
 REVIEWS

Waste Heat Recovery from Industrial Furnaces. A Symposium. (Published by Chapman & Hall Ltd., London). 1948. Pp. x+383. Price 35sh. nett.

This is an important publication of great practical value. The contributors to this Symposium conducted by the Institute of Fuel, London, are eminent authorities in different branches of the subject handled by them. The chief aim of everyone of the authors has been the application of available scientific data in a most practical manner to introduce the latest methods of waste heat recovery and derive financial benefit.

The Institute of Fuel is one of the most important technical organisations in England and national in its outlook. The present publication is educative and propogandistic in the methods of its approach and appeal. It is mainly addressed to British industrialists. Mr. G. N. Critchley says: "It therefore becomes a matter of great importance to study the means whereby the limited amount of fuel available may be made to produce the greatest output of goods, not only for home requirements but also to supply export markets on a far greater scale than ever before." The manner and method of achieving this, are elaborated by the contributors in a most scientific and practical manner in the body of the book. All those who are engaged in industries that use large quantities of coal or gas should feel grateful to the authors.

It is necessary to keep in mind that this publication confines itself only to the subject of the recovery of heat from waste gases from industrial furnaces,—nothing more or nothing less. It does not deal with the whole subject of fuel economy which forms the subject of matter of a masterly treatise entitled "Efficient use of Fuel" published three or four years ago by H.M.G. Stationery Office, London. As a matter of fact a general study of this treatise as well as a study of the book entitled "Industrial Furnaces" published by Messrs. John Wiley and Sons will form a helpful and useful background for fully appreciating the recovery of waste heat from industrial furnaces.

According to the temperature required in industrial heating operations, the flue gases must leave at a more or less elevated temperature which will obviously be above the temperature to which materials are heated in the

furnace. Part of the sensible heat of these gases will be required to create the necessary draught if a chimney is used for this purpose. If a fan is used for creating the draught the outlet temperature can be very much lower. The gap (or difference) between the outlet temperature of the furnace and the minimum permissible temperature of discharge represents heat which could be saved. This, in essence, is what is popularly known as waste heat recovery from industrial furnaces.

For purposes of waste heat recovery, recuperators or regenerators are in use. Recuperators consist broadly of systems of flues, some of which carry in-going air, and others outgoing flue gases at a higher temperature, so arranged that there can be heat interchange between the air and gas. On the other hand, a regenerator is simply a heat exchanger constructed of refractory material. In its simplest form it comprises two chambers filled with chequer firebricks, the bricks being so stacked that gases can flow freely between them and around them. The waste heat from industrial furnaces has in very many instances been utilised for the raising of steam in specially designed waste heat boilers.

The first two chapters of the book under review furnish all the scientific data on the theoretical side of the problem. Then follows special experiments conducted on pilot plant scale on the engineering side of the problem to determine the factors governing the design of regenerators (with special reference to coke ovens) and tubular metallic recuperators and waste heat boilers. The remaining chapters have the problems of special industries like carbonising industries, metallurgical industries and the glass container industry considered in great detail with a view to introduce economies in working by the recovery of waste heat. Closely connected with waste heat recovery are problems of refractories and insulations. Adequate treatment has been given to these two subjects. The savings that can be effected in the annual consumption of coal and the labour employed and the consequential cash gain by adoption of waste heat recovery methods in a scientific manner by some extra capital equipments have been analysed and the results given in Tables I and II. These two tables merit very close study and will convince any industrialist about the wisdom of installing waste heat recovery equipment as soon as possible.

Taking into consideration such an ordinary and routine thing as proper insulation, it is amazing to read in Tables I & II that by proper insulation applied to the roof of a glass melting furnace at a cost of £210 and on the basis of working the furnace for 8,000 hours in a year, 940 tons of coal can be saved per annum which would cost £1,880. If the insulation would last for five years, the annual return on the investment would amount to 895% and during the five-year period of the insulation's life, the total return on the capital invested would be 4,475%! This is not all. The labour required to mine 940 tons of coal per annum or 4,720 tons during the five year period of insulation's life is a national gain, since this labour can be employed to produce more coal or be employed in other gainful occupations.

The book is recommended for study by every student of fuel technology. It more than repays the time required for it. The price of the book is somewhat on higher side.

