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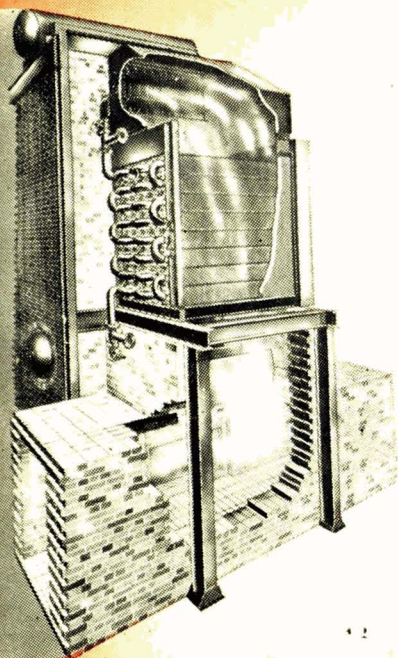
The Chemical Age

VOL LXIX

31 OCTOBER 1953

No 1790

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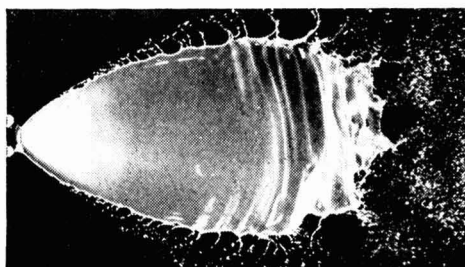
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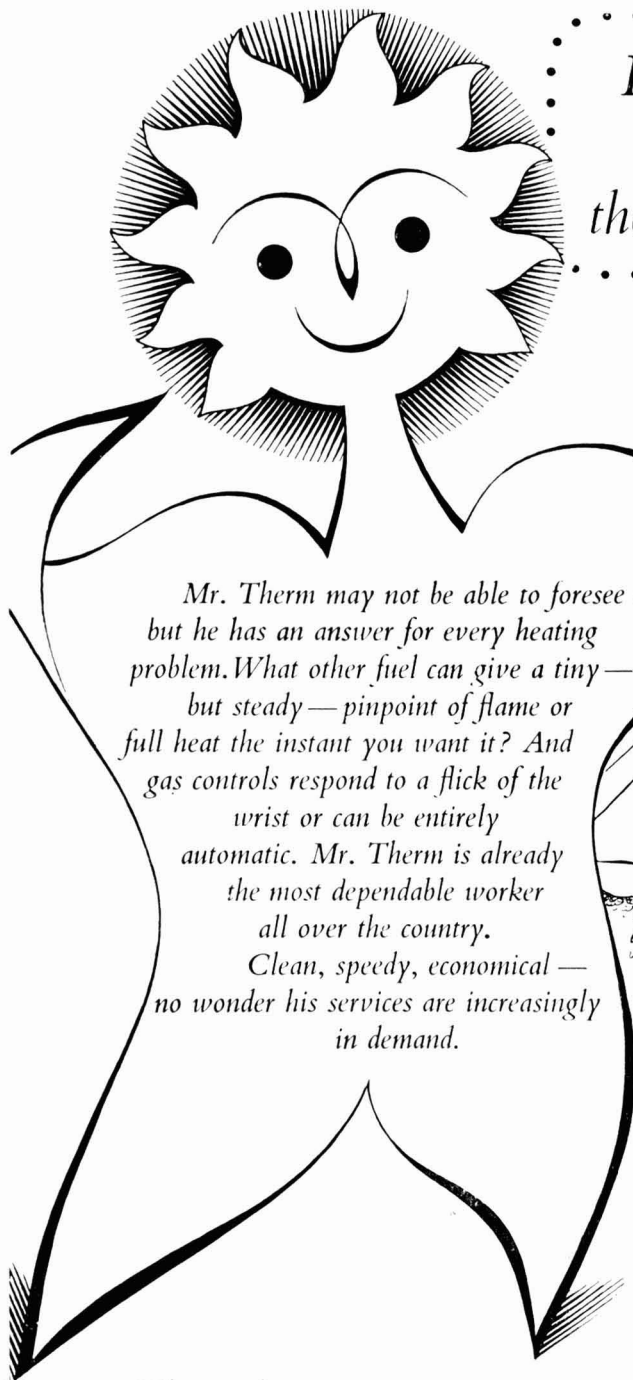
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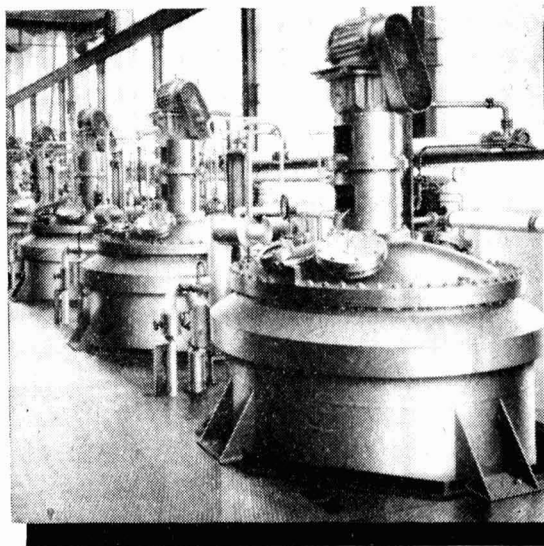
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Number 1790

The Chemical Age

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Editor : *E. A. Running*

Publisher & Manager : *John Vestey*

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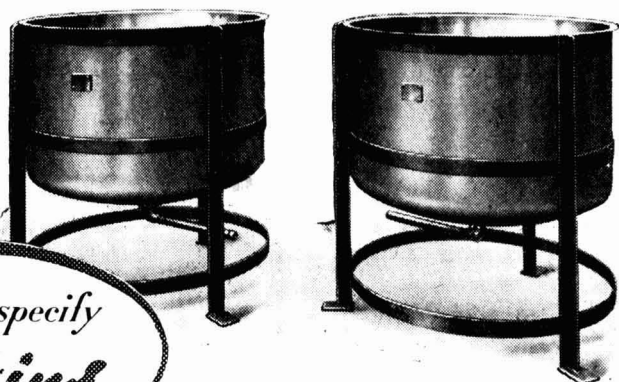
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Biological Sodium

THOUGHTS upon the puzzle of sodium as an essential and non-essential element in nutrition are stimulated by the publication of Dr. Lehr's paper read last year in London to the SCI Agriculture Group (*J. Sci. Food Agric.*, 1953, 4, 640-71). The essentiality of sodium in animal nutrition cannot be denied. Sodium is abundantly present in blood and other body fluids. It helps to control the acid-base balance, muscle activity, and water retention in the tissues. Sodium deficiency retards growth, reduces the efficiency of food utilisation, diminishes energy, and prevents reproduction. There is often too little clarity of thought in perceiving where the functions of salt end and those of sodium begin, for salt has been a common addition to animal and human diet from Biblical times and it is only in the past few centuries that man could even suspect that both the sodium and chlorine in salt exercised major and essential, but separate, functions. Yet in the plant kingdom sodium cannot be listed among the essential elements. Plants can grow to maturity on a sodium-free diet. Nevertheless, when plants growing in soil are analysed, all will be found to contain sodium—the amounts may vary from one per cent of the dry matter weight to as little as 0.01 per cent, but the element will certainly be present. Sodium is not as heavily present in soils (except in saline soils) as is potassium or iron, but it is not among the scarcer soil elements. When the average mineral contents of a large number of soils are listed, it is found that sodium is at least as abundant as calcium. It is surely anomalous that an element that is always present in soils, always taken up by plants, and essential in the diet of men and animals should nevertheless be deemed non-essential to plant nutrition. It is mysterious that one link in the biological chain should differ

so fundamentally in the balance of its bio-mineral requirements.

Sodium in plant nutrition, however, is not dismissed as useless. Though ranked as non-essential, it has been accepted as a beneficial nutrient and for certain plants, but by no means for all, sodium has been described as 'essential for maximum growth and full health.' Such plants can grow without it but they grow better with it—they are sodium-responsive but not sodium-dependent. The notable example is sugar-beet—indeed, all the beet family with mangolds as well. Salt today is widely applied as a fertiliser to the sugar-beet crop and four to five cwts. of salt per acre will generally give an additional sugar yield of from three to five cwts. For many other crops of economic importance the benefits of sodium are less obvious, and on present evidence the case for providing sodium in fertiliser form is difficult to press. At the same time it must be realised that the amount of research attention given to sodium as a crop nutrient has been much less than that given to many other elements.

The close association of the functions of sodium and potassium has clouded rather than clarified the puzzle. Inevitably this sister-element, long established as a major and essential plant-nutrient and with much-feared deficiency consequences, has overshadowed the humbler sodium. When sodium-supplying materials have given good crop responses, it has been readily supposed that the effects are due to substitution for potassium. This, indeed, can happen. Sodium, if added to soils in marked quantity, is capable of releasing small amounts of potassium from complex chemical imprisonment. Also, within the metabolism of plants, it is possible, according to Lehr, for sodium to undertake some of the essential functions of

potassium; just as, conversely, potassium can undertake some of sodium's functions. This is a most awkward piece of natural organisation for experimental study; in seeking to departmentalise the functions of the two elements, the problem must be faced that the departments overlap in operation. Moreover, the extent to which they overlap is inconsistent. The great value of the paper is that more than any previous verdict upon the role of sodium it illuminates these dark confusion of hypothesis and observation.

Dr. Lehr puts forward the view that all plants have an essential requirement of sodium/potassium and that in this respect species of plants fall into two main groups. First, those whose sodium/potassium requirement has three distinct and separate parts: (a) for functions that can be satisfied only by potassium, (b) for functions that can be satisfied by either potassium or sodium, and (c) for functions of better growth, i.e., beneficial but not essential, that can be satisfied only by sodium. Second, those plants whose sodium/potassium needs are simpler and of two kinds: (a) for functions that can be satisfied only by potassium and (b) for functions that can be satisfied by either element. For different species the ratios of (a), (b), and, where existent, of (c) will vary widely. The markedly sodium-responsive plants are those of the first kind for which (b) and (c) are larger than (a), e.g. sugar-beet, mangolds. With such plants, the potassium demand can be fully satisfied but there is still a big and further response to sodium; yet without sodium a useful cropping standard can be reached because in those circumstances potassium undertakes the replaceable part of the sodium functions. Crops that are feebly or inconsistently responsive to sodium—inconsistent at any rate in the random experience of field treatments—are those for which there is no separate sodium-only set of functions, but simply some 'area' within the sodium/potassium requirement that can be satisfied by sodium or potassium. With such crops, therefore, responses to sodium will often have been noted and would be due to potash deficiency under the growing conditions; equally, failures to respond to

sodium will have been noted, and would be due to potash sufficiency. We can certainly understand why salt was so much prized as a manure in the pre-Liebig centuries for then potash was supplied only casually and as an unacknowledged constituent of manures and wastes.

But for all this the plant and animal links in the nutritional chain do not seem perfectly matched. 'Study of the figures for the sodium contents of feeding stuffs reveals that those of vegetable origin are poor in the element. It is generally agreed that commonly-used fodders, cereals, cereal by-products . . . do not contain enough sodium to meet the optimum requirements of farm animals, although acute sodium deficiency is rare on ordinary diets . . .' (F. E. Corrie, 'Some Elements of Plants and Animals,' 1948.) And in the animal body sodium is essential in its own right, with functions that cannot be regarded merely as beneficial 'extras' or as functions that potassium can exercise instead. So there are salt-licks for cattle—optional and direct sources of sodium fortification. And we have to consider, though at present few do, whether salt as a pasture fertiliser, even if it does not increase the measurable output of grazing food, may not greatly improve the pasture's nutritional value. Potassium in excess of needs can be harmful to animal health. Has enough attention yet been paid to the sodium: potassium balance in fodder?

The critical essentiality of phosphorus in plant and animal nutrition is well enough known. Ultimately life's expansion on this planet must be ruled by the supply of available phosphorus. A new aspect of sodium's nutritional role has been indicated since Dr. Lehr read his London paper. In the presence of sodium, phosphorus suffers less loss of availability. Sodium salts reduce phosphate reversion in fertiliser manufacture (*Agricultural Chemicals*, 1953, 8, 62); sodium as a cation in the soil may increase the uptake of phosphorus by plants (G. C. Lewis *et alia*, 1952, *Soil Science*, 74, 227.) Here is quite another story and one that is perhaps of less significance than the direct role of sodium for some plants, yet of more significance for those plants that are not substantially sodium responsive.

Notes & Comments

The Chemist's Hire

THE Royal Institute of Chemistry has issued the results of its recent remuneration survey (*Journal R.I.C.* 1953, 77, 379-387) and comparing these with the figures for the 1947 survey, it is evident that there has been a significant advance in chemists' salaries or earnings during the six-year period. For the latest survey an average salary range rather than a single average figure is given; this, in view of the varied fields in which chemists may work, is probably more suitable guidance from a professional body than the statement of a stark average. The survey was, of course, an entirely voluntary operation and it is interesting to wonder why the response in 1947 was 87.2 per cent but in 1953 only 67.6 per cent. Were chemists then more concerned with the sordid side of their work, more apprehensive that changes in personal remuneration during the war years had lagged behind changes in other chemists' remuneration? Certainly the smaller response suggests less anxiety or uncertainty in 1953.

£200 to £300 Increase

IN 1947 the average remuneration of a Fellow was £1,064 for the age-group 36-40; for the same age-group in 1953 the average range is £1,370-£1,500, a minimum rise of £300. For associates, the age-group 26-30 in 1947 showed an average remuneration of £566, but in 1953 an average range of £750-£810; a minimum increase of £184. For the next age-group, 31-35, the two averages were £722 and £940-£1,020, showing a minimum rise of £218. These particular age-groups are cited here because, taking both surveys, they represent the most 'populated' of the various classifications, and are likely, therefore, to be the most typical samples. It seems that younger chemists have added about £200 to their incomes and slightly older and more experienced chemists have added £300; proportionately, however, these are rises of the same rate, for a £200 advance on £650-£750 is roughly similar to one of £300 on £1,000-£1,100. As crude figures these remuneration in-

creases may seem satisfactory and even be envied by some less fortunate sections of the community. The truth is that they do no more than reflect the reduced purchasing value of the £; chemists' earnings—on the average—have kept pace with inflation. There is certainly no sign that chemists have taken an unfair advantage from the increasing importance of their ability in post-war industry. Even in the coldest depths of the wages-freeze, increases justified by rises in productivity or output were not condemned. Though the duties of most chemists must certainly have been associated with sharp and important increases in national output, it is apparent that their pay has merely kept pace with the dwindling value of the pound.

Private Enterprise Pays Best

A NEW table in the 1953 summary makes interesting comparison of average salary ranges in different classes of chemical employment, e.g.

Industry	£1,280—£1,470
Nationalised industry	£1,040—£1,150
Government	£1,050—£1,140
University	£1,170—£1,330
School	£860—£930

The difference between nationalised and private industry as a rewarding employer is worthy of note. The best men are unlikely to choose nationalised laboratories or factories for there is no 'status-differentiation' between one kind of industry and another, not at any rate in the same sense that a differentiation would be admitted to exist between industry and university research.

