subject are given at some length together with extracts from those of other countries.

Letters to the Editor.

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British and Foreign Scientific Apparatus.

IT may, perhaps, be useful if I attempt to sum up the conclusions that seem to me to be justified from the somewhat divergent views that have been expressed by those who have written upon this question.

It is satisfactory to find that the makers are keenly desirous of meeting the requirements of the scientific worker. I think I am correct in saying that the majority of these prefer to obtain British rather than foreign goods, even at a somewhat higher price, provided that the quality is sufficiently good. It is here that the difficulty shows itself. It is significant that most of the makers who have written on the matter belong to the optical industry, and it is in this case that the state of affairs appears to be the least to be complained about, except, perhaps, in the smaller accessory apparatus, such as the object-marker referred to by Mr. Dunkerly (*NATURE*, June 3, p. 425). It is chiefly with regard to glass, porcelain, and chemicals that experience has been unfortunate. There has undoubtedly been improvement, but the impression given is that the makers as a whole have not altogether grasped the necessity of putting some of their best men to the work, and that there has been some carelessness in sending out goods of inferior quality. I have been told of flasks the necks of which drop off on the draining rack. It is natural that the users should be critical, especially when a large expense in time and money may be incurred by the breakage of a beaker in the final stage of a process.

The exhibitions arranged by the British Science Guild in 1918 and 1919 showed that excellent apparatus can be produced, and the difficulty is presumably in the main a matter of price. Glass and porcelain of quite satisfactory quality are being made in this country, and due credit should be given to the makers. The Worcester porcelain works, for example, supply excellent crucibles. At the same time, consumers meet with the experience that a large order cannot be relied upon to be of uniform quality. It is unfortunate, though perhaps unavoidable, that unsatisfactory apparatus was put on the market in the early stages of the supply of British glass, and it was to enable a greater perfection to be attained that I made the suggestion of a subvention (*NATURE*, May 6, p. 293). It is to be remembered that this is being done through the research associations of the Department of Scientific and Industrial Research, and it is in the direction of more scientific investigations that progress is to be looked for. In this connection, I may direct attention to the statement in the leading article of *NATURE* for June 24 that the profit of some three or four German dye-making firms in 1919 was more than 3,000,000*l.*, as compared with only 172,000*l.* by the British Dyestuffs Corporation.

The manufacturers want prohibition of import of foreign apparatus, at all events for a time, with the granting of special licences to import. I think it will be generally agreed that this would not meet the case, owing to the difficulty and delay that would necessarily be involved. They do not wish for a tariff, and the only alternative seems to be a grant in some form. When British goods have attained the neces-

sary quality and are then put on the market, it appears that there will not be any great risk of foreign competition in the matter of price. Indeed, according to several correspondents, there is little to be feared at the present time. But opinions are not in agreement.

There should be no objection to "manufacturers' associations," provided that their object is to obtain the advantage of more economical methods of manufacture, as by uniformity of standards and large-scale production, rather than the maintenance of high prices.

The cost of all research work, whether paid for by Government grants or otherwise, is greatly increased by inferior apparatus. At the present prices of materials, a single biochemical preparation may cost 4*l.* or 5*l.* or more. This may be lost by breakage at the final stage. The question naturally arises whether economy would not be effected by allowing free import, even at the cost of subventions to British makers.

With reference to Mr. Watson Baker's statement (*NATURE*, June 24, p. 518) that there are 12,000 German binoculars in London, I confess that I had chiefly in mind the use of apparatus in teaching and research. The sale for general use certainly raises a difficulty. As to losses incurred by work done for Government Departments during the war, so far as my information goes payment for these did not err on the side of economy. Liability for excess-profit duty surely implies that the profit has been made.

The statement by Mr. C. Baker (*NATURE*, May 20, p. 356) that capitalists will not put money into the business raises another question. It may well be that British makers do not find it profitable to undertake the supply of fine chemicals and special apparatus used only in small amount, even apart from foreign competition. If so, why not give up the trade to those who make a profit on the sale?