So far as conditions obtain in India, the biggest users of coal for industrial purposes happen to be the Tata Iron & Steel Co., and the Indian Iron & Steel Co. Reports indicate that they both seem to be alive to this problem and a lot has been done in this direction. They seem to be up-to-date on this subject but still, —one never knows—a study of this book may reveal places where the waste heat recovery has been neglected and may be adopted in future. So far as the cement industry in India is concerned, it is a matter of regret that the industry as a whole has not looked into this problem at all. It is a great pity. One hopes that just as the British Government did during the war time and subsequently, our own Government would carry on propaganda to educate the sponsors of the cement industry about the waste heat recovery problems. So far as the glass industry is concerned, enterprising firms like Messrs. Ogale Glass Works, seem to be alive to this problem and they have recuperative or regenerative devices in connection with their tank furnaces. The methods employed in the glass bangle industry, since they are produced on a comparatively small scale, do not seem to admit of these modern methods of heat recovery but it is hoped that the new Institute of Glass Technology started as one of the National institutions will devote its closest attention to design improved furnaces even for the bangle industry to save fuel. In connection with the contact sulphuric acid manufacture at Tata Iron and Steel Works and also at Belagula at the Mysore Chemicals & Ferti-

lisers Factory, waste heat boilers have been employed. There have been some sporadic attempts at the Mysore Iron & Steel Works to use the flue gases from wood carbonisation retorts to pre-dry the incoming wood. On the whole, Indian industrialists do not seem to have been seized of the importance of this problem and the sooner they did the better it will be. The new All-India Institute of Fuel Technology that will be started at Dhanbad will have to undertake this work in a systematic manner and introduce all the latest methods of waste heat recovery by insisting on this, by legislation if necessary.

The importance of this problem to a country like England can be gathered by a quotation from the Foreword to the book by Mr. E. W. Smith. "It has been authoritatively stated that not more than 15–20% of the energy of our coal supplies is usefully employed... Even an additional 5% improvement would mean the savings in coal mined of between fifty to seventy million tons a year....!" The entire output of coal in India, roughly about thirty million tons a year, is only half of what Mr. E. W. Smith hopes to gain by introducing rational methods of waste heat recovery in England! Therefore, all those in India concerned with the future of industrial development should wake up and lose no time in tackling the problem in India in the most up-to-date manner.

Without in any way trying to detract from the exceptional merits of the publication, the reviewer may be permitted to notice the very first sentence by Mr. G. N. Critchley in his introduction to the book: "At the present time (June 1946) it appears likely that for at least some years ahead supplies of coal mined in Great Britain will be insufficient to meet full industrial requirements. There is thus a probability that fuel will, unless it proves economically practicable to import large quantities from abroad, be a major factor restricting national prosperity." It almost looks humorous that England, even as a distant possibility, thinks of importing coal from abroad. England has always prided herself on her coal deposits and time and again prominent people have made public statements, with a sense of pride to which they are entitled to. One prominent man stated:—"Civilisation is economy of power and our natural power is coal". Another leader stated: "It is cheapness and abundance of coal which has made us (British Empire) what we are." In fact, Great Britain has been one of the chief

countries for exporting coal in exchange for raw materials and foodstuff. Even now, the present Labour Government is fully determined to maintain the export of coal to other countries of the World and to afford bunkering facilities to steamships. And England is not likely to lightly change this attitude. The question then arises, "Why should England envisage a time when she may have to import coal from abroad?" It can only mean that she would like to have a tight hold on her export markets in order to maintain her national economy in other directions and if and when necessary also to import coal from other countries. In connection with the Organisation for European Economic Co-operation (O.E.E.C), two white papers have been presented to the Parliament by Sir Stafford Cripps recently. It is mentioned therein that the coal exports which have been always a great asset in the Nation's economy have now assumed even greater importance as they can directly reduce the dollar expenditure of other European countries. With this thing in view, Sir Stafford Cripps suggests a target of 40 million tons for exports and bunkers from a total output (including open-cast) of between 250 to 260 million tons of coal mined in England. It only means that she does not want to lose even a single market. If necessary, she may import coal for her own needs and export her own coal abroad and thus continue her dominant position in a field in which she has been all too powerful all these years. There is nothing wrong in this and we wish them well.