Caribbean Chemistry

THE Report of the five British industrialists who visited Jamaica, Trinidad, Barbados, and British Guiana has been published by the Colonial Office at a timely moment when the troubles of one of these territories are so much in the public mind. The Report is fairly forthright; if it does not exactly pour cold water on many of the hopes for rapid industrial expansion in the West Indies, it unhesitatingly shows

that some of the basic necessities do not yet exist. The growth of industry must depend mainly upon increases in purchasing power of the home populations; and these increases must largely come from expanded agricultural production. Fundamental chemical projects — such as sulphuric acid from gypsum, caustic soda and chlorine from brine electrolysis, or the ammonia-soda alkali process—are virtually ruled out because the minimum economic scale of output would be vastly greater than the present or reasonably foreseeable needs of the West Indies. There are much better prospects for bottled industrial gases— CO_2 , C_2H_2 , and oxygen—as these are mainly imported at present and the transport of cylinders is so costly. A synthetic drug industry has no prospect whatsoever of successful establishment, but the extraction of drugs from herbs might be practicable. Alcohol is already substantially manufactured in Jamaica from molasses and there appear to be bright prospects for similar ventures in the three other territories.

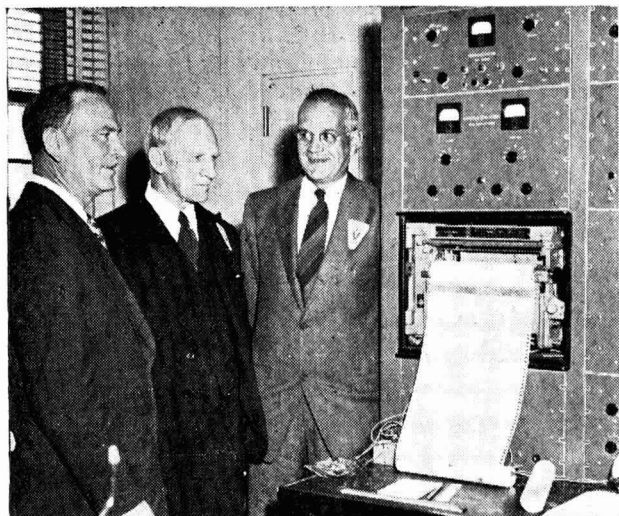
Efficiency Standards

THE standard of efficiency in most of the current industrial enterprises seems discouragingly low. Wartime controls have been maintained voluminously and needlessly, with much protection for the least efficient producers. There is a dearth of foremen and potential foremen, but immigration rules clearly

aim at deterring overseas technicians and managers from entering the territories. This is dictated by local opinion, powerfully insistent upon home appointments when vacancies occur; but the Report describes this attitude as 'wholly misguided' when, in fact, persons of the proper calibre and experience are not available for key industrial posts. There are excellent prospects for coconut oil and this crop can be greatly expanded, but the processing factories are mostly low in efficiency, and at present in British Guiana alone 150,000 gallons of oil a year are wasted because small farmers extract oil themselves. Of the numerous soap factories, based upon the coconut oil, only two that were visited approached European standards of efficiency. Antiquated plant, indifferent management and control, and too small a scale of operation are the weaknesses in the West Indies.

Risks Must be Taken

A GAINST this background, and with political unrest as a disturbing influence, it is difficult to see how new and large industrial enterprises can be launched. All of them would require large capital investments from overseas. Nevertheless, populations are rising at an alarming rate, and the resultant poverty intensifies unrest and political extremism. Distressed areas must sometimes be rescued by taking risks.



Sir Robert Robinson recently visited the USA to receive from the American Chemical Society the Priestley Medal for distinguished service. Whilst in America, Sir Robert visited the Esso Research Centre at Linden, New Jersey, where he was greatly interested in work being carried out on hydrocarbon analysis and in the use of spectrographic apparatus in this field of research. In the picture he is shown (centre) examining this apparatus with Dr. W. J. Sparks, Director of the Chemical Division, and Professor R. C. Elderfield, of Michigan University

Plastics in the Tropics

Satisfactory Results of Polythene Tests

BEHAVIOUR of polythene in tropical conditions is the subject of a report resulting from the latest of the tests being carried out at the instance of the Ministry of Supply-British Plastics Federation sub-panel of the Inter-Services Plastics panel. Evaluations of the effect of climatic conditions in the tropics on some properties of plastics are continually being carried out as a long-term policy and a report on the result of tests on expanded plastics has already been published.

Dr. W. E. de B. Diamond, Director of the British Plastics Federation, makes the following comment on the polythene tests:— 'These are the first reliable results obtained about polythene, because in spite of the development of tropical chambers for testing, it is difficult to simulate exact conditions. The tests into the effects of climatic conditions are essentially long-term and will no doubt be continued at intervals as new and improved materials come into use. There are a large number of plastics materials already undergoing tests.'

The tests on polythene are regarded as particularly important, as the material is specified for a variety of high frequency electrical applications because of its low power factor and permittivity, and is also suitable for such purposes as packaging and water-piping because of its ductility and inertness.

Protection Against Deterioration

The report, issued by the Ministry of Supply, shows that the inclusion of 0.1 per cent of carbon black in polythene provides a considerable measure of protection against deterioration of properties due to light. Two grades of polythene, each sample of which contained antioxidant (0.1 per cent of 'Non-oxal' DCP) but which were presented both with and without the inclusion of carbon black (0.1 per cent 'Kosmos' B), were exposed for periods of three, six or 12 months to four sets of conditions—jungle undergrowth, jungle clearing, semi-desert and tropical surf beach—in Nigeria, while those specimens requiring special test equipment were returned to London in hermetically sealed containers.

Conclusions of the report are that polythene is resistant to the moisture of tropical climate as represented mainly by the jungle exposure sites, but is susceptible to the actinic effects of the tropical sun, preponderant on the beach and desert exposure sites. These effects, however, are greatly reduced by carbon black (which is specifically recommended for this purpose by the makers of polythene).

Main Results

The main results of the continued sun exposure were:

an increase in 'brittleness,' exemplified by loss of flexibility and extensibility, a rise in cold bend temperature and the appearance of surface cracks, and a thirtyfold rise of power factor in the absence of carbon black or tenfold rise in the presence of carbon black, under the worst conditions of the trials described in the report.

As ductility and low power factor were the foremost properties leading to the selection of polythene in preference to any other material, the report concludes that it would be necessary either to be satisfied with a limited service life in direct sunlight, or to provide additional protection for the material.

There was no difference in the behaviour of the two grades on trial: 'Alkathene' grade 7 is a medium extrusion grade of polythene, and grade 20 is softer and of lower average molecular weight.

Among extracts from detailed results are the following:—

Biological examinations: There was no indication that fungal growths (of which there were only traces at all sites except the jungle clearing) had attacked the polythene itself. Growths seemed to be confined to extraneous matter on the surface.

Changes in dimensions: A general progressive shrinkage in both directions at all sites (greatest at the semi-desert site, least in jungle undergrowth).

Changes in weight: With the exception of the batches at the jungle clearing site, which did not contain carbon black, all specimens showed a progressive loss in weight.

Tensile properties: Exposure on the semi-desert and beach sites ultimately lead to a considerable reduction in elongation particularly in the absence of carbon black.

Dielectric properties: Permittivity and power factor properties remained practically unaffected in all batches in the jungle undergrowth. Carbon black protected batches in the jungle clearing, where, however, considerable deterioration took place in the absence of carbon black. The protection afforded by carbon black was no longer sufficient for specimens exposed for more than six months at the semi-desert or surf beach sites.

Low-temperature flexibility: The small concentration of carbon black used afforded partial protection against embrittlement, which, however, is nearly exhausted after one year on the sunny sites. Unprotected material has a useful life as regards brittleness of six months or less in the desert, less than a year on the surf beach and about one year in the jungle clearing.

(The Report, entitled 'Reports on Plastics in the Tropics. 2. Polythene,' is published by HM Stationery Office, 2s. net.)

BLSGMA Annual Dinner

Growth of Industry Outlined

THE British Lampblown Scientific Glassware Manufacturers' Association held their annual dinner on Wednesday evening, 21 October, at the Frascati Restaurant, London, 150 members and guests attending.

In proposing the toast of 'The President and the Association,' the principal guest, Professor W. E. S. Turner, O.B.E., D.Sc., F.R.S., Emeritus Professor, Department of Glass Technology at the University of Sheffield, referred to the close association that has always existed between the Department of Glass Technology and the lampworking section of the glass industry.

It was difficult to realise that, prior to the First World War, the lampworking section of the glass industry was practically non-existent, but following an approach by Mr. Frank Wood to the Department of Glass Technology a training establishment for lampworkers was created and the close association between the Department and the lamp workers established.

He was particularly pleased to see present representatives from the tubing manufac-

urers. The growth of lampworking had gone hand in hand with the development of fully-automatic methods for producing the large quantities of tubing necessary for this type of product.

In conclusion, Professor Turner paid a tribute to the lamp workers. They were skilled operators producing remarkable objects. They were artists in their own rights.

Replying to this toast, Mr. H. H. Zeal, president of the Association, referred to the serious position of Britain during the 1914-18 War and paid tribute to Professor Turner for the assistance he had given in the creation of the lampworking industry. At the outbreak of the Second World War the industry was securely established. Due to the impact of that war, the industry had grown and it was inevitable that difficulties should occur during the change over from war to peace. He thought that this change over had been creditably achieved and disruption avoided.

Among the guests were Mr. V. Stott, of the Department of Scientific and Industrial Research, Mr. H. Cornes, Ministry of Supply, and Mr. R. W. H. Cook, Ministry of Health.

The dinner was followed by entertainment. All arrangements were in the hands of Mr. H. V. Stout, and the staff of the Glass Manufacturers' Federation.

Alkali Tariff Proposal

IMPERIAL Chemical Industries of Australia and New Zealand are reported to have applied to the Tariff Board at Melbourne for a protective duty of 95 per cent on alkalis made in Australia. This is one of the highest the Board has ever had to investigate. Duties of less than this rate are requested on certain chlorine products. The 95 per cent rate is asked for on soda ash, caustic soda, bicarbonate of soda, and calcium chloride.

The company points out that despite improved efficiencies and larger manufacturing capacity, a serious drift in costs has occurred since 1947. As a result of its efforts basic costs had been lowered as shown at Osborne, South Australia, where capacity had been duplicated. Whereas the basic wage had increased 120 per cent over the period total labour costs increased by only 66 per cent.

Effluents from Paper Mills

Highest Priority Given to Pulp Washing Research

APPROXIMATELY 80,000 gallons of water are needed for each ton of fine writings or printings produced by the paper industry, and up to 150,000 gallons for every ton made in a rag mill. The cost of pumping, filtering and softening such very large quantities of water makes it just as important to economise in the use of this commodity as in steam or any other raw materials. To recycle the bulk of the backwater from the wet end of a papermaking process is therefore an important gain. Not only do many waste liquors contain a proportion of recoverable fibre, loading and (sometimes) colour, but their re-use reduces water consumption and eases the problem of disposing of the very large quantities of effluents resulting from the large-scale production of paper and board.

Apart from the economies which can be effected by backwater treatment and fibre recovery, the necessity for efficient methods of effluent disposal has been enhanced by recent legislation bringing the discharge of polluting matter into streams and rivers under closer control. Problems associated with the disposal of waste and effluent from mills have therefore been accorded a very high priority by the British Paper and Board Industry Research Association. A programme covering every aspect of the effluent problem was drawn up by the Association as a result of conversations with Government representatives, the Ministry of Health, and the Scottish Board of Health. A considerable proportion of the Association's staff is engaged in this field of research, which covers both laboratory investigations and extra-mural work.

Fully Equipped Laboratories

The Association's headquarters at St. Winifred's Laboratories, Kenley, Surrey, are fully equipped for laboratory studies of all papermaking processes and small-scale mechanical apparatus has been installed for trying out processes at the intermediate stage between bench and pilot-plant investigations. This apparatus includes a plant specially constructed for effluent research.

The laboratory work is aimed at providing information on the best possible method of

treating the effluent; for example, whether the individual wastes should be mixed or treated separately; whether chemical coagulants should be used; whether the sludge from one of the wastes can be re-used in the mill or elsewhere; the effect of the addition of virgin long-fibred stock on sedimentation, and the types of biological purification best suited to the effluent.

In order to amass data on the different methods of effluent disposal, extensive extra-mural work is essential. A pilot plant has been constructed at a paper mill and is being used for tests on actual mill effluents. The extra-mural work includes a study of effluent treatment plants already in use, in order to determine which of the known methods of treatment—for example, addition of acid, alum, copperas, treatment in settling beds, filters and save-alls, double filtration, etc.—provides the most efficient system of treatment.

Long Term Research

This research has been in progress for several years and has as its objective the solution of the major technical problems of the disposal of waste and effluent from paper and board mills in the most economic and practical way. Throughout the investigations attention is being paid to such questions as economic efficiency and comparative costs. Close contact is being maintained with the Water Pollution Research Laboratory of the Department of Scientific Research, who are working on similar problems.

The paper and board industry is divided broadly into two sections: mills using imported pulp and those which digest the raw materials themselves. These are usually straw, rags or esparto grass, the most extensively used being esparto, which comes mainly from North Africa. After preliminary treatment the raw materials are boiled with a caustic solution under pressure. This process removes the lignin from the materials and produces pulp, the residue being a black liquor containing caustic soda and other undesirable substances. This liquor is drawn off and goes to evaporators, where it is reconditioned together with washings

from the pulps. The material removed from the solids end of the evaporator is burnt to produce soda ash, which is dumped.

From this brief description it is evident that the liquors from the pulping processes contain a considerable proportion of alkaline materials, together with certain organic substances. The recovery of caustic soda from the black liquor is not economic and the treatment of this liquor is one of the major problems of the industry.

Methods of BOD Reduction

Various methods of BOD reduction have been attempted, such as sludge activation and percolating filters. These processes usually give satisfactory results with acid liquors, but are less successful when the liquor is alkaline. Nevertheless the Association has been able to devise systems of percolating filters which appear to give a throughput almost equal to that of a normal sewage works. Pilot plant trials with percolating filters and a surface aeration plant have been arranged at an esparto mill, the objects being to investigate the two methods of BOD reduction under mill conditions and to obtain comparative data regarding their efficiencies.

One way of easing the difficulties associated with effluents is to reduce to a minimum the amount of liquor to be thrown away. Improvements in the efficiency of pulp washing and of the soda recovery system at esparto mills would naturally have this effect. The Association has therefore accorded the highest priority to this line of research. Trials have been carried out at paper mills and considerable success has been achieved in this direction.

The mills which purchase pulp have problems of their own, which are associated mainly with suspended fibres and suspended solids. The Association is endeavouring to determine the most efficient method of recovering usable solids from excess backwater. The treatment of backwater and the most suitable plant for this purpose depend on a number of factors, such as the type of furnish commonly used, the frequency of colour changes, and the cost of the plant. The most important considerations are the final recovery cost as compared with the value of recovered fibre, and the proportion of fresh water employed. Large, open sedimentation tanks occupy valuable space and collect dirt and dust, but they are often

necessary where large volumes of water are used for boiling and washing and pollution presents a difficult problem. Separation by sedimentation is being superseded to an increasing extent, however, by more modern methods such as save-alls working on the principle of fibre flotation, which are economical of time and space.