The desire of the British industry for prohibition of import appears to rest chiefly on the fear of competition by Germany. I am not one of those who imagine that because an instrument is of German origin it is necessarily superior to all others. Indeed, I have heard of instruments verified at Charlottenburg being found inaccurate. It would certainly be less obstructive than total prohibition if the restriction applied to German goods only. But there are other considerations to be remembered here, such as the importance of giving an opportunity to that country to restore its credit. However this may be, the large profits of their chemical industries referred to above raise some doubt as to the real cause of the present unsatisfactory conditions in Germany.

The point raised by Mr. Dunkerly that American microscopes and lenses are being sold here, although the rate of exchange is against us, suggests that the source of the trouble is not the low value of the German mark. This view is confirmed by other correspondents. If it is correct, there would be no real gain in a mere prohibition of import. Improvements in modes of manufacture are needed, and we come back again to the necessity for more scientific research.

I note that the British Optical Instrument Manufacturers' Association (*NATURE*, May 20, p. 355) considers that a tariff might have the result of removing the inducement to improve quality, but I foresee so many difficulties in the way of convincing a Government official that a particular piece of apparatus could not be obtained in England that I am unable to accept the suggestion of import by permit as a satisfactory alternative. If, however, it were possible for every scientific worker to obtain without difficulty a general permit for the import of

any apparatus at any time the situation would be different.

There seems to be much doubt as to whether it is really possible to obtain foreign apparatus at a price much lower than the British. Should this be the case, the payment of a subsidy might be considered where there is actual underselling. The test would then become one of quality.

The importance of the subject may, I think, serve as an excuse for this lengthy letter. Scientific workers have every desire to assist the development of the industry, but they feel that they are not justified in wasting time and money where it could be avoided. And if this correspondence has brought out the fact that satisfaction has not yet been given in the matter of quality, especially in the case of certain goods, it will have been of some value. It is possible that users have not sufficiently made known their difficulties to the makers, and have been sometimes content with the purchase of foreign material when further inquiry and discussion might have enabled British goods to be forthcoming.

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The Separation of the Isotopes of Chlorine.

MR. D. L. CHAPMAN's argument appears essentially to be similar to that already developed from a quite different point of view by Lindemann (*Phil. Mag.*, 1919, vol. xxxvii., p. 523; vol. xxxviii., p. 173), that because isotopes are (theoretically) separable by physical means, they must also be chemically separable according to thermo-dynamical reasoning. The fact that the particular mode of separation by semi-permeable membranes (assumption (3), *NATURE*, July 15, p. 611) is highly fanciful need not obscure the nature of the argument. Lindemann's conclusion that, though isotopes cannot be identical chemically, the difference may be reduced to an unmeasurable one of the second order of magnitude by suitable assumptions as to the "Nullpunktenergie," seems to indicate the more hopeful line of advance. The chemical non-separability of isotopes, of which there is an accumulated mass of experimental evidence, seems to call for consequent adjustments in thermo-dynamic theory rather than the reverse.

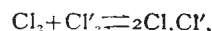
The following considerations may throw light on the matter. I have stated (*NATURE*, June 24, p. 516) that, on the assumption of the chemical identity of the isotopes, the distribution given by probability considerations of the two kinds of atoms among the three kinds of molecules is

$$\text{Cl}_2 : \text{Cl}'_2 : \text{Cl.Cl}' : : n^2 : (1-n)^2 : 2n(1-n) \quad (\text{i})$$

where n and $(1-n)$ are the fractional proportions of the Cl and Cl' atoms respectively. This leads to the equilibrium condition

$$[\text{Cl}_2][\text{Cl}'_2] = \frac{1}{4}[\text{Cl.Cl}']^2 \quad \dots \quad (\text{ii})$$

Now if one applies in the conventional manner this result to the reversible reaction



denoting by k_1 and k_2 the coefficients of velocity of the direct and the inverse reactions, one gets

$$k_1 n^2 (1-n)^2 = k_2 \{2n(1-n)\}^2$$

or

$$k_1 = 4k_2.$$

This, to say the least, is unexpected, because if coefficients of velocity of reaction have any physical significance at all, one would expect them to be the same for substances assumed to be chemically identical. The result is clearly due to a loose method of