Finally it is to be hoped that the Institute of Fuel, London, will publish other studies in the economy and use of fuel as soon as possible. Our thanks are due to this Institute for giving the world public this valuable publication.

S. G. SASTRY.

British Chemical Nomenclature. A. D. Mitchell. (Edward Arnold & Co.), 1948. Pp. 156+iv. Price 21/- net.

It is sad to contemplate that chemistry still lacks what Foster in the middle of the last century described as "the legal language of the science—a language whose terms are, as far as possible, strictly defined and have an exact and generally recognised value". Several attempts to standardise chemical nomenclature through international conferences have borne fruit only to a limited extent, partly because of the desire on the part of the national societies not to deviate from their established usage, and partly because of the

failure of these conferences, meeting at rear intervals, to keep pace with the rapid advances made in the meantime. In the absence of a universal system of nomenclature, the various publishing societies have adopted the only possible alternative, *viz.*, that of framing a set of rules for their own guidance. Thus have arisen three main systems, *viz.*, the British, the American and the Continental or German systems, each with its own established rules of nomenclature and enumeration which are often quite arbitrary and in many instances entirely different from those of the other two. No systematic attempt appears so far to have been made to present any of these systems in a consolidated form, although it must be admitted that the problem has been studied comparatively more fully in America than elsewhere, the compilation of the Ring Index by the American Chemical Society being justly regarded as a most valuable contribution.

The present volume embodying the conventions adopted in the *Journal of the Chemical Society* is therefore to be welcomed. The lucid lecture on British Chemical Nomenclature delivered by the late Dr. Clarence Smith in 1936 has been the only authoritative account recorded so far of this system, but the subsequent additions and amendments to the principles enunciated in it have often been hidden away in the footnotes of the *Journal*. With over twenty years of association with the *Journal*, the author of the book under review is eminently fitted to accomplish the task which he has set out to perform, *viz.*, to prescribe general principles and their application to a variety of individual cases. The very nature of the contents of the book which are, in the main, a collection of rules of nomenclature and enumeration of both inorganic and organic compounds, prevents their detailed examination here. The journals in India tend to allow a good deal of freedom to authors in the choice of the system of nomenclature, but it is desirable that at least each journal adheres strictly to one definite system of nomenclature. Chemists using the British system will find this monograph to be of great service. The author has rightly drawn the attention of his readers, wherever necessary, to the gaps and inconsistencies in the present usage. The flexibility of the rules and the freedom that is often allowed to individual authors naturally result in inconsistencies which reach bewildering proportions in the case of complex fused ring systems.

On the need for a radical reform of the existing systems and for the adoption of a

Universal system there can be no two opinions. International bodies never seem to realise that if any uniformity is ever to be attained chaos avoided, concessions must be made." A new system of notation and enumeration of organic compounds proposed by G. M. Mason in his book ("A New Notation & Enumeration System for Organic Compounds", McGraw-Hill, Green & Co., 1946) with its simple and invariant set of rules resulting in unique ciphers for the compounds which could be handled mechanically by a system of punch-cards for the purposes of indexing, literature survey, etc., has much to recommend itself for universal adoption. But, in spite of a general desire to do away with trivialities in chemical literature, it is doubtful if this system can succeed in doing so, since ciphers share with the graphical formulae some of the inherent drawbacks of the latter, namely, the lack of a facile speech equivalent. The get-up of the book is excellent and the index is comprehensive.

B. B. DEY.

Research in Industry. (Published for D.S.I.R. and the Board of Trade by His Majesty's Stationery Office, London. Price 1sh. 6d.)

The articles published in the volume cover a variety of industries, i.e., cotton, wool, rayon, glass, pottery, iron and steel, lace, linen, boots and shoes, paint, furniture, plastics, light engineering and electrical consumer goods. In addition there are articles on electronics, machine tools, industrial design and radar. The emphasis in each case is laid on the value of research for the future, both immediate and more distant, but examples of what research has already done for the industry are also given.

The article on wool for instance, describes research work done on carding which proved that lines of development employing higher speeds and fewer parts were practicable, contrary to previous accepted opinion. It was not possible to specify an 'ideal' card and to demonstrate this to firms and their carding engineers. With this machine a great increase in production can be obtained. Further, it is possible to achieve most of the advantages of the 'ideal' card by modifying the existing cards, without waiting for new ones.