The Association has completed a critical survey of standard methods. Following this survey, a test system was devised in its laboratories whereby it is usually possible to determine from examination of the effluent under investigation the optimum size and shape of settling tank for the treatment of the particular product. The Association has also compared the efficiency of proprietary save-alls and is able to advise members on the type best suited to the mill in question.

It is anticipated that these studies of effluent problems will eventually lead to a combination of known methods, which will result in a considerable increase in the efficiency of treatment.

It is part of the Association's service to investigate particular problems on behalf of individual members in connection with the disposal of effluent, and to give advice on what are considered to be the best methods of dealing with such problems. The stage has now been reached where several graduates are employed for the sole purpose of examining members' queries, advising what plant should be installed, and preparing a technical scheme together with an estimate of the cost. The full cost of this service is borne by the member concerned on a time and materials basis, no profit being made by the Association. Technical inquiries are also dealt with on all other aspects of paper-making, but no routine tests are carried out.

Founded in 1945

The British Paper and Board Industry Research Association was founded by the Paper Makers' Association of Great Britain and Northern Ireland on 6 February, 1945. The director, Dr. N. R. Hood, was appointed in September the same year, and in March 1946 the Association acquired the lease of a building and surrounding land at Kenley, Surrey, which it subsequently purchased. The building was originally erected as a high grade preparatory school for boys and stands in approximately 11 acres of grounds. It has a total floor area on four floors of

about 20,000 sq. ft. The premises have been modernised and converted to the requirements of the Association. A fire destroyed part of the building in November 1949, and rebuilding was not completed till July 1952. Despite this setback, the Association has made rapid progress and it now has a staff of 54, of whom 23 are graduates.

Besides the work on effluents, investigations are in progress on new paper machine design and the mechanics of water removal on Fourdrinier paper machines. Studies at mills have yielded information that indicates the need for a certain amount of laboratory investigation, the ultimate aim being to improve the efficiency of water removal on the machines.

Mechanism Studied

Associated with this research is an investigation of the actual mechanism of water removal on the drying cylinders by heat. Here it has been necessary to start at the very beginning, because there appears to be no scientific instrument available which is capable of carrying out the necessary measurements with sufficient accuracy for the Association's needs. The investigators are therefore developing a special instrument for this purpose. On the instrument and paper testing sides, the Association is engaged in a detailed study of the range of applicability and efficiency of the various instruments in common use. The various methods of carrying out standard tests used in the industry, such as the tensile test and the burst test, are being subjected to a critical examination. Attempts are also being made to improve the main tests used in pulp evaluation.

The microscopy side is building up a library of micrographs of fibres which, it is hoped, will eventually be unique in Britain. This collection will be of great value in the identification of fibres sent in by members.

Another investigation is directed mainly towards obtaining a better understanding of the fundamentals underlying what is known as the beating effect. An attempt is being made to find out just what happens to the fibres during beating and why it happens, in order that methods of beating may be improved. For the purposes of this research new techniques for both electron and optical microscopy are being developed.

The chemical section are working on the bleaching of fibres and the mould-proofing

of paper and board for the packaging of commodities other than food. Laboratory tests for the degree of mould resistance of samples of paper have been developed and a satisfactory degree of mould resistance, as judged by laboratory tests, has been obtained with certain fungicides. The results of this work show sufficient promise to merit extension to full-scale trials.

Much attention has been devoted to methods of pulping indigenous raw materials, of which the most promising from a production standpoint is wheat straw. The possibilities of certain home-grown timbers have been examined for the Forestry Commission. For one of the Empire Governments a very thorough examination was made of the available raw materials of that particular country as potential sources for supplying local requirements of paper for cement sacks and writings. Literally hundreds of suggested raw materials have been examined, all of which have papermaking potentialities, but fall down in the economics of collection.

The Association recently devised a system of co-operation with the Paper Machinery Makers' Association, with which it will now be more closely linked. It is also extending its scope for associate membership in order to benefit from the support of the many firms with varying degrees of interest in the paper industry.

The Association co-operates very closely with PATRA, with whom it is hoped to carry out joint research on certain common problems. Informal liaison is maintained with the Institute of Paper Chemistry at Appleton, Wisconsin, the Canadian Pulp and Paper Research Association, the Swedish Forest Products Laboratory, and the Central Laboratory of the Finnish Papermakers' Association.

New Tank Construction Method

Time and costs are claimed to be saved by an Australian company's new method of constructing oil storage tanks 47 ft. high and of 30 ft. diameter. The top cone-shaped roof and top circular section are completed and placed on foundations; then a second circular section is constructed and placed below the top section, which is elevated as required; the third section goes under the second, and so on until the raised tank is complete and resting on its foundations.

Students Gain Overseas Experience

Growing Success of International Exchange Scheme

THE scheme for the international exchange of students is growing in favour according to the sixth annual report of The International Association for the Exchange of Students for Technical Experience (IAESTE).

This organisation—founded in 1948—is an independent non-Government body which has consultative status with UNESCO and the United Nations Economic and Social Council. Its chief aim is the exchange, at institutions of higher education, of students who wish to obtain technical experience abroad relative to their studies in the broadest sense. Another important aim is the promotion of international understanding and goodwill among students of all nations.

Number Increased

The latest report shows that the number of students exchanged internationally this year was 3,783, which was an increase of 290 over last year. The Advisory Committee has considered the future possible expansion of the Association's activities and visualises the necessity of creating a link between the present European membership of IAESTE and the Near East. The Association is now firmly established in 18 countries.

During the summer vacation this year the number of students sent abroad from Great Britain under IAESTE was 544, an increase of 56 over last year. Of that number, 82 were students of chemistry and 36 students of chemical engineering. Foreign students received in exchange in Great Britain totalled 623 (an increase of 21 over last year), of whom 54 were students of chemistry and 31 students of chemical engineering.

Students of chemistry and chemical engineering respectively were sent abroad by other participating countries as follows:—Austria, 16 and 30; Belgium, 0 and 9; Denmark, 0 and 28; Finland, 13 and 43; France, 21 and 21; Germany, 73 and 4; Israel, 3 and 12; Italy, 0 and 13; Netherlands, 3 and 38; Norway, 3 and 15; Spain, 0 and 9; Sweden, 9 and 32; Switzerland, 24 and 0; USA, 4 and 2; Yugo-Slavia, 9 and 20.

Students of chemistry and chemical engineering respectively were received by other

countries as follows:—Austria, 10 and 12; Belgium, 0 and 2; Canada, 2 and 1; Denmark, 0 and 18; Finland, 5 and 23; France, 61 and 0; Germany 84 and 41; Israel 0 and 5; Italy, 1 and 6; Netherlands, 0 and 50; Norway, 11 and 2; Spain, 0 and 15; Sweden, 21 and 32; Switzerland, 10 and 3; USA, 1 and 3; Yugo-Slavia, 10 and 8.

Universities in Great Britain which took part in the scheme this year were those of Cambridge, Durham, Oxford, Queen's (Belfast), St. Andrews, Birmingham, Bristol, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Nottingham, Sheffield and Southampton, besides the School of Metalliferous Mining (Cornwall), South West Essex Technical College, University College of South Wales and Monmouthshire and the following London institutions:—Battersea Polytechnic, Imperial College, Institut Français du Royaume-Uni, King's College, Northampton Engineering College, Regent Street Polytechnic, Sir John Cass College and University College.

Among the British industrial concerns participating in the scheme this year were The A.P.V. Co., Ltd.; Ashmore, Benson, Pease & Company; Henry Balfour & Company, Ltd.; The British Oxygen Co., Ltd.; British Thomson-Houston Company, Ltd.; The Bryan Donkin Company, Ltd.; Davey, Paxman & Company, Ltd.; Dorr-Oliver Company, Ltd.; Dunlop Rubber Company, Ltd.; Hackbridge & Hewittic Electric Company, Ltd.; Hilger & Watts, Ltd.; Imperial Chemical Industries, Ltd.; George Kent, Ltd.; Peter Lind & Company, Ltd.; May & Baker, Ltd.; Merryweather & Sons, Ltd.; Metafiltration Company, Ltd.; Metropolitan-Vickers Electrical Company, Ltd.; The Mirreles Watson Co., Ltd.; Monsanto Chemicals, Ltd.; Morgan Crucible Company, Ltd.; Pye, Ltd.; Henry Simon (Holdings), Ltd. and John Thompson, Ltd.

Tinplate Production

World tinplate production of 479,000 tons during August included US output of 348,548 tons and UK production of 41,100 tons. The total was 21,000 tons less than that for August, 1952.

The Analysis of Cobalt

Part V—Colorimetric Methods

THE majority of methods proposed in recent years for the determination of cobalt depend on the formation of a coloured product. The cobalt is, however, itself highly coloured, and Ringbom and Sundman¹ have carried out a successful determination of the metal in concentrations of 5 gm. per litre by measuring the pink colour of the solution. The error incurred was 0.6 per cent and the method was useful as a control method. The same authors showed that concentrations of cobalt of the order 10 mg. per litre could be determined satisfactorily by measuring the blue colour of the thiocyanate complex, the error again being 0.6 per cent.

Solutions of cobalt chloride in ethyl alcohol have a pronounced blue colour and spectrophotometric measurement shows an absorption at 655 $m\mu$. The percentage transmission, according to Ayres and Glanville,² depends only on the cobalt concentration. These workers developed a convenient and accurate method for the determination of cobalt based on this colour. Water in the ethyl alcohol reduces the absorption; concentrations of water in alcohol up to 6 per cent can be measured by this method.

Geld and Horowitz³ measured the absorption of cobalt solutions at 660 $m\mu$ in a photoelectric colorimeter set to zero with hydrochloric acid. Tin was removed as metastannic acid, and copper and lead by electrolysis. The electrolyte, containing about 0.5 gm. of sample, was then treated with perchloric acid and a solution of stannous chloride in hydrochloric acid, and the absorption measured. Nickel did not interfere in amounts up to 3 per cent.

Complexes with Peroxy Acids

Divalent cobalt solutions react with peroxy acids to form a complex which exhibits maximum absorption at 260 and 440 $m\mu$, the greater sensitivity being obtained at the shorter wavelength.⁴ Beer's law is followed for amounts of cobalt between 0 and 8 ppm. The main interfering ions are Cu^{++} , Fe^{+++} , Cr^{+++} , Ti^{++++} , vanadate, molybdate, ferrocyanide, uranyl and dichromate. Barium, cadmium, calcium, alumin-

ium, lead, manganese, strontium, silver, zinc and zirconium interfere by forming a precipitate or turbidity. The colour is developed by treating a neutral solution of cobalt with hydrogen peroxide and sodium bicarbonate.

Young and Hall⁵ have established the optimum conditions for applying the Vogel test to samples containing 0.01-4.0 per cent cobalt. The blue cobalt complex should be formed at pH 0.9-1.0 and, after adding all the reagents, the final pH should be 3.5-4.0. Sodium thiosulphate was found to be more effective than stannous chloride in reducing ferric iron. Ammonium hydroxide and ether are recommended for dissolving the blue compound. Large amounts of iron do not interfere if ammonium acetate and tartaric acid are added.

Semi-micro Modification

A semi-micro method has been described for the colorimetric determination of cobalt by this thiocyanate procedure, using acetone as solvent⁶. Pyrosulphate removes interference due to iron. The final blue colour is compared in cylinders with standards treated in the same way.

Bayliss and Pickering⁷ used the thiocyanate complex as a means of extracting cobalt before its micro-determination by other methods. The procedure is as follows: Dissolve the sample containing 0.01-0.02 mg. of cobalt in sufficient 6N hydrochloric acid to give 5 ml. in excess. Add 20 ml. of 60 per cent ammonium thiocyanate solution and buffer the solution with 1M ammonium citrate until any red ferric thiocyanate just disappears. Dilute with water to 50 ml., add 4 ml. of ether and extract the buffered solution with 3 successive 20 ml. portions of a mixture of 35 per cent ammonium hydroxide and 65 per cent ether. The cobalt enters the non-aqueous phase as $(NH_4)_2Co(CNS)_2$.

Shake the combined extracts with two 20 ml. portions of 2N ammonium hydroxide, thus returning the cobalt extracts to the aqueous phase. Evaporate the combined extracts to dryness, add 20 ml. of 6N nitric acid to destroy the thiocyanate and evaporate to dryness. Neutralise the resulting ammonium bisulphate with 2N

ammonium hydroxide and evaporate to dryness. Determine the cobalt, preferably by the nitroso-R-salt method.

The thiocyanate method has been used to determine cobalt in nickel.⁹ Pyrophosphate is added to retain nickel in a state insoluble in a mixture of water and methyl acetate in which ammonium cobalt thiocyanate is soluble. The direct colorimetric determination of cobalt in a 4 gm. sample of commercial nickel by this means gives results which are comparable with those obtained after the preliminary separation as the complex with 1-nitroso-2-naphthol. The colorimetric method is just as accurate and much faster than the gravimetric method. The results obtained showed a 0.02 per cent accuracy on the weight of sample taken.

Small Amounts in Nickel Salts

For the determination of small amounts of cobalt in nickel salts Pevtsov⁹ devised the following procedure: Dissolve 1 gm. of the substance in 25 ml. of water, add 5 ml. of 50 per cent ammonium thiocyanate solution and 10 ml. of a mixture of *iso*-amyl alcohol and ether (in a 2:5 volume ratio), then 5 ml. of 33 per cent ammonium acetate solution and shake thoroughly. Add 3 drops of 10 per cent tartaric acid, shake and compare the colours of the alcohol-ether layer in transmitted light with standard solutions. Cobalt in 0.001 per cent concentration can be determined by this method.

Chatfield and Topper¹⁰ have applied the thiocyanate method to the determination of cobalt in driers. 'Cellosolve' is used to dissolve ammonium thiocyanate and also cobalt acetate which is used as standardising agent. The method is applicable to cobalt determinations, in oils, varnishes and resins.

Uri¹¹ has determined the stability of the cobalt thiocyanate complex in various concentrations of alcohol and ammonium thiocyanate by photometric extinction methods. There are limiting concentrations of ammonium thiocyanate depending on the alcohol concentration, above which the cobalt is quantitatively converted into the complex and Beer's law is obeyed. The best results are obtained by heating 1 ml. of the cobalt solution with 3 ml. of 15 per cent alcoholic ammonium thiocyanate, diluting to 10 ml. with 96 per cent alcohol and measuring the extinction at 570 m μ .

Kitson¹² has shown that the interference

due to copper and iron in the thiocyanate procedure can be eliminated by reducing these metals with chlorostannic acid. The blue colour given by cobalt ions and ferricyanide in ammoniacal solution has been used by DeGray and Rittershausen¹³ to determine 0.5-4.0 mg. of cobalt with an accuracy of 0.006 mg. A linear relationship between colour developed and cobalt concentration is observed when a filter covering the wavelength range 400-470 m μ is used.

Perhaps the best colorimetric reagent for cobalt is nitroso-R-salt (disodium 1-nitroso-2-hydroxy-3,6-naphthalenedisulphonate). Sideris¹⁴ first separated cobalt as dipotassium sodium cobaltinitrite, and then measured the extinction of the stable red dyestuff formed by cobalt and nitroso-R-salt.

McNaught¹⁵ used nitroso-R-salt for the colorimetric determination of as little as 0.02 μ g. of cobalt per ml. Oxidising and reducing agents are likely to interfere. In the presence of citric, oxalic and nitric acids, the solution must be neutralised before the reagent is added. Ferrous salts, cyanides, persulphides, copper, peroxides and ammonium salts should be absent. Most of the common elements do not interfere. A twentyfold excess of nickel can be tolerated but iron should be completely removed.

Interference Due to Copper

Lugg and Josland¹⁶ reported that the determination of cobalt with nitroso-R-salt failed in the presence of excess calcium. Macpherson and Stewart¹⁷ stated that interference due to copper could be avoided by displacing it from solution with aluminium. They used a Pulfrich photometer in combination with a green filter to eliminate interference by other metals and obtained results reproducible to 0.1 ppm.

For the determination of cobalt in metallurgical products the following procedure¹⁸ has proved successful:—Neutralise the solution (from which the ions of Group II have been removed and which contains not more than 0.5 mg. of cobalt) with 20 per cent sodium hydroxide solution to a deep wine red colour if ferric iron is present, or in the absence of iron to a faint pink with phenolphthalein. Add immediately 2 ml. of Speker acid (150 ml. H₃PO₄ [d=1.75], 150 ml. of H₂SO₄ [d=1.84], H₂O to 1 litre), 10 ml. of reagent (0.5 per cent solution of nitroso-R-salt) and 10 ml. of 50 per cent sodium acetate

solution. Bring to a vigorous boil, add 5 ml. of nitric acid and boil at least 1 minute, but not longer than 2 minutes. Cool and dilute to 100 ml. Measure the colour in a photoelectric absorptiometer.

Willard and Kaufman¹⁹ have determined which light filter is most satisfactory for determinations of cobalt with nitroso-R-salt, because different authors have recommended different filters. Experimental evidence has shown that extinction measurements at 420 $m\mu$ give the greatest sensitivity and a blue filter is indicated. At concentrations below 0.02 mg. of cobalt per ml. Beer's law does not hold. In a more recent paper, Claasen and Westerveld²⁰ claimed that the most suitable wavelength for the analysis is 550 $m\mu$. To make up for the loss in sensitivity, they used 2 cm. cells. Interference by copper was diminished to some extent by doubling the amount of reagent added. Nickel interfered considerably in the determination.

Shcherbov²¹ examined the colour in the 520-550 $m\mu$ region, or at 500 $m\mu$ using a green filter with blue threshold. He found that the colour was diminished by aluminium, but that a 3- or 4-fold excess of reagent compensated for this.

Dean²² used an ion-exchange technique to make the nitroso-R-salt reaction specific for cobalt. He applied the method to steels and copper- and nickel-base alloys, the red cobalt complex being developed in the usual way. The solution is passed through a 5-6 cm. column of alumina previously washed with dilute perchloric acid. The red band remains at the top of the column. After washing the column with hot 1M nitrous acid (70°-80°) the complex is eluted with 1M sulphuric acid and the extinction measured at 500-520 $m\mu$. The standards need not be chromatographed. Iron must be completely oxidised.

Cobalt in Soils

Kidson and his colleagues²³ have estimated traces of cobalt in soils by the nitroso-R-salt method. Iron in large quantities was removed as ferric chloride by shaking with ether. Copper was removed by precipitation with hydrogen sulphide.

Cobalt in soils has also been estimated by Black²⁴ using 1-nitroso-2-naphthol. The acidity must be controlled and the colour of excess reagent destroyed by treatment with sulphite. The best pH is 5.2; high concentrations of ammonium salts should be

avoided in making pH adjustments. Iron can be removed by a basic acetate separation without impairing the accuracy of the method.

Determination in Steels

Dymov and Volodina²⁵ also preferred the 1-nitroso-2-naphthol method for the determination of cobalt in steels. For steels containing (a) less than 1 per cent Co, and (b) between 1.5 per cent Co, dissolve 0.1 gm. of sample and dilute to 100 and 200 ml. respectively. For (a) use 10 ml. of solution; for (b) use 5 ml. of solution. Add the same amount (10 or 5 ml.) of 20 per cent Rochelle salt solution, and the same amount of 5 per cent potassium hydroxide solution and make up the volume to 100 ml. Add 15-20 ml. of reagent (0.01 per cent 1-nitroso-2-naphthol in 1 litre of 0.05 per cent sodium or potassium hydroxide solution) per 100 ml. of cobalt solution. Use a blue light filter when measuring the extinction. Chromium up to 14 per cent, tungsten up to 17 per cent and nickel up to 1 per cent do not interfere. Construct two calibration curves (one for cobalt less than 1 per cent.; the other for cobalt between 1-5 per cent) based on galvanometer deflections. Up to 5 per cent of cobalt, the values do not deviate more than 0.2 per cent from results obtained by the Ilinski-Knorre gravimetric method.

Yoe and Barton²⁶ have made a spectrophotometric study of the colorimetric determination of cobalt with 2-nitroso-1-naphthol, with specific attention to the optimum conditions, the effects of various salts and the interference of certain ions. The method proved very sensitive for determining cobalt but the chief disadvantages are the great influence of the ammonia concentration and the low solubility of the complex. The sensitivity compared favourably with that of the 1-nitroso-2-naphthol method. The most suitable wavelength for transmission measurements is 525 $m\mu$. Nickel and copper interfered.

The trioxalatocobaltate ion absorbs maximally at 605 $m\mu$. Cartledge and Nickels²⁷ estimated cobalt by oxidising oxalic acid solutions of the metal with lead peroxide. The complex oxalate ion has a dark emerald green colour which is directly proportional to the amount of cobalt present. Manganese interferes.

To carry out the test take an aliquot part of the main solution with 1-50 mg. of cobalt

and add sodium hydroxide till a slight permanent precipitate forms. Add 2 ml. of glacial acetic acid, 5 ml. of 20 per cent ammonium acetate, 10 ml. of 1M potassium oxalate and about 1 gm. of lead peroxide. Set aside, away from bright light for 5-10 minutes with occasional shaking. Dilute to 50 or 100 ml., filter, discard the first portion of the filtrate and measure the extinction of the remainder. Results are within 1 per cent with 40 mg. of cobalt and within 0.03 mg. with 1.5 mg. of cobalt.

Mehlig and Zeagas²⁸ applied the trioxalato-cobaltate colour system to the determination of macro quantities of cobalt. They found that chromium, copper, iron, manganese, calcium and nickel interfered.

Resorcinol Reagent

Resorcinol in sodium nitrate-thiocyanate solution gives a red colour with cobalt solutions. Saravi²⁹ estimated cobalt in amounts less than 0.1 gm. per litre by the following procedure:—To 1 ml. of cobalt solution add 2 ml. of reagent (equal volumes of 0.05M sodium nitrate and 0.05M resorcinol freshly mixed) and then add 1 drop of 5N hydrochloric acid and 5 ml. of 20 per cent ammonium thiocyanate solution. Shake the mixture for 2 minutes in a separating funnel with 5 ml. of ether and compare the colour with a standard. As much as 10 times excess of nickel causes no interference.

o-Nitrosophenol forms highly coloured inner complex salts with metal ions. Those of cobalt (greyish-brown), palladium and ferric iron are distinguished from the others by their easy solubility in petroleum ether. Cronheim³⁰ determined cobalt by neutralising the solution (from which Fe^{+++}) had been removed by cupferron) to methyl orange and diluting the solution so that 100 ml. contained about 1.5 mg. of cobalt. The solution was transferred to a separating funnel, 5 ml. of citrate buffer (pH 4.0) added and 2 ml. of a solution of *o*-nitrosophenol in petroleum ether. After shaking for 20 minutes the organic layer was transferred to a graduated flask. The process was repeated twice, the aqueous layer being washed thoroughly with petroleum ether (2×2 ml. portions). The 10 ml. of extract was transferred to a cell and the extinction measured. About 12 μg . of cobalt can be determined in this way.

Overholser and Yoc³¹ gave spectrophotometric data for the complex formed by

o-nitrosorcinol with cobalt. A 0.05 per cent solution of *o*-nitrosorcinol was used as reagent for the determination of as little as 1 part of cobalt per 20 million parts of solution. Copper interfered when present in amounts greater than 0.02 mg. Zinc and cadmium interfered and several salts caused off-colour shades if the solution was allowed to stand longer than an hour.

Moss and Mellon³² suggested the use of terpyridyl (2,6-di-2'-pyridylpyridine) hydrochloride as a colorimetric reagent for the determination of cobalt in the range 0.0-50 ppm. Changes in pH between 2 and 10 do not affect the colour shade or intensity and Beer's Law is valid. Copper, nickel and Fe^{+++} must be removed.

A study of the reactions of 20 amines with cobalt and dimethylglyoxime has been made by Lee and Diehl.³³ *o*-Phenylenediamine gave the most intense but an unstable colour. Benzidine proved less sensitive for the determination of cobalt, but the colour was stable and conformed to Beer's Law at the absorption maximum of 450 μm . The transmittance was found to be a minimum and to be constant over the range of pH 4.8 to 7.0. The method is applicable to 0.02-0.5 mg. of cobalt in 100 ml. of solution. Polya and Wilson³⁴ also used the benzidine dimethylglyoxime procedure for the determination of cobalt and gave a calibration table for the range 1-50 μg . per ml.

REFERENCES

- Z. anal. Chem.*, **115**, 402 (1939).
- Anal. Chem.*, **21**, 930 (1949).
- Am. Foundryman*, **20**, 56 (1951).
- Anal. Chem.*, **24**, 945 (1952).
- Ind. Eng. Chem. (Anal. Ed.)*, **18**, 264 (1946).
- Zavodskaya Lab.*, **11**, 1022 (1945).
- Ind. Eng. Chem. (Anal. Ed.)*, **18**, 446 (1946).
- Mikrochemie*, **22**, 101 (1937).
- Zavodskaya Lab.*, **5**, 1176 (1939).
- J. Oil and Colour Chemists' Assoc.*, **31**, 125 (1948).
- Analyst*, **72**, 478 (1947).
- Anal. Chem.*, **22**, 664 (1950).
- Ind. Eng. Chem. (Anal. Ed.)*, **14**, 858 (1942).
- ibid.*, **9**, 145 (1937).
- New Zealand J. Sci. Tech.*, **18**, 655 (1937).
- Australian J. Exptl. Biol. Med. Sci.*, **14**, 319 (1936).
- Biochem. J.*, **32**, 763 (1938).
- Ind. Eng. Chem. (Anal. Ed.)*, **18**, 474 (1946).
- Anal. Chem.*, **19**, 505 (1947).
- Rec. trav. chim.*, **67**, 720 (1948).
- Zavodskaya Lab.*, **15**, 1399 (1949).
- Anal. Chem.*, **23**, 1096 (1951).
- New Zealand J. Sci. Tech.*, **18**, 601 (1937).
- Soil. Sci.*, **51**, 387 (1941).
- Zavodskaya Lab.*, **13**, 137 (1947).
- Ind. Eng. Chem. (Anal. Ed.)*, **12**, 405 (1940).
- ibid.*, **13**, 20 (1941).
- Chemist-Analyst*, **40**, 76 (1951).
- Rev. col. farm. nac. Rosario*, **6**, 159 (1939).
- Ind. Eng. Chem. (Anal. Ed.)*, **14**, 447 (1942).
- ibid.*, **15**, 310 (1943).
- ibid.*, **15**, 74 (1943).
- Proc. Iowa Acad. Sci.*, **57**, 187 (1950).
- Australian J. Sci.*, **13**, 26 (1950).

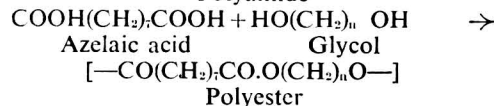
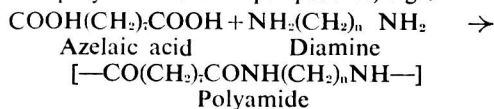
Long Chain Dicarboxylic Acids

by R. W. MONCRIEFF, B.Sc., F.R.I.C., F.T.I.

SOME of the most useful of the synthetic polymers which have become so ubiquitous are the linear polymers. They can be made in a variety of ways, but for those which are prepared by condensation, a long chain dicarboxylic acid is an excellent starting material, particularly if the acid is an α - ω acid.

Given an acid such as azelaic
 $\text{COOH}(\text{CH}_2)_7\text{COOH}$

it is clear that the preparation of polyamides and polyesters is a simple process, e.g.:—



Sebacic acid, which has one methylene group in its chain more than azelaic acid, has been reacted along the lines indicated above with hexamethylene diamine to give Nylon 610, which has a lower moisture equilibrium content than standard Nylon 66, and which has been used for the manufacture of bristles.

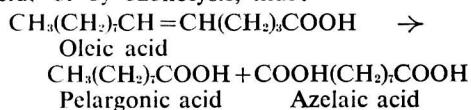
Some of the esters of azelaic and sebacic acid were found^{1,2,3,4} during the war to have exceptional properties which made them of great use as lubricants for instruments and for aircraft at very low temperatures. Compounds of the long chain dicarboxylic acids have also found industrial applications as plasticisers and as alkyds for finishes and laminating resins. There has, however, always been one factor that has limited their application for really large outlets, and that has been the question of supply.

Restricted Supplies

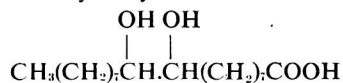
Sebacic acid has probably been the most widely used of such acids and it has so far been obtained by a caustic soda fusion process from castor oil. It has accordingly not been cheap and the available and potential supplies from this source would not permit the undertaking of very large scale manufacture of derivatives.

Similarly, azelaic acid has been obtained by a variety of processes from oleic acid or

from natural fats and oils which were rich in oleic acid. Essentially its preparation requires only that the double bond in oleic acid be severed by oxidation; this has been done on an industrial scale by using chromic acid,⁵ or by ozonolysis, thus:



Alternatively, the oleic acid may first be treated with a mild oxidising agent to convert it to dihydroxystearic acid



and this may be split by treatment with molten caustic soda.⁶

Such methods are, nevertheless, relatively costly and the uses to which the long chain dicarboxylic acids can be put have been limited.

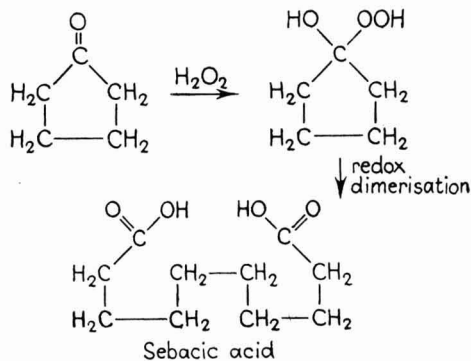
New Preparative Method

A new method of preparation of such long chain acids has recently been disclosed and it has the advantage that it uses, as raw material, cyclopentanone or cyclohexanone, which can be obtained from petroleum relatively cheaply and in unlimited quantities.

The new method of preparation depends first of all on the conversion of the cycloalkanone to its hydroperoxide. A method for this conversion was described by Milas⁷ in 1942. It consisted of the treatment of the cycloalkanone with anhydrous hydrogen peroxide in ethereal solution.

Recently, it has been shown by Du Pont de Nemours & Co.⁸ that these peroxides can be converted under redox conditions to produce the dicarboxylic acid in one step. Under redox conditions an oxidation-reduction process takes place in which an electron transfer occurs with the simultaneous formation of a free radical.