A more spectacular example of the impact of science on industry has been the steady replacement in the potteries of the old type of kiln-fired bottle oven by the modern tunnel kiln. The advantages of this are that the

labour involved in firing ware is reduced, the work is made more pleasant, the firing cost is lowered, the quality of the actual ware is improved, and the thermal efficiency of the oven is increased. The kilns are fired by smokeless fuel, which will decrease the heavy pall of smoke which, up to now, has been an unpleasant feature of the pottery areas.

The article on electronics gives some details of what these devices are able to do for manufacturers. They can control machine tools, detect internal flaws and faults in metals, match colours, count and inspect finished products for size, surface finish, and weight. Almost any property of a product can be measured. There is wide scope for these devices in the protection worked from guillotines, presses, millers and so on. The application of the electronics to industry is practically limitless.

One of the industries which might be described as the child of research is plastics. Some of the uses of the 'silicones' are described in the article by Mr. N. J. L. Megson. In the baking industry, for example, silicones can replace fat for greasing baking tins. One application of silicone resin permits the baking of very many batches of loaves, whereas with fat the tins have to be greased after every batch. Only ten years ago silicones were regarded as laboratory curiosities having no commercial possibilities!

The potentialities of research applied to industry are well illustrated in the section on machine tools. Investigations carried out recently on drilling showed that the overall economic efficiency can be greatly increased by applying the results obtained. Moreover, these investigations and others showed that a few hundred pounds spent on this type of small tool research will save or yield as many thousands of pounds each year in a single factory if properly applied.

The necessity of following up research results at once is stressed in a foreword by Sir E. Appleton. As an example, he mentions the publication of a report on the fire proofing of fabrics for which the Stationery Office received a considerable number of orders from the U.S.A. within a few days of publication.

Organic Reactions: Vol. IV. Edited by Roger Adams. (Wiley & Sons, Inc., New York; Chapman & Hall, London), 1948. Pp. 428. Price \$ 6.00.

The fourth volume of the series of extremely valuable reviews of important synthetic organic

Chemical reactions maintains the high standard of the first volume which appeared in 1942. In the previous volumes each chapter is written by a specialist and provides a comprehensive survey of a reaction, which includes a general discussion of its nature and mechanism, its scope and limitations, and a detailed description of experimental procedure for the synthesis of typical compounds by the use of the reaction. Tables of the various compounds synthesised by or subjected to the reaction under review, pertinent experimental conditions including the yields obtained, and numerous references to the literature are, as in the earlier volumes, notable features of the book.

The Diels-Alder reaction, discussed in Chapters 1 and 2, is of outstanding importance on account of its versatility and the light it has thrown on the mechanism of polymerisation. The various types of compounds which can serve as dienes and as dienophiles are tabulated and the vast literature on the constitution of the adducts with maleic anhydride (in Chapter 1) and with ethylenic and acetylenic compounds (in Chapter 2) is ably summarised. With the commercial production of dienes such as butadiene, furan and their derivatives, and considering the wide variety of compounds which can serve as dienophiles, this review would stimulate the synthesis of hitherto unknown and inaccessible compounds by new applications of the Diels-Alder reaction.

The synthesis of aliphatic and aromatic amines by reductive alkylation (the introduction of alkyl groups into ammonia or a primary amine or secondary amine by means of an aldehyde or ketone in the presence of a reducing agent) is described in Chapter 3. By a suitable choice of conditions high yields of amines with the desired degree of alkylation can be achieved by this one step synthesis.