In order for the free radical formation to take place, a reducing agent for the peroxide compound must be present; ferrous ion is the preferred reducing agent. Furthermore, it is very important that the reaction mixture be substantially free of oxygen or air, since oxygen inhibits the dimerisation step



Conversion of cyclopentanone to sebacic acid

until it has been used up and so decreases the yield of dibasic acid.

As with many other reactions, this one goes most easily in the presence of a common solvent, one that will dissolve both the peroxide compound of the cycloalkane and the ferrous compound; methanol is particularly preferred.

Dodecanedioic Acid

While the redox reaction can be carried out under a wide range of conditions, those that are preferred are illustrated in the following example:

Cyclohexanone and hydrogen peroxide are reacted to give the hydroperoxide as described by Milas. The hydroperoxide (5 gm.) is dissolved in 100 ml. oxygen-free methanol under a nitrogen atmosphere and cooled to -30° . Ferrous sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, (10 gm.) is similarly dissolved in 100 ml. oxygen-free methanol under a nitrogen atmosphere and cooled to -30° . The hydroperoxide solution is poured into the ferrous sulphate solution; there is a rise in temperature to -10° , and the solution turns reddish brown in colour due to the oxidation of the ferrous iron to ferric hydroxide. The solution is then evaporated to near dryness on a steam bath, 200 ml. of 7.5 per cent caustic soda are added, and the mixture warmed. The solution is filtered to remove ferric hydroxide, hydrochloric acid is added to precipitate the dodecanedioic acid. In this example a yield of 53 per cent of theory was obtained.

If the experiment is made without first freeing the methanol from oxygen (suitably by boiling under a nitrogen atmosphere), only a very low yield is obtained.

The peroxide compound can be prepared in ways other than that described by Milas and for a large scale operation these would probably be preferred. For example, cyclohexanone can be treated with molecular oxygen at 70° , using an azonitrile catalyst and added calcium carbonate, or it may be done in the presence of ultra-violet light with the addition of benzoin or a photoinitiator. A suitable treatment is as follows:

400 gm. cyclohexanol is irradiated with a Sun Lamp so that the temperature of the solution remains at $60-65^{\circ}$, and oxygen is introduced. After 20 hours' exposure, about one quarter of the cyclohexanol has been oxidised to cyclohexanone peroxide. The unchanged cyclohexanol is distilled off under a pressure of 0.3 mm. and the residual peroxide dissolved in methanol. Oxygen is removed from it by bubbling nitrogen through; it is cooled to -78° and treated with a deoxidised solution of ferrous sulphate in boiled methanol. Thereafter the reaction mixture is evaporated, treated with aqueous alkali, filtered and acidified to precipitate dodecanedioic acid.

The preparation of a near homologue of sebacic acid, *viz.* dodecanedioic acid, directly from cyclohexanol which is cheap and abundant, may open up new possibilities for the uses of this acid and indeed for long chain aliphatic α,ω -dicarboxylic acids generally.

REFERENCES

- 1 E. M. Bried, H. F. Kidder, C. W. Murphy and W. A. Zisman, *Ind. Eng. Chem.*, **39**, 484 (1947).
- 2 G. M. Hain, D. T. Jones, R. L. Merker and W. A. Zisman, *ibid.*, **39**, 500 (1947).
- 3 W. A. Zisman, C. M. Murphy and J. K. Wolfe, *USP*, 2,539,504 (1951).
- 4 W. M. Bruner, *Ind. Eng. Chem.*, **41**, 2860 (1949).
- 5 Emery Industries Inc., *BP*, 604,281 (1944).
- 6 R. L. Logan, *USP*, 2,625,558 (1953).
- 7 N. A. Milas, *USP*, 2,298,405 (1942), assigned to Research Corporation, New York.
- 8 E. I. du Pont de Nemours & Co., *BP*, 697,506 (1953).

Cosmetic Chemists to Meet

The second meeting of the Society of Cosmetic Chemists of Great Britain will be held on Wednesday, 2 December, at 7.45 p.m. in the balcony room of the St. Ermin's Hotel, Caxton Street, S.W.1. The lecture, entitled 'Molecular Interactions at the Solid-liquid Interface, with Special Reference to Emulsions Stabilised with Solid Particles,' will be given by Dr. J. H. Schulman, of the Department of Colloid Science, University of Cambridge, and the meeting is an open one.

Expansion in Canada

Growth in Petrochemicals Main Feature

STIMULATED, first by World War II and then by the war in Korea, the Canadian chemical industry has grown rapidly in recent years, and the most recent phase of expansion is now nearing completion. This is largely concerned with the production of petrochemicals, and is aimed at augmenting Canada's output of fertilisers, plastics and synthetic fibres.

A review in 'Foreign Trade,' the weekly publication of the Canadian Department of Trade and Commerce, summarises the present situation and examines future prospects. The review is in six parts, the first of which was published on 3 October.

Because of Canada's increasing population and rising standard of living, there is little reason, says the article, to suppose that this upward trend will fall off. The demand for many chemicals is reaching the point where home production would be an economic proposition; indeed, there already exist considerable export possibilities for such products as oil, natural gas and non-ferrous metals, and new facilities for the treatment of by-products from these resources are urgently required.

Serve Long-term Needs

Nearly two-thirds of the money being devoted to the erection of new chemical installations is for the development of petrochemicals. Some of these new facilities are part of the nation's present defence effort, but in the main they have been designed to serve the long-term needs of Canada's agricultural, consumer goods and strategic resource industries.

Most of the new sulphur production, for instance, will go into pulp, newsprint and other paper products. Several of the largest plants being built are for fertilisers, plastics and synthetic fibre intermediates. Numerous other facilities are being created to serve the needs of Canada's soap, paint and motor vehicle manufacturers. A number are also being launched by firms engaged primarily in the production of strategically important staples such as oil, the base metals and aluminium.

Chemicals whose production has devel-

oped since the war include ethylene glycol; insecticides; antibiotics such as penicillin, streptomycin and aureomycin; and the hormone cortisone. The plastics moulding industry has been able to draw heavily on new capacity for producing styrene monomer at Montreal and Sarnia, and vinyl resins at Shawinigan Falls and Montreal. There are insistent demands for chemical substitutes such as detergents and synthetic fibres.

More New Chemicals

As a further result of the present production programme, a number of chemicals are being produced, or are about to be produced, in Canada for the first time. These include carbon black, pentaerythritol, formaldehyde, phthalic anhydride and polyethylene. Among chemicals which are at present imported, but which it should soon prove economic to produce at home, are methyl chloride, tetraethyl lead, elemental sodium, textile dyes, and numerous new plastics and chemotherapeutics.

Canada has recently become the most important export market for US-produced chemicals. In 1952, \$166,000,000 worth of chemicals imported from the US represented 88 per cent of the total, and resulted in an adverse balance of over \$90,000,000. Shipments from the UK have been declining since the early 1920's, and Germany is no longer a major supplier.

In the export field also, business with the UK has declined. This has been offset, however, by increased sales in other countries, and particularly in the US, which now take over 50 per cent of Canadian chemical exports. Over 25 per cent of the total of Canadian exports is accounted for by fertilisers, and another 15 to 20 per cent by sodium compounds, synthetic rubber and synthetic resins.

Output Must be Trebled

Nevertheless, in order to reach parity and at the same time achieve self-sufficiency in chemicals, Canadian output will have to be nearly trebled. It is obvious that expansion in Canada's chemical industry is far from spent.

Electroplated Coatings

British Standard Revised

THE British Standards Institution have just issued a revision of BS. 1224, 'Electroplated Coatings of Nickel & Chromium,' which was originally published in 1945.

The principal reason for this revision is that the original document did not fully meet the requirements of the motor car industry and it has been extended to cover coatings on materials other than steel and copper. The standard has been drawn up with a view to specifying the essential qualities of the coatings in question. It is realised that it is impossible at present to specify completely every factor affecting the performance of an electroplated coating.

An important feature of this British Standard is the minimum thickness of the deposit and particular attention is drawn to the effect of the contour. It will be noted in Clauses 6 and 12 that the requirements for minimum thickness normally apply only to those portions of the significant surface which can

be touched by a ball of 1 in. diameter. It is hoped, therefore, that manufacturers will allow this vital consideration of surface contour to influence the design of any article on which a durable electroplated coating is essential.

It has not been found possible to specify average thicknesses as these vary considerably with the size and shape of the article and the method of plating. It was also impracticable to give guidance on the usage of the various classifications, due to the difference in requirements. It is also pointed out that the importance of conserving nickel has been taken into account in the preparation of the document by specifying alternative coatings using copper undercoatings; particular attention is drawn to these coatings. Additionally, a salt spray test has been specified and appendices give details of the methods by which the tests should be carried out.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, W.1. (2s. 6d.).

New MOR Developments

IN recent years the spraying of stable white oil/water emulsions on to textile fibres during the 'opening' stages of the spinning operation has been shown to be of definite assistance to processing and effective in suppressing dust, so eliminating fly on machines and helping to improve the health of operatives. On their stand at the 'Textile Recorder' Textile Machinery and Accessories Exhibition the latest developments in their 'Puremor' emulsion preparation and spraying equipment are being shown in actual operation by the White Oils Division of Manchester Oil Refinery (Sales), Ltd. Recently, considerable advances in the technique of using free scouring oil/water/tint emulsions for identification tinting have been made, particularly in the synthetic fibre field, and the latest equipment developed by MOR for this purpose is being exhibited. Also on show is the MOR range of high grade textile machinery lubricating oils including the new white mule spindle oil, which meets the requirements of the new Mule Spinning (Health) Special Regulations 1953, for an oil of wholly mineral origin and complete biological inactivity.

Match Monopoly

IN the House of Commons last week, the President of the Board of Trade, Mr. Peter Thorneycroft, announced that he was adopting all the recommendations, except that dealing with price control, contained in the report of the Monopolies Commission on the match industry. 'As I have already informed the House,' he said, 'I accept the conclusion of the report of the Monopolies Commission and that, taken as a whole, the arrangements which have obtained between the British Match Corporation and the Swedish Match Company operate against the public interest. Further, I am seeking the removal of objectionable restrictions, such as division of sales in the British market.'

The British Match Corporation and the Swedish Match Company had been in negotiation with a view to the conclusion of a revised agreement to eliminate features of the existing agreement which the Government considered objectionable. These negotiations were still proceeding and he would, of course, have to consider the terms of any revised agreement. Mr. Thorneycroft added that he would make a further statement in due course.

Organic Silicon Compounds in Industry

Modern Products for Modern Needs

WHEN in 1937, Kipping intimated that the probable future of organic silicon derivatives would be disappointingly limited, he had underestimated the many useful physical properties of the compounds he had so capably prepared, and scarcely had he uttered this almost historic statement, when the new organic silicon derivatives began to find ready applications in the ever expanding realms of industry.

With the advent of high altitude flying, improved lubricants with improved viscosity-temperature functions were required, and organic silicon compounds were found very suitable. The desire for elastomers having good flexibilities at very low temperatures automatically involved the application of organic silicon compounds as gaskets and mountings, these new products tending to displace the more conventional compositions extant.

The application of organic silicon compounds is in fact very varied, and these compounds, on account of their high dielectric values, have been used either as insulating liquids, or as impregnates for laminates, in electrical condensers. Their good heat-resisting characteristics in conjunction with their flexibility at high temperatures have proved particularly significant in the manufacture of gaskets, these being generally prepared as laminates of glass cloth fibre with organic silicon compounds.

The poor wetting properties of the polysiloxanes have found a further application for these compounds, in the manufacture of water-repellent fabrics.

Synthesis of Polymers

The synthesis of silicon polymers mainly depends upon the intermolecular condensation of bi- or trifunctional silanols, produced by the hydrolysis of appropriate alkyl halogen-silanes. These compounds were originally prepared as far back as 1873, when Landenburg reacted phenylmercury with silicon tetrahalide, the process being modified later by the use of Grignard reagents.

Today, however, alkylhalogen silanes are best prepared by passing a stream of alkyl halide over silicon at 300° or, alternatively, in inert atmospheres over various

silicon-copper alloys (BP. 575,673).

The organic silicon compounds of use in industry usually consist of hydrolytic products of a given organic halogen silane. The hydrolysis of methyl dichlorosilane, for example, yields an intermediate bifunctional diol, intermolecular dehydration of which affords the corresponding polysiloxane. The production of organic linear polymers gives viscous liquids, oils or pliable flexible materials, while the production of trifunctional intermediates, by virtue of possible cross linking, makes possible the formation of more rigid compounds.

Some Industrial Applications

In the manufacture of brake blocks, mixtures of alkyl silicon halides are hydrolysed to afford copolymeric siloxane compounds, which may be cured with triethanolamine. Water repellent films necessary for the formation of good paint surfaces have been made from organic silicon esters formed by the interaction of tridodecoxy silicon chloride with the sodium salts of fatty acids. Impregnating materials as used for electrical insulations are obtained by treating dimethyl-dihalogen silanes with ferric chloride hexahydrate to give silicon gums. Condensers having minimum changes of capacity with temperature variation have been constructed from alternate layers of methyl and phenyl silicone resins respectively.

In the engineering world, greases comprising carbon blacks of particle size below 60 μ have been prepared from oily silicones (BP. 607,695), extreme pressure greases having in addition such ingredients as phosphorus sesquisulphide, etc. New synthetic lubricants have also been prepared from the polyalkyldisiloxanes, these being obtained by the fractional distillation of the reaction products of diphenyl silane diol and trimethylchlorosilane.

Silicols react with oil modified glyceryl phthalates to afford highly finished and flexible resins, the free hydroxyls of the glyptal resins probably condensing with the bifunctional silane diols, the latter compounds being freshly prepared by the hydrolysis of organic silane dihalides. The silicon cross linking between alkyl resin molecules,

being one of condensation, is probably of the following linear structure: $-O-Si(R)_2-O-$.

Organic silicon polymers suitable for the embedding of electrical equipment are made by reacting aryl di-isocyanates with polyhydroxysilicols, the $-NH.COOSi\equiv$ linkage conferring rigidity to the plastic linear silicon polycondensates.

Complex polyhydroxy silicols have been synthesised by the alcoholysis of *sym(bis)*-acetoxymethyl dimethyl diphenyl disiloxane, methyl stearyl dichlorosilane and phenyl methyl dichlorosilane, the resulting product being then reacted with toluene 3:5 di-isocyanate. It is probable that the alcoholysis of such products yields intermediate linear hydroxy dimethylol alkylaryltrisiloxanes which may undergo a chain-lengthening process by the interaction of the isocyanate radicals at the hydroxyls, the chain lengthening being effected through the introduction of silicourethane structures.

The anti-foaming properties of silicon compounds have been used in the prevention of foam during the process of emulsion polymerisation, and the stickiness experienced during the milling of butadiene copolymers has been substantially minimised by the introduction of 0.1 to 0.01 per cent by weight of an organic polysiloxane to the synthetic rubber during the milling operation (BP, 632,390).

Indian Newsletter

(From Our Own Correspondent)

THE Fifth Consultative Committee of the Colombo Plan met in New Delhi. Meetings at ministerial and lower levels were attended by representations of the UK, Canada, USA, Australia, New Zealand, India, Pakistan, Ceylon, Burma and seven other countries, besides the World Bank and ECAFE. The second report of the Colombo Plan, presented at the session, takes stock of the development programmes and the achievements of the South and South East Asian countries during the past year. [The Colombo Plan came into operation in July, 1951, and the first report was issued last year.] It was recommended that a publicity organisation be set up for the Colombo Plan.

The Council for Technical Co-operation under the Colombo Plan laid great stress in its policy session on the provision of practical training facilities within the area.

It also urged the periodic evaluation of the technical assistance received from experts and in the form of equipment or training facilities.

* * *

According to the report of a Parliamentary committee set up to review the work of licensing of industries, during the past six months 153 applications were made for licences to establish new industrial undertakings or to effect substantial expansion to existing industries. Of these, 121 were granted licences and 21 were refused; the remainder are under consideration. The registration and licensing of undertakings covering 45 industries came into force last year. Among these were undertakings concerned with rayons, dyestuffs, soap and other toilet goods, ferromanganese, glue and gelatine. The scope of the Act has now been widened by an amendment to cover the manufacture of new articles and changes in location of the industry, and further requires periodic reports of the progress of the industry.

* * *

The Minister for Production recently announced that the Government proposed to start a second DDT manufacturing plant in India and it may probably be located in Travancore. The first DDT plant (in Delhi) will go into production in May next year.

The Government of Assam have decided to establish a quinine factory in the State at a cost of about £15,000.

The State started a 900-acre cinchona farm seven years ago. This is now ready for exploitation and arrangements are being made for the purchase of necessary machinery and equipment.

Must Submit Proposals

The Iron and Steel Board, after consultation with the industry, have published and circulated to iron and steel producers concerned a Notice requiring them to submit for the Board's consent under Section 6 of the Iron and Steel Act, 1953, any proposals for modernisation or development estimated to cost more than £100,000 and which fall within the scope of the Board's powers under that Section. The Board will from time to time be reviewing this criterion in the light of experience.



The Chemist's Bookshelf

DIPOLE MOMENTS. By R. J. W. Le Fevre. Third edition. John Wiley & Sons, New York; Methuen & Co., London. 1953. Pp. 140. 8s. 6d.

Professor Le Fevre's monograph on dipole moments is too well known for a new edition to need much introduction. As successful as any of the Methuen series, it has been used by generations of students of physics and chemistry as an invaluable summary of knowledge in this important field. Although the publishers claim that the book is intended for honours students and for workers in other branches of science, the author makes no bones of the fact that his efforts are directed towards helping an ordinary research worker to make useful measurements of dipole moments and to begin the interpretation of them. The truth is that both aims, in the small compass of 140 pages, are surprisingly fully met.

For this new edition, the author has not rewritten the book nor materially altered the presentation of the contents. Instead, he has contented himself with bringing each section up to date by the addition of appropriate new matter. Although a casual glance, therefore, will reveal little change, a re-reading will bring to light a fair amount of new and interesting material.

The introductory chapter, which gives a lucid rather than critical account of the theory of dielectric polarisation, is followed by a description of the author's apparatus for measuring dielectric constant, sufficient detail being given to ensure that similar equipment could be brought into operation with the minimum of trouble. An outline is also given of the recent developments in microwave spectroscopy, made possible by the rapid wartime advances in radar. New techniques enable accurate measurements of the power factor of dielectrics to be made in the microwave region, and so permit direct evaluation of the dipole moment on the basis of the Debye theory. The dipole moment may also be evaluated from observation of the Stark 'splitting' of spec-

tral lines in the microwave region, a method which shows much promise if only because of its intrinsic high accuracy. The method is restricted at present to fairly simple polar molecules, but rapid developments in this field are to be expected. Unfortunately, the apparatus required for microwave spectroscopy is intricate, and its detailed description beyond the scope of Professor Le Fevre's monograph. The most readable section of the book is the chapter devoted to problems of molecular structure. The author has made many useful contributions himself in this field and succeeds in giving a fascinating account of the numerous problems tackled successfully by the dielectric technique.

This little book is a masterpiece of compression. Its continued usefulness both to university students at degree level and to research workers in the field of dielectrics is not in doubt.—R. C. PINK.

FORMALDEHYDE. By J. Frederic Walker. Second edition. Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., London. 1953. Pp. xvi + 575. 96s.

The production of formaldehyde began in the United States on a small scale in 1901, but progress has been so rapid that formaldehyde now ranks as a major industrial chemical with current American output of the order of 1,000,000 lb. (37 per cent commercial solution) per year. Formaldehyde is manufactured and marketed on the commercial scale chiefly in the form of an aqueous solution containing 37 per cent by weight of dissolved formaldehyde. Usually sufficient methanol (about 8-15 per cent) is present in the solution to prevent precipitation of polymer during transportation and storage. Some formaldehyde is also marketed in the form of the polymeric hydrate, paraformaldehyde.

Since the first edition of this work was published in 1944 improved methods for the manufacture of formaldehyde have been

developed, new uses for this compound have been found, and many notable contributions to the study of its fundamental properties have been made. The second edition is approximately 50 per cent larger in size than its predecessor, but this is mainly due to the expansion of individual chapters, since the general layout of the original edition is preserved.

The opening chapter deals with the production of formaldehyde, which is prepared at the present time mainly from methanol, although increasing quantities (about 20 per cent in 1948) are now being derived from the direct oxidation of hydrocarbon gases. An extensive account is given of the physical and thermodynamic properties of the simple monomer, solutions of formaldehyde and of the formaldehyde polymers. The description of the chemical properties of formaldehyde and of its reactions with various organic and inorganic compounds includes an account new to this edition of the reactions of formaldehyde with heterocyclic compounds. The detection and quantitative analysis of formaldehyde solutions and polymers are also considered in some detail. An account is provided of hexamethylene tetramine (formed by the reaction of formaldehyde and ammonia), which reacts as formaldehyde in many instances and may be regarded as a special form of formaldehyde from the standpoint of use.

The two final chapters describe fully the many and varied uses of formaldehyde, its polymers and hexamethylene tetramine. At the start of the 20th century formaldehyde was chiefly used as a disinfectant and embalming agent, but the development of the synthetic resin industry based upon the initial discoveries of Dr. Baekeland in 1909 resulted in a much increased demand for this compound. During the second World War demand for formaldehyde also resulted in part from the growing production of the explosive, cyclonite (RDX), prepared by the nitration of hexamethylene tetramine. With the return to peacetime conditions the plastics industry now consumes about three-quarters of the total output of formaldehyde, but this compound also finds important uses in the textile, paper, leather, dye, rubber and chemical industries.

The author has prepared a valuable and comprehensive summary of the salient facts relating to the production, properties and

uses of formaldehyde, and the volume can be confidently recommended to all those interested in this important chemical.—G.S.E.

CHEMISTRY OF THE LANTHANONS. By R. C. Vickery. Butterworths Scientific Publications, London, 1953. Pp. 296. 35s.

Perhaps a more specific title for this book would be 'The Analytical Chemistry of the Lanthanons,' as the body of material deals with separation techniques and analytical methods. The lanthanons, formerly known ambiguously as the 'rare earths,' comprise the fifteen elements whose atomic numbers range from 57-71. For too long now, the chemistry of these elements has remained under a cloak, and the author is to be congratulated for the enthusiastic way in which he has tackled this unique compilation. The subject matter is rigorously treated and critically evaluated. The text and style are clear and desirably concise, but the book is perhaps designed for study rather than for easy reading.

The first 64 pages of the volume are concerned with the historical development, modes of occurrence, structure, spectroscopy, paramagnetism, isotopic constitution, radioactivity and valency of the lanthanons. In the next 204 pages separation techniques are detailed, including precipitation reactions and crystallisation, oxidation-reduction and miscellaneous procedures. Also in this section are chapters on the final purification of lanthanon compounds, properties of the lighter and heavy lanthanons, and analytical methods. Noteworthy is a complete separation scheme, including a table giving the sequence of operations.

The final chapter details the uses and applications of the lanthanons and an appendix summarises the salient characteristics of the element yttrium, which precedes the lanthanons in Periodic Group IIIa and which closely resembles them in chemical properties. Each chapter is fully referenced (792 references in all) and there are comprehensive name and author indexes.

The book will be a welcome and valuable addition to the working library of the chemist. The analytical chemist in particular will feel gratified to find so much useful material gathered in one place. As befits a book of this quality, the binding and format are excellent.—A.J.N.

HOME

Rayon Works Closing

Breda Visada rayon works at Littleborough, near Rochdale, employing some 340 operatives, ceased production at the end of this week.

Oil Exports Up

According to the latest official returns, exports of refined petroleum products earned Britain £52,942,000 in the first nine months of this year, compared with £36,106,000 in the same period last year, and £52,351,000 for the whole of 1952.

New BSI Draft

The British Standards Institution is distributing draft copies of a proposed standard on drawing conventions for laboratory apparatus. These include recommended conventions for glass and other ware, liquids, graduations and joints. Copies of the draft may be obtained from the BSI, at 2 Park Street, London, W.1, and comments must be submitted by 1 December.

OEEC Pollution Mission

Sponsored by the OEEC chemical products committee, a mission arrived in Britain last weekend to study techniques of prevention of air and water pollution by industrial wastes. This is part of a European tour of investigation prior to a projected mission to the US. At a preliminary conference in Paris on 30 March, five representatives of the ABCM expressed the opinion that arrangements should be delayed slightly, but the OEEC secretariat was anxious for the mission to carry out its work as soon as possible; it has not been possible, therefore, for British representatives to co-operate as fully as had been hoped. Mr. M. D. Bone, from Billingham, is a full-time member of the mission; Dr. Jackson of The Distillers Co., will take part in the visit to France; Dr. I. S. Wilson, of Monsanto, accompanied the visit to Germany; and Dr. Birse, the Scottish Alkali Inspector, visited Sweden. This week the mission, which numbers about 20, has visited the Shell refinery at Stanlow, Courtaulds at Preston, British Enka Ltd., Monsanto, May & Baker, and the DSIR Water Pollution Research Laboratory.

Ammonia Tank Bursts

A Deptford boilerman, William J. Bell (34), was killed and five other men injured when one side of a tank containing 30,000 gal. of concentrated ammonia gave way at the South Eastern Gas Board premises, Phoenix Wharf, Greenwich, last week. The five injured men—overcome by fumes—were taken to hospital, but only one was detained.

Tinplate Works Reopening

Announcing that the Gorseinon and Pontardawe old-type tinplate works would restart operations on Monday, the Steel Company of Wales stated this week that 'considerable assistance' had been given to the company by trade union representatives in arranging for the men required to man the mills. The works were closed down at the beginning of this year because of mounting stocks of tinplate.

Chemical Exports in September

The total value of British chemical exports during September was £10,525,119, compared with £9,800,428 during August. Figures for the same months last year were respectively £10,616,689 and £10,044,203. Exports of ammonium compounds fell in value, but copper sulphate and sodium compounds rose. Values of exports to Commonwealth countries rose in nearly every case, and exports to the USA also showed a considerable increase.

Controlling Sewage Foam

Experiments in the control of foam in sewage plants due to detergents were described recently by the chairman of Birmingham Trade and Rea District Drainage Board, Alderman Paddon Smith. He said that the board had co-operated with certain manufacturers in these experiments, which had included spraying purified sewage over the surface of the purification tanks to beat down the foam. Unfortunately the objections to this practice were as serious as the foam nuisance itself. Anti-foam agents had been employed with success, but it was considered that the expense of their use would be too great.

OVERSEAS

Fungistatic Wrappings

Sorbic acid is being incorporated in the wrappings of cheeses and other perishable foods in America, as an anti-mould agent. The US Food and Drug Administration recently declared the acid safe for use with foods.

Australia's Uranium

Speaking in Canberra last week, Mr. Howard Beale, Australian Minister of Supply, denied that the country was getting less than the market value for the uranium it sold to the Anglo-American Combined Development Agency. He said the price was at least as good as that paid anywhere else in the world.

More Canadian Petrol

Canada's output of crude petroleum climbed 29 per cent in the first half of this year to 33,382,766 barrels compared with the first six months of last year, according to the latest statistics. Production reached 6,806,375 barrels in June, as against 6,131,792 in May, and 5,399,169 in June last year.

Water-Soluble Paint

A water-soluble resin paint is being marketed in the US by Reichhold Chemicals Inc., under the name of 'Hydrophen.' The paint is based on a phenol and an alkyd resin, which on treatment with ammonia becomes completely water-soluble. The solution may be diluted with tap-water, and applied directly to metallic surfaces as a clear finish, or pigmented to produce an opaque finish. After drying, the coating is made water- and corrosion-proof by heat-treatment.

New Phosphoric Acid

It has been drawn to our attention that our report under this heading (19 September) that crystalline phosphoric acid is being produced in Vienna by the Hardig Co., is not strictly correct. The company, whose name is correctly Hardung & Co., are agents for phosphoric acid manufactured only by La Fonte Electrique, at Bex in Switzerland. The product has been registered under the name 'Crystallised phosphoric acid F.E.B.' and contains 99 per cent H_3PO_4 .

Copper Production in Chile

For the first nine months of this year, copper production in Chile was 255,682 metric tons, compared with 272,540 tons in the corresponding period in 1952.

Magnesium Casting in Brazil

A factory for the pressure casting of magnesium has just been opened in Sao Paulo, Brazil, by German interests. Initial production is expected to be between 10 and 20 tons of metal a month.

Sulphuric Acid Plant

Australia's biggest single-unit sulphuric acid plant at Port Adelaide is rapidly taking shape. An Adelaide firm has been given a £A20,000 contract for steel for the roaster house, which will accommodate three flash roasters to burn pyrites from Nairne, producing gas which will be converted to acid at the rate of 300 tons an hour.

MCA Semi-Annual Meeting

The Manufacturing Chemists' Association, Inc., will hold its 1953 semi-annual meeting at the Waldorf-Astoria Hotel, New York City, on Tuesday, 24 November. The all-day session will be given over to discussion of important problems now facing the chemical industry.

Uranium Discovered

The discovery of 'what looks like an important new find' of uranium-bearing ores in a remote area of Wyoming, has been confirmed by the USA Atomic Energy Commission. Mr. Charles Towle, of the AEC exploration branch, said that as it was an isolated area it would take a considerable time to evaluate and determine the extent of the ore deposits.

Plastic Tank Constructed

A glass-reinforced polyester tank for the transport of liquid chemicals has been manufactured in America by the American Cyanamid & Chemical Corp. An example recently displayed in New York measured nearly 22 ft. in length, held 3,400 gal. and weighed 7,025 lb. The tank requires no corrosive-resistant lining and is very easily repaired. It is estimated that under mass production methods the plastic tanks might cost only one-third as much as the stainless steel type at present in use.

PERSONAL

To mark his completion of 50 years' service with the firm, MR. SIDNEY MITCHELL, an instrument maker at W. G. Pye & Company, Ltd., Cambridge, was presented with a gold watch by MR. C. A. W. HARMER, one of the directors, who also presented Mr. Mitchell's wife with a needlework trolley. The board of management were among those who gathered to honour Mr. Mitchell. When Mr. Mitchell joined the firm in 1903, his training included hand-wood polishing, brush enamelling, lacquering, engraving and dividing—operations all performed by specialists nowadays. The instrument maker used his own initiative in making parts to suit each other.