Methods for the synthesis of α -hydroxy ketones of the general formula $R\text{-CHOH-CO-R}^1$, known as acyloins if R and R^1 are aliphatic residues and as benzoin if these are aryl residues, are discussed in Chapters 4 and 5. The synthesis of benzo-quinones by oxidation, discussed in Chapter 6, is also of value for the preparation of quinones from naphthalene and other polycyclic hydrocarbons, as well as heterocyclic compounds. The selective hydrolysis of an acid chloride to the corresponding aldehyde in presence of a suitable catalyst, usually supported palladium, is discussed in Chapter 7; the Rosenmund reduction is probably the best method for converting acids to the corresponding aldehydes and has wide

applicability. The Wolff-Kishner reduction of a carbonyl to a methylene group by heating the semicarbazone, the hydrazone or the azine in the presence of an alkaline catalyst, described in the last chapter, is a valuable alternative for the more common Clemmensen reduction, and is to be preferred to the latter in the case of the compounds of the pyrrole and furan series which are sensitive to acids; compounds of high molecular weight are not amenable to reduction by the Clemmensen method, but the Wolff-Kishner reaction is applicable.

K. V.

Theory of Groups and Its Application to Physical Problems. By S. Bhagavantam and T. Venkatarayudu. (Andhra University, Waltair), 1948. Pp. xii+234. Price Rs. 20.

As Physics extends its frontiers further and further, various new types of Mathematics are pressed into service and every succeeding generation of physicists has to master more and more of these mathematical disciplines almost always under protest as History shows. There was a time when the infinitesimal calculus itself was thought of as a difficult subject, to be introduced only into advanced treatises and even then with an apology. British authors fought shy of Vector Analysis in the same way and even now it is sparingly used in English books. The Theory of Relativity made it necessary for physicists to master Tensor Analysis, and again we see it being slowly introduced into text-books, often in a disguised garb. And now we have Group Theory, against learning which even Dirac is reported to have protested. One regrettable result has been that we no longer have physicists like Lord Rayleigh who are familiar with both the theoretical and experimental branches of physics. The experimenter has to take the theorist on trust, while very often the theorist does not know and does not want to know what his symbols mean. But time has shown that learning a new type of mathematics will in general become inevitable as physics advances. It will be more graceful and less painful if the acquisition is not unduly put off.

We may congratulate the authors of the book before us for showing that Indians are not slow to learn and employ even such an arduous discipline as Group Theory. Another reason for our congratulation is that while most of the scientific books produced in India are cram-books and notes, this is a high class production resulting from original study and investigation. The book is further noteworthy

to the large number of different problems treated, and so, whether we learn Group Theory or not, we can turn to the book for various useful results. We have here the results of the application of Group Theory to vibrations of molecules and lattices, atomic and molecular spectra, Raman Effect, Nuclear Spin, Crystal Optics, Optical Activity, Elasticity, Photo-elasticity, Piezo-electricity and Electrical Double Refraction. This list of applications should certainly convince even the most sceptical that learning Group Theory is worth while. It is also not an exaggeration to say that the book shows a collection of useful information not easily to be found anywhere else within two covers.

While the copiousness of the information is one of the merits of the book, it is also the source of its chief weakness which is undue compression. Almost every sentence is a theorem or an important part of a proof, and the sentences run into paragraphs without results, so that anyone who does know something of the subject will be bewildered. The equations are not numbered, and when references are made to previous treatment in the book, the reader does not know where to turn and has to search, sometimes at random. Figures are all too scarce and this adds to the difficulty of following the text. As an example of this, it will be seen that "Symmetry Operations and Point Groups" treated in twelve pages of small type with three pages full of figures in Herzberg's "Infra-red and Raman Spectra of Polyatomic Molecules," are here compressed into less than four pages of open printing with no figures. (The figures given in Chapter II are artistic, but not of much practical use.) In the same way most of the information given in Wigner's Gruppen-theorie from p. 63 to p. 78 is here condensed into pages 18-24. Chapter V of the book condenses almost half of the information in any book on Wave Mechanics (e.g., Pauling & Wilson's book) into 11 pages. One has to learn all about matrices as used in the book from three pages in Chapter IV. If only the authors had allowed themselves more space and arranged the matter in a more interesting way so as to make the chief results stand forth, the value of the book would have been enhanced to an appreciable extent.

The arrangement of the material does not show a logical plan; we oscillate from groups to lattices and jump to atomic spectra and back to groups. Some important parts of the theory are to be found thrust into appendices. The discussion of the relative merits of the theories

of Raman and Born is useful but does not seem to lead to any definite judgment, and occupies much space in the middle of the book. The attempt seems to have been to indicate as many applications of Group Theory as possible at any point that offered itself in the development of the book.