At board meetings held on 21 October, MR. WILLIAM JAMES DEVERALL, works manager, Joseph Crosfield & Sons, Limited, was appointed a director of Joseph Crosfield & Sons, Limited, and of William Gossage & Sons, Limited. Mr. Deverall, who is 47, was born at Penarth, South Wales. He received his early education at Lord Weymouth's Grammar School, Warminster, and his scientific training jointly at Cardiff Technical College and University of South Wales & Monmouthshire. He graduated as a Bachelor of Science of London University by external examination and later was elected an Associate Member of the Institution of Chemical Engineers. In 1928 he entered the works laboratory of Lever Brothers, Port Sunlight, Limited, and after experience in the production and technical records department extending to 1936 was appointed assistant works manager of T. H. Harris & Sons, Limited, soap and glycerine manufacturers, Stratford and Bow.

From 1941 to 1943 Mr. Deverall was at the Queniborough Ordnance Factory, and from 1943 to 1945 at the Risley Ordnance Factory, firstly as production manager and later as assistant superintendent. On the cessation of hostilities he joined the technical staff of Joseph Crosfield & Sons, Limited, and was appointed works manager in 1946. Recently he was appointed a member of the Association of British Chemical Manufacturers Manchester Area Committee on Productivity in the Heavy Chemicals Industry.

MR. J. T. L. CUTHBERT has been appointed chief chemist to Batchelors Peas Ltd., Sheffield. Aged 27, he was educated at St. Bede's College, and obtained his B.Sc. Tech. at Manchester University.

MR. L. P. O'BRIEN, chairman and managing director of Laporte Industries Limited, left for Australia by R.M.S. *Orcades* on 28 October. It is understood that the Laporte Group has arranged to purchase the minority interest in their subsidiary company, Crystal-Laporte Proprietary Limited, Sydney, NSW, and that the plant at Botany is being further enlarged to cope with the increasing demands for Laporte products.

Obituary

The death occurred last week of MR. WALTER GEORGE WALDRON. Mr. Waldron, who was 81, was formerly chairman of a number of companies, including the Anglo-Greek Magnesite Co., and Erinoid Ltd.

MR. GEORGE BARNES SALKELD, aged 60, chief chemist for High Duty Alloys, Ltd., since 1940, was found dead in the garden of his home, Shatton Lodge, Lorton, Cocker-mouth, on 18 October. Death was established as being due to natural causes.

The Director of the Metallurgical Institute in the Technical University of Aachen, PROFESSOR EUGEN PIWOWARSKY, died last week at the age of 61. He had taught at Aachen for over 30 years, and was the author of numerous papers and books, including the standard work 'Hochwertiges Gusseisen.'

MR. CHARLES ALBERT GARDNER, director of John Clark & Company, manufacturing chemists, West Street, Sheffield, who died recently aged 82, bought the business in 1897, and supplied Sheffield and district steelworks with heavy chemicals and a wide range of oils and paints. He was also a director of the Sheffield Magnet Company and Gardshaw Foundry, Ltd., Beighton.

Publications & Announcements

THE October issue of the *Journal of the Institute of Fuel* is largely devoted to reports by the Flame Radiation Research Joint Committee of 'Burner Trials at IJmuiden.' The other principal articles are 'Progress Review No. 26: Heat Transfer' by the Mechanical Engineering Research Laboratory, DSIR, and 'Electricity Supply—Past and Present' by Sir John Hacking.

* * *

A NEW technical bulletin on ethyl acetoacetate has just been issued by Carbide and Carbon Chemicals Company. Physical and chemical properties; specifications and shipping data; uses and potential applications for this valuable reactive intermediate are included. Ethyl acetoacetate finds its major outlets in the pharmaceutical and dyestuff industries. Important ethyl acetoacetate derivatives are used in the manufacture of paint, lacquer, and printing inks. This chemical is an intermediate in the synthesis of Hansa dyes and azo dyes of the pyrazolone series. Ethyl acetoacetate is used in the preparation of such important pharmaceuticals as synthetic anti-malarial compounds; the anti-neuritic vitamin B₁; and the fever-alleviating drugs, antipyrine and amidopyrine. Copies of the bulletin (F-8292) are available from Carbide and Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

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FROM the earliest days of the development and production in their works of stainless and 'Staybrite' steels, Firth-Vickers Stainless Steels, Ltd., Vickers House, Broadway, Westminster, London, S.W.1, have endeavoured to maintain a policy of close co-operation and exchange of technical information with users and prospective users of their steels. The experience thus gained over the years, together with the continuous research and development which take place in their own laboratories and works, enable them to offer a unique service of guidance in the selection and use of suitable materials from the wide range of corrosion-resisting and heat-resisting steels now available. Charts and booklets are obtainable, giving details of compositions and properties, together with instructions for machining, manipulation, etc. One issue of the company's

magazine, 'Enchiridion,' contains a special display of illustrations showing the use of 'Staybrite' steel in the manufacture of phosphoric acid.

* * *

EXTRAORDINARY transparency to ultra-violet light is claimed for the transparent form of Vitreosil (pure fused quartz) by the Thermal Syndicate, Wallsend, Northumberland, in their Publication LL 17/8/53. Cells made from this material, it continues, are extremely useful in absorption experiments, treatment of bacteriological specimens, and for ultra-violet spectrophotometer work in general. The Vitreosil range of spectrophotometer cells includes both cylindrical and rectangular types, many of which are suitable for use in Unicam and Beckman spectrophotometers. Each cell has endplates made of specially selected transparent material, fused to the main body of the cell and ground to plate-glass finish. The actual area of the endplates is slightly larger than the required working surface. Further details can be obtained from the leaflet.

* * *

THE almost complete reliability of modern welding, when backed by suitable inspection and radiological facilities, has led to a great increase in the use of welding for building up pipework. To meet this trend, the range of SPA screwed unions has been enlarged to include socket welded unions from $\frac{1}{2}$ in. up to 2 in. nominal bore. These new SPA unions will be made from a similar grade of hot forging to that employed for SPA screwed unions. Chemical and mechanical tests are carried out on each heat of steel. The hot forging process leaves the forging completely free from mechanical strains and with a close-grained structure which is tough and entirely free from blowholes and porosity. Also, the grain flow is so regulated as to give the maximum strength in exactly the directions required. All-steel unions are recommended to avoid pitting due to electrolytic action whenever the piping carries liquids containing traces of sulphur, sulphuric acid, ammonia, etc. All unions are given a rustproof finish by Parkerising. Details relating to a given application will gladly be given by Shay Products Ltd., 17 Little St. Leonards, Mortlake, London, S.W.14.

British Chemical Prices

LONDON.—Conditions on the industrial chemicals market have been reasonably active for the period, and inquiries for shipment have been fairly good. Delivery specifications to home consumers have covered good volumes but there is little inclination to enter into new contract business except on a short term basis. The supply position is fairly easy on all sections of the market although reports suggest that some items, such as barium chloride and hexamine, are none too plentiful for spot delivery. Prices are steady at recent levels and there has been no further change in the quotations for the non-ferrous metal compounds. Activity in the coal tar products market has been fairly steady with perhaps a little better inquiry for cresylic acid both on home and export account.

MANCHESTER. — Manchester chemical

traders report a continued steady movement of textile, bleaching and dyeing chemicals into consumption at Lancashire works, while users in the woollen and rayon industries are also absorbing reasonably good supplies. Taking the other leading outlets as a whole, a fair aggregate quantity of a wide range of chemicals is being taken up. Prices generally maintain a steady to firm front. In the fertiliser market the tendency is for buying operations, including forward business, to increase gradually. The leading light and heavy tar products are going steadily into consumption.

GLASGOW.—Prices have remained steady during the past week and the over-all position has been more or less on a par with the previous week's trading, with the demand from the textile trade remaining steady.

General Chemicals

- Acetic Acid.**—Per ton : 80% technical, 1 ton, £86. 80% pure, 10 tons, £92 ; commercial glacial 10 tons, £94 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.
- Acetic Anhydride.**—Ton lots d/d, £138 per ton.
- Acetone.**—Small lots : 5 gal. drums, £143 per ton ; 10 gal. drums, £125 per ton. In 40/50 gal. drums less than 1 ton, £105 per ton ; 1 to 9 tons, £105 per ton ; 10 to 49 tons, to £103 per ton ; 50 tons and over, £102 per ton.
- Alcohol BSS, Butyl.**—£161 per ton in 10-ton lots.
- Alcohol, Ethyl.**—300,000 gal. lots, d/d., 2s. 11d. per proof gallon ; 100,000 and less than 200,000 gal. lots, d/d, 3s. per proof gallon.
- Alum.**—Ground, about £23 per ton, f.o.r. MANCHESTER : Ground, £25.
- Aluminium Sulphate.**—Ex works, £14 15s. per ton d/d. MANCHESTER : £14 10s. to £17 15s.
- Ammonia, Anhydrous.**—1s. 9d. to 2s. 3d. per lb.
- Ammonium Bicarbonate.**—2 cwt. non-returnable drums ; 1 ton lots £58 per ton.
- Ammonium Chloride.** — Grey galvanising, £31 5s. per ton, in casks, ex wharf. Fine white 98%, £25 to £27 per ton. See also Salammoniac.
- Ammonium Nitrate.**—D/d, £18 to £20 per ton.
- Ammonium Persulphate.** — MANCHESTER : £6 5s. per cwt. d/d.
- Ammonium Phosphate.**—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.
- Antimony Sulphide.**—Golden, d/d in 5-cwt. lots as to grade, etc., 2s. 2d. to 2s. 8d. per lb. Crimson, 3s. 4½d. to 4s. 5¼d. per lb.
- Arsenic.**—Per ton, £59 5s. nominal, ex store.
- Barium Carbonate.**—Precip., d/d ; 2-ton lots, £35 5s. per ton, bag packing.
- Barium Chloride.**—£42 5s. per ton in 2-ton lots.
- Barium Sulphate (Dry Blanc Fixe).**—Precip., 4-ton lots, £38 per ton d/d ; 2-ton lots, £38 5s. per ton d/d.
- Bleaching Powder.**—£21 per ton in casks (1 ton lots).
- Borax.**—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s. ; in 1-cwt. bags; commercial, granular, £39 10s. ; crystal, £42 ; powder, £43 ; extra fine powder, £44 ; B.P., granular, £48 10s. ; crystal, £51 ; powder, £52 ; extra fine powder £53.

- Boric Acid.**—Per ton for ton lots in free 1-cwt. bags, carriage paid : Commercial, granular, £68 ; crystal, £76 ; powder, £73 10s. ; extra fine powder, £75 10s. ; B.P., granular, £81 ; crystal, £88 ; powder, £85 10s. ; extra fine powder, £87 10s.
- Butyl Acetate BSS.**—£173 per ton, in 20-ton lots.
- sec. - Butyl Alcohol.**—5 gal. drums £159 ; 40 gal. drums : less than 1 ton £124 per ton ; 1 to 10 tons £123 per ton ; 10 tons and over £122 per ton ; 100 tons and over £120 per ton.
- tert. - Butyl Alcohol.**—5 gal. drums £195 10s. per ton ; 40/45 gal. drums : less than 1 ton £175 10s. per ton ; 1 to 5 tons £174 10s. per ton ; 5 to 10 tons, £173 10s. ; 10 tons and over £172 10s.
- Calcium Chloride.**—70/72% solid £12 10s. per ton.
- Chlorine, Liquid.**—£32 per ton d/d in 16/17-cwt. drums (3-drum lots).
- Chromic Acid.**—2s. 0¼d. to 2s. 0¾d. per lb., less 2½%, d/d U.K.
- Citric Acid.**—1-cwt. lots, 205s. cwt. ; 5-cwt. lots, 200s. cwt.
- Cobalt Oxide.**—Black, delivered, 13s. per lb.
- Copper Carbonate.**—MANCHESTER : 2s. 3d. per lb.
- Copper Sulphate.**—£74 per ton f.o.b., less 2% in 2-cwt. bags.
- Cream of Tartar.**—100%, per cwt., about £10 2s.
- Diacetone Alcohol.**—Small lots : 5 gal. drums, £162 per ton ; 10 gal. drums, £172 per ton. In 40/45 gal. drums ; less than 1 ton, £142 per ton ; 1 to 9 tons, £141 per ton ; 10 to 50 tons, £140 per ton ; 50 to 100 tons, £139 per ton ; 100 tons and over, £138 per ton.
- Ethyl Acetate.**—10 tons lots, d/d, £135 per ton.
- Formaldehyde.**—£37 5s. per ton in casks, d/d.
- Formic Acid.**—85%, £82 10s. in 4-ton lots, carriage paid.
- Glycerine.**—Chemically pure, double distilled 1.260 S.G., £14 7s. 6d. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.
- Hydrochloric Acid.**—Spot, about 12s. per carboy d/d, according to purity, strength and locality.
- Hydrofluoric Acid.**—59/60%, about 1s. to 1s. 2d. per lb.
- Hydrogen Peroxide.**—27.5% wt. £124 10s. per ton. 35% wt. £153 per ton d/d. Carboys extra and returnable.
- Iodine.**—Resublimed B.P., 16s. 4d. per lb. in 28 lb. lots.
- Iodoform.**—25s. 10d. per lb. in 28 lb. lots.
- Lactic Acid.**—Pale tech., 44 per cent by weight £122 per ton ; dark tech., 44 per cent by weight £74 per ton ex works 1-ton lots ; dark chemical quality 44 per cent by weight £102 per ton, ex works ; usual container terms.
- Lead Acetate.**—White : About £136 per ton.
- Lead Nitrate.**—About £116 per ton.
- Lead, Red.**—Basis prices per ton. Genuine dry red lead, £124 ; orange lead, £136. Ground in oil : red, £150 10s. ; orange, £162 10s.
- Lead, White.**—Basis prices : Dry English, in 5-cwt. casks £142 per ton. Ground in oil : English, under 2 tons, £162 15s.
- Lime Acetate.**—Brown, ton lots, d/d, £40 per ton ; grey, 80-82%, ton lots, d/d, £45 per ton.
- Litharge.**—£124 per ton, in 5-ton lots.
- Magnesite.**—Calcined, in bags, ex works, £22 to £24.
- Magnesium Carbonate.**—Light, commercial, d/d, 2-ton lots, £84 10s. per ton, under 2 tons, £92 per ton.
- Magnesium Chloride.**—Solid (ex wharf), £16 per ton.
- Magnesium Oxide.**—Light, commercial, d/d, under 1-ton lots, £245 per ton.
- Magnesium Sulphate.**—£15 to £16 per ton.
- Mercuric Chloride.**—18s. 3d. per lb. in 5 cwt. lots ; smaller quantities dearer.
- Mercury Sulphide, Red.**—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.
- Methanol.**—Pure synthetic, d/d, £28 to £38 per ton.
- Methylated Spirit.**—Industrial 66° O.P. 100 gals., 5s. 4½d. per gal. ; pyridinised 64° O.P. 100 gal., 5s. 6½d. per gal.