Misprints are really few. We have noticed minor ones on pages 44, 46, 97, 101, 127, 161 and 203. On page 36 dV in $\int \psi_1^* \psi_2 dV$ is said to be an element of 'phase space'. In Fig. 15 the letter O is not present.

References to other books and original papers are not given except a general list at the end of the Preface. It is therefore difficult to find the original contribution of the authors of the book, although there are indications to show that a good deal is original. We only wish that the condition of inflation and paper shortage evidenced by the price and the compression were soon removed so that the authors felt free to discuss the material at their leisure and provide it with the illustrations so necessary to understand the subject. The book would then be an even more valuable acquisition to a Physics Library. Even as it is, it is an essential and valuable contribution to the literature of Physics.

T. S. S.

The Basis of Chemotherapy. By Thomas S. Work and Elizabeth Work. (Oliver & Boyd Ltd., London), 1948. Pp. xx + 435. Price 26/- net.

The development of knowledge in the branch of chemotherapy has been so rapid during the past few years and the field covered by this development so varied that it is difficult for any individual to keep in touch with the progress in branches of science outside his speciality. Consequently when those who have spent some time in the study of this important subject are willing to co-ordinate their knowledge and present it in a concise and readable form they perform a service of great value. Work and Work have served two distinct purposes in writing this volume. Firstly, they have presented the knowledge available upon the chosen topic in a form intelligible to those whose activities may be along a wholly different line. Many chemists fail to realise how closely their investigations may be connected with other work which on the surface appears far afield from their own. This book enables us to form closer contact with works on the allied lines of research. The second purpose is to promote research in

the branch of science covered by the book by furnishing a well-digested survey of the progress already made and by pointing out directions in which investigation needs be made. To facilitate the attainment of this purpose enough references have been given so that any one interested can readily find access to the literature. The specialist does not need exhaustive bibliographic treatment, as he is already familiar with the material in his field. A critical selection has, therefore, been made on those papers which are important.

The reader is assumed to have a knowledge of the background of biochemistry, organic chemistry and microbiology. For the sake of continuity and brevity many aspects of chemotherapy are only mentioned. It is hoped, nevertheless, that this description will make available to the workers in this line the trends and meaning of a field in which much difficulty is caused by a great mass of conflicting data. A critical evaluation requires so much elaboration that the authors make no pretense to be exhaustive. They have tried to build up a composite picture of intermediary metabolism of living cells, particularly bacterial cells as shown by their nutrition requirements. A study in this direction may help in elucidating the mode of action of known chemotherapeutic drugs and in developing new ones. The authors have dealt with kinetics of enzymic reaction and the subject of enzyme inhibition, so that the reader is able to distinguish between various types of inhibition known to occur. Since enzyme inhibition is often a reversible process, it is often found that the growth inhibiting action of drugs on living cells can frequently be removed by the addition to the drug-cell-system of what is known as 'antagonists'. In the chapter on drug antagonism the authors have elaborately dealt with this factor which can bring about removal of drug from its site of action. A study of antagonism leads us also to the field of drug resistance. Drug resistance is a tool for the study of acquired character, inheritance, differentiation and the relation of gene to environment. The authors have to be congratulated for trying to explain these points very lucidly.

The underlying pattern of the book is a carefully prepared and informative historical survey of the topic, an interpretation of the present and latest development in the field and an indication of some of the unsolved problems still confronting the chemotherapists. The book is highly recommended to those engaged in the field of research in chemotherapy.

N. N. DE.

The Chemistry and Manufacture of Indian Dairy Products. By K. S. Rangappa and K. T. Achaya. (The Bangalore Printing & Publishing Co., Ltd., Bangalore-2). 1948. Pp. xi+189. Price Rs. 10.

The book contains a useful collection of data on Indian milk and milk products. Though several standard text-books on the technology and chemistry of milk and its products are available, these invariably include only the data obtained under conditions widely differing from those prevailing here. During recent years, a considerable amount of published literature on Indian dairy products has accumulated which is widely scattered and not always easily accessible. The authors have done a great service in bringing all these data together.

The book is divided into three broad divisions covering 14 chapters, and is supplemented by author and subject indexes. The methods of preparation of important dairy products are described. In a vast country like India various modifications are followed for preparing the same product, but the outlines given help to convey a fairly general picture. The composition and characteristics of Indian milk products are described in detail. Side by side, these data have been compared with the results obtained by workers in other countries. This helps to bring out clearly the outstanding points between the two. References up to the year 1948 have been included mainly from the authors' own work, but a few omissions are noticeable. At some points matter irrelevant to the subject of the book has been allowed to creep in, and the data for the composition of some of the less well-known products are not quite up to date. But apart from these few corrections of a minor nature, the authors have accomplished a difficult task with credit, considering the fact that this is the first time that such a publication has been compiled. The book fulfils a long felt gap and is sure to be widely appreciated by specialists and students. The printing and illustrations have been done clearly, and the book has a very attractive get-up.

NOSHIR N. DASTUR.

The Indian Association for the Cultivation of Science—Annual Report, 1947-48.

The first part of the report contains a brief review of the development plan, research personnel and other matters, the resumé of the scientific work done in the Association being given as an Appendix. The development plan seeks to create five new departments, viz., of

General Physics (Optics), Theoretical Physics, Organic Chemistry, Inorganic Chemistry and Physical Chemistry, as also to supplement the researches of the Department of X-Rays and Magnetism in the domain of Molecular Structures. The plan further contemplates that the researches carried out in the Association would be such as to find application in investigations of the physics and chemistry of High Polymers. Partial effect has already been given to the plan during the period under review by the appointment of two new Professors and providing each with a part of the approved research personnel.

The researches carried out in the Department of X-Rays and Magnetism under the M. H. L. Professor were mainly concerned with the studies of the extra-reflections in Laue photographs and their temperature variation, low angle scattering and structure analysis of phenanthrene crystals, radiographic study of coals, and X-ray studies of plastics, glass and fibres. The interesting work on the magnetic behaviour of dia- and para-magnetic substances especially in the form of single crystals has been continued. A systematic study of the magnetic and electrical properties of semi-conductors has also been undertaken. In the year under report, nine papers have been published.

The work done in the Optics Department is mainly concerned with the Raman spectra of various compounds in different states of aggregation and at different temperatures. The Department of Physical Chemistry was in existence for a period of three months only. Research work on polymerisation, kinetics of halogenation of sodium acetate in glacial acetic acid, surface active agents, etc., has been started.

R. S. K.

Practical Zoological Illustrations: Invertebrates. By W. S. Bullough. 32 cards. (Macmillan & Co., London), 1948. 15sh.

This set of semi-diagrammatic figures of typical invertebrates including *Branchiostoma* consists of 32 plates intended for the High School and first year University courses.

While the figures are useful as guides, the intermediate students of Indian Universities will feel the want of the sectional views of many of them. Particularly, *Lumbricus* is not of any use to them.

In *Nereis*, the head is not correctly drawn and also all the setæ are shown to be uniformly of the same type. The number of

bundles of Malpighian tubules, the gonapophyses and the correct delineation of the leg of *Blatta* are necessary.

In *Branchiostoma* (Amphioxus) the representation of gill slits and the nerve cord are not accurate.

It is hoped that the students who refer to these cards will make use of them as the author wishes them to be and not for copying them.

The printing of the cards is excellent. The price is unfortunately above the reach of the average Indian student.

L. S. R.

Bulletin of the World Health Organisation: Vol. I, No. 2. (Sales Section, Palais des Nations, Geneva, Switzerland), 1948.

Report of the Expert Committee on (1) Tuberculosis, (2) Various Methods of Malarial Control, (3) Malaria Control in Egypt by Species-Eradication Method—A gambiense, (4) Cholera Epidemic in Egypt in 1947.

The Committee recommend organisational and control measures pertaining to various items under report. They recommend and give expert advice to countries which have not got proper Public Health Organization in order to combat major health problems such as malaria, tuberculosis, venereal diseases, which three diseases owing to their widespread prevalence, the Committee consider to be international rather than national or racial problems.

In the campaign against tuberculosis, the aim is to have a uniform standard in devising ameliorating measures, such as: (1) prevention, (2) case finding, (3) isolation and medical care, (4) social and economic protection of the afflicted. The salient features of the preventive method is training of technical personnel, expert advice, health education and propaganda to stimulate popular co-operation, besides (1) uniform procedure regarding research relating to preparation of tuberculin and tuberculin testing, (2) preparation and application of B.C.G. vaccine, (3) classification of tuberculosis, (4) x-ray interpretation of mass radiology, (5) evaluation of the new chemotherapeutic agents, etc. The Committee emphasises the importance of complete co-operation and co-ordination efforts on the part of the official and private agencies in order to obtain maximum results.

In the sphere of malaria prevention, the Committee gives first priority to mosquito control measures by drainage, application of D.D.T. and other suitable larvicides and insecticides. More research on these lines is needed. The Committee does not overrule the

importance of chemotherapy and chemoprophylaxis in the clinical control of epidemic malaria. Chemoprophylaxis however efficient is only considered a palliative measure. Therapy plays only a secondary role in the prevention of malaria. The Committee considers the importance of basic research on the following subjects, which should be encouraged in places where there are proper facilities, *viz.*, Rockefeller Foundation, Indian Research Fund Association, and British Colonial Research Committee:—

1. Parasite—Animal relationship; 2. Vector and insecticides; 3. Epidemiology; 4. Chemotherapy and chemoprophylaxis.

Applied research on the following is also recommended:

1. Choice of control method; 2. Insecticides; 3. Organization and equipment.

The Bulletin will be found very instructive to all Public Health Workers and may be commended to be read in the original.

K. P. MENON.

Industrial Hygiene and Toxicology. In two volumes. Prepared by a group of Specialists under the Editorship of Frank A. Patty, Director, Industrial Hygiene Service, General Motors Corporation, Detroit, Mich. Vol. I. (Interscience Publishers, New York, London). 1948. Pp. xxvii+531.

Hazards associated with various occupations such as mining, smelting, etc., were known from ancient time and certain precautions were taken to minimise the dangers from inhaling metallic dust and fumes. The first organised effort was the result of the introduction of labour legislation of the 19th century in England to reform the deplorable conditions of the workers in English Cotton Mills. Further reforms took place from time to time. Even so they were of the nature of the periodical examination of workers and prescribe remedial measures; no attention was paid to improve environmental condition to prevent the occupational disease. Although there were many books published on the medical and legal aspects of occupational and industrial disabilities there are only a few books on industrial toxicology and still fewer on preventive engineering and control of occupational diseases. The present concept of industrial hygiene began to develop during the World War I as a result of ill-health and increased mortality among workers in muni-

tions factories. Organised efforts to impart instructions bearing industrial hygiene began by institution centres of study in American Universities, the first of which was established at Harvard Medical School where initially a Department of Applied Physiology was started. Other Institutions then began to spring up imparting instructions in industrial hygiene in collaboration with Doctors, Engineers and Chemists. Under the impact of World War II, industrial hygiene units were established in all the industrial States of U.S.A. Managements have realised the importance of improving the environmental conditions of the employees to ensure industrial efficiency and enhanced dividends. The present volume is a collective effort of various authors with thorough knowledge of the problems of efficient industrial conditions. The Editor is one who has to his credit vast experience in the field and is now the Director of Industrial Hygiene, General Motors Corporation, one of the largest single industrial organisations in the United States of America. The book is neatly got up and the textual matter is discussed in sufficient detail to afford an intelligent understanding of the various aspects of the subjects, which are classified as follows:—

1. Industrial Hygiene Retrospect and Prospect. 2. Industrial Hygiene Records and Reports. 3. Industrial Hygiene Survey and personnel. 4. Personal factors in competence and fatigue. 5. Environmental factors in fatigue and competence. 6. Physiological effects of abnormal atmospheric pressure. 7. Mode of entry and action of toxic material. 8. Sampling and analysis of atmospheric contaminants. 9. Radiant energy and Radium. 10. Ventilation. 11. Occupational dermatoses. 12. Visible marks of occupation and occupational diseases. 13. Fire and Explosive hazards of combustible, gases, etc.

The author stresses the need for the active collaboration of Engineers, Doctors, Chemists, Psychologists and Socialists all working together to achieve the common end of the well being of the workers and efficient industrial output. The book will be a source of valuable information to those who are interested in industrial welfare and organisation.

It is hoped that Volume II on Toxicology will be equally useful.

K. P. MENON.