- Methyl Ethyl Ketone.**—10-ton lots, £141 per ton del.
- Methyl isoButyl Ketone.**—10 tons and over £162 per ton.
- Nickel Sulphate.**—D/d, buyers U.K. £154 per ton. Nominal.
- Nitric Acid.**—£35 to £40 per ton, ex-works.
- Oxalic Acid.**—Home manufacture, in 5-cwt. casks, £139 per ton, carriage paid.
- Phosphoric Acid.**—Technical (S.G. 1.700) ton lots, carriage paid, £87 per ton; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.
- Potash, Caustic.**—Solid, £94 10s. per ton for 1-ton lots; Liquid, £37 15s.
- Potassium Bichromate.**—Crystals and granular, 11½d. per lb.; ground, 1s. 8d. per lb., standard quantities.
- Potassium Carbonate.**—Calcined, 96/98%, £59 10s. per ton for 1-ton lots, ex-store.
- Potassium Chloride.**—Industrial, 96%, 1-ton lots, £23 to £25 per ton.
- Potassium Iodide.**—B.P., 14s. 10d. per lb. in 28-lb. lots; 14s. 4d. in cwt. lots.
- Potassium Nitrate.**—Small granular crystals, 8s. per cwt. ex store, according to quantity.
- Potassium Permanganate.**—B.P., 1s. 9½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8½d. per lb.; technical, £8 11s. 6d. per cwt.; for 5 cwt. lots.
- isoPropyl Alcohol.**—Small lots; 5 gal. drums, £118 per ton; 10-gal. drums, £108 per ton; in 40-45 gal. drums; less than 1 ton, £83 per ton; 1 to 9 tons £81 per ton; 10 to 50 tons, £80 10s. per ton; 50 tons and over, £80 per ton.
- Sal ammoniac.**—Dog-tooth crystals, £70 per ton; medium, £67 10s. per ton; fine white crystals, £21 10s. to £22 10s. per ton, in casks.
- Salicylic Acid.**—MANCHESTER: Technical 2s. 7d. per lb. d/d.
- Soda Ash.**—58% ex-depot or d/d, London station, about £14 3s. per ton.
- Soda, Caustic.**—Solid 76/77%; spot, £25 to £27 per ton d/d. (4 ton lots).
- Sodium Acetate.**—£70 to £75 per ton d/d.
- Sodium Bicarbonate.**—Refined, spot, £13 10s. to £15 10s. per ton, in bags.
- Sodium Bichromate.**—Crystals, cake and powder, 9½d. per lb.; anhydrous, 11½d. per lb., net, d/d U.K. in 7-8 cwt. casks.
- Sodium Bisulphite.**—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.
- Sodium Carbonate Monohydrate.**—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.
- Sodium Chlorate.**—£75 15s. to £82 per ton.
- Sodium Cyanide.**—100% basis, 9½d. to 10½d. per lb.
- Sodium Fluoride.**—D/d, £4 10s. per cwt.
- Sodium Hyposulphite.**—Pea crystals £28 a ton; commercial, 1-ton lots, £26 per ton carriage paid.
- Sodium Iodide.**—B.P., 16s. 4d. per lb. in 28-lb. lots.
- Sodium Metaphosphate (Calgon).**—Flaked, loose in metal drums, £123 ton.
- Sodium Metasilicate.**—£22 15s. per ton, d/d U.K. in ton lots.
- Sodium Nitrate.**—Chilean Industrial, over 98% 6-ton lots, d/d station, £27 10s. per ton.
- Sodium Nitrite.**—£31 per ton (4-ton lots).
- Sodium Percarbonate.**—12½% available oxygen, £8 2s. 10½d. per cwt. in 1-cwt. drums.
- Sodium Phosphate.**—Per ton d/d for ton lots: Di-sodium, crystalline, £37 10s., anhydrous, £78 10s.; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.
- Sodium Prussiate.**—1s. to 1s. 1d. per lb. ex store.
- Sodium Silicate.**—£6 to £11 per ton.
- Sodium Sulphate (Glauber's Salt).**—£10 per ton d/d.
- Sodium Sulphate (Salt Cake).**—Unground, £6 per ton d/d station in bulk. MANCHESTER: £6 10s. per ton d/d station.
- Sodium Sulphide.**—Solid, 60/62%, spot, £31 per ton, d/d, in drums; broken, £32 per ton, d/d, in drums.
- Sodium Sulphite.**—Anhydrous, £59 per ton; pea crystals, £37 12s. 6d. per ton d/d station in kegs; commercial, £23 7s. 6d. per ton d/d station in bags.
- Sulphur.**—Per ton for 4 tons or more, ground, £22 16s. 6d. to £25 6s. according to fineness.

Tartaric Acid.—Per cwt. : 10 cwt. or more, £10 10s.

Titanium Oxide.—Standard grade comm., with rutile structure £143 per ton; standard grade comm., £130 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d : white seal, £89 10s. ; green seal, £88 10s. ; red seal, £87.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 3½d. to 3s. 1½d. per lb. Crimson, 3s. 4½d. to 4s. 5½d. per lb.

Carbon Bisulphide.—£60 to £65 per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—Ton lots, £74 10s. per ton.

India-rubber Substitutes.—White, 1s. 6¾d. to 1s. 10¼d. per lb. ; dark, 1s. 4½d. to 1s. 8d. per lb.

Lithopone.—30%, £50 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Sulphur Chloride.—British, £55 per ton.

Vegetable Lamp Black.—£64 8s. per ton in 2-ton lots.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £16 2s. 6d.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1 £27 9s.

'Nitro-Chalk.'—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots, d/d nearest station, July to September, £26 5s. per ton ; October to November, £26 7s. 6d. per ton.

Coal-Tar Products

Benzole.—Per gal., minimum of 200 gals., ex-works, 90's, 4s. 10¾d. ; pure, 5s. 2d. ; nitration grade, 3s. 3d.

Carbolic Acid.—Crystals, 1s. 4d. to 1s. 6¼d. per lb. Crude, 60's, 8s. MANCHESTER : Crystals, 1s. 4½d. to 1s. 6¼d. per lb., d/d crude, 8s. naked, at works.

Creosote.—Home trade, 1s. to 1s. 4d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 1s. to 1s. 8d. per gal.

Cresylic Acid.—Pale 99/99½%, 5s. 8d. per gal. ; 99.5/100%, 5s. 10d. American, duty free, for export, 5s. to 5s. 8d. naked at works.

Naphtha.—Solvent, 90/160°, 4s. 10d. per gal. for 1000-gal. lots ; heavy, 90/190°, 4s. 3½d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots.

Naphthalene.—Crude, 4-ton lots, in sellers' bags, £14 12s. to £22 per ton, according to m.p. ; hot pressed, £28 per ton in bulk ex-works ; purified crystals, £53 per ton d/d.

Pitch.—Medium, soft, home trade, 160s. per ton f.o.r. suppliers' works ; export trade, 230s. per ton f.o.b. suppliers port.

Pyridine.—90/160°, 32s. 6d. to 35s. per gal. MANCHESTER : 42s. 6d. to 45s. per gal.

Toluol.—Pure, 5s. 7d. ; 90's, 4s. 10d. per gal., d/d. MANCHESTER : Pure, 5s. 6d. per gal. naked.

Xylol.—For 1000-gal. lots, 5s. 8d. to 5s. 10d. per gal., according to grade, d/d.

Intermediates and Dyes (Prices Nominal)

m-Cresol 98/100%.—3s. 9d. per lb. d/d.

o-Cresol 30/31° C.—1s. 4d. per lb. d/d.

p-Cresol 34/35° C.—3s. 9d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—88/89°C., 1s. 11d. per lb.

Dinitrotoluene.—S.P. 15° C., 1s. 11½d. per lb. ; S.P. 26° C., 1s. 3d. per lb. S.P. 33°C., 1s. 1½d. per lb. ; S.P. 66/68°C., 1s. 9d. per lb.

p-Nitraniline.—4s. 5½d. per lb.

Nitrobenzene.—Spot, 9¼d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—2s. per lb.

o-Toluidine.—1s. 7d. per lb., in 8/10-cwt. drums, drums extra.

p-Toluidine.—5s. 6d. per lb., in casks.

Dimethylaniline.—3s. 1d. per lb., packed in drums, carriage paid.

Chemical & Allied Stocks & Shares

ALTHOUGH the impending United Steel issue tended to monopolise attention, stock markets have remained active, and, particularly in the industrial sections, there have been numerous individual features of strength, helped by a number of dividend increases. Chemical and kindred shares participated in the general trend because sentiment was assisted by company statements indicating that the better trend in some sections of the industry is continuing. I.C.I. were strong, and this week touched 50s. 9d.—highest so far this year—on share bonus rumours, but they were denied by the company. I.C.I. have already announced raising of their interim dividend from 5 per cent to 6 per cent, and the market is assuming that, if the better trend continues in the industry and export trade does not slacken off, a higher total than last year's 13 per cent dividend is a reasonable possibility. Laporte 5s. shares strengthened to 13s. in response to the half-yearly progress report and the higher interim, though the directors warned that the latter is merely to bring it more into line with the final payment and should not be taken as indicating a higher total. Reichhold Chemical 5s. shares at 7s. 1½d. remained under the influence of their interim dividend. Monsanto 5s. shares at 22s. 6d. have not held best levels, while British Glues 4s. shares at 10s. 6d. eased after an earlier good rise. Fisons, however, were strong at 39s. 9d. in response to higher dividend estimates. Borax Consolidated deferred at 35s. 1½d. were steady. Albright & Wilson 5s. shares were 17s. 4½d. Coalite & Chemical 2s. shares moved up to almost 2s. 7½d., while British Chrome Chemicals 5s. shares were 16s. 6d., Brotherton 10s. shares 23s. 9d. and Greeff-Chemicals Holdings 5s. shares 15s. 4d., Hardman & Holden 5s. shares were 9s. 4½d., and William Blythe 3s. shares 6s. 4d. Yorkshire Dyeware & Chemical 5s. shares have moved up to 7s. 9d. Calor Gas shares have been an active market up to 31s. 6d. Pest Control 5s. shares changed hands around 4s. 9d. W. J. Bush were 48s. 6d., Johnson Matthey changed hands up to 78s. 9d., and Burt Boulton & Haywood were 27s. 6d.

Glaxo were 44s. 7½d. following the financial results. The 4s. units of the Distillers Co. strengthened to 17s. 6d., while United

Molasses at 32s. 3d. were also higher on balance, as were Turner & Newall at 58s. 9d., while Unilever were 53s. 9d. on market talk of a possible increase in the interim dividend. Courtaulds at 46s. 7½d. eased following the unchanged interim dividend. Calico Printers were active, but at 50s. 9d. have not held best levels, the chairman's statement that large scale production from the big I.C.I. Terylene plant will have to be awaited before Calicos benefit materially from royalties on this textile fibre having affected sentiment to some extent. Boots Drug 5s. units were 23s. Dunlops strengthened to 53s. 3d. partly on talk that plans may be made for the building of a synthetic rubber plant in Britain. There has been a better trend in shares of plastics companies. British Xylonite were 31s., Bakelite 10s. shares 24s. 6d., Kleemann 1s. shares 10s. 3d. and British Industrial Plastics 2s. shares have moved up to 5s. Paint shares, too, were better, notably Jenson & Nicholson 5s. shares which rose to 12s. 3d., while Lewis Berger 4s. units were 9s. 6d., and British Paints 4s. units moved up to 14s. 3d. Guest Keen have been active around 50s. 6d. despite market talk that more capital may have to be raised if the company decides to reacquire its former steel interests. Elsewhere, Powell Duffryn at 26s. 1½d. have strengthened following the chairman's reference to the amount of additional compensation expected for nationalised coal assets and his confidence in the group's new interests. Oils were active again though best levels were not held. Anglo-Iranian were £7½. The company's interim dividend will have been announced by the time these notes are in print. The market has been talking of the possibility of a share bonus from Anglo-Iranian sooner or later.

Reichhold Chemicals Ltd.

We much regret that in a reference to the above-named company in our issue of 17 October (p. 820) the name was inadvertently given as Reichhold Chemicals Inc. The registered office of the company is Beckacite House, Speke, Liverpool, 19. Mr. G. S. Bache is the joint managing director.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Increases of Capital

The following increases of capital have been announced:—CUPRINOL LIMITED, from £20,000 to £40,000; GABAIL LIMITED, from £500 to £5,000; W. H. GREEN (CHEMISTS), LIMITED, from £2,500 to £20,000; THOMAS MCLEAN & SONS, LIMITED., from £100 to £3,000; OXY-CATALYST COMPANY, LTD., from £100 to £1,000; ZEMS LIMITED, from £1,500 to £4,500.

Changes of Name

The following changes of name have been announced:—Sparth Soap Co., Ltd., to Berend Chemicals, Ltd., on 15 October, 1953. Lion Zipp Fastener Co., Ltd., to Lion Products (Chemicals), Ltd., on 2 October.

Company News

Barclay & Son Ltd.

Net loss of £14,430, subject to tax of £106, is reported by Barclay & Son Ltd., manufacturing chemists, for the 14 months to 28 February last. Credit forward, after transfer of £14,997 from general reserve, is £2,388. The directors recommend a capital distribution of 5 per cent, not subject to tax.

British Alkaloids Ltd.

For the six months to 30 September last, the sales of British Alkaloids Limited, state the directors, have been maintained in comparison with those for the corresponding period of last year. The interim dividend of 12½ per cent is the same as for last year, when the final dividend was 17½ per cent.

Laporte Industries Ltd.

An increase in the interim dividend from 2½ per cent on the £1,479,950 ordinary stock to 5 per cent on the £1,486,950 ordinary stock is being paid by Laporte Industries Limited (formerly Laporte Chemicals Limited) in respect of the year ending 31 March next. The chairman, Mr. L. P. O'Brien, announces that the all-round improvement referred to last June has been maintained. The improvement in the

interim dividend, however, is based on the directors' desire that there should be a smaller difference between the amount of the interim and final dividends and it should not be taken as an indication that the total dividend for this year may be increased beyond that paid for the two previous years.'

Major & Co. Ltd.

The consolidated net profit of Major & Company, Ltd., chemical manufacturers, tar distillers, etc., for the year ended 31 March last, was £33,658, after tax and including £10,000 excess provision for tax in previous years, etc. The dividend is the same as last year at 12 per cent.

Mathieson Chemical Corporation

Earnings of Mathieson Chemical Corporation for the nine months to 30 September, 1953, were \$13,806,153. These compare with earnings of \$10,915,458 for Mathieson & Squibb combined in 1952. The merger with E. R. Squibb & Sons took place on 1 October, 1952. Sales for the nine-month period and third quarter respectively were \$184,074,445 and \$60,385,994, compared with \$162,134,699 and \$54,536,509 for both companies prior to the merger in 1952.

Powell Duffryn Ltd.

Speaking at the annual meeting of Powell Duffryn Limited last week, the chairman, Sir Herbert Merrett, stated that the total compensation to be received by the company for assets vested in the National Coal Board would certainly be £15,000,000, of which about £12,900,000 had been received on account. At least 50 of the company's claims had been settled. The board had no intention of returning any capital to the stockholders as it believed that the money could be employed in the business. Referring to coal, Sir Herbert said:—'. . . we are back to a buyer's market. We are, therefore, compelled to live up to specifications which are somewhat exacting, and it is fortunate that if developments are quickly centred upon those valuable reserves of saleable coal for export, we shall still be able to hold many of the markets where high prices can be obtained, even though we may find it necessary to import domestic and industrial qualities which are in plentiful supply in Europe without having to expend dollars for American coal.'



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Next Week's Events

MONDAY 2 NOVEMBER

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Joint meeting, London Section and Food Group. A. G. Ward: 'Recent Advances in Gelatin Research.'

TUESDAY 3 NOVEMBER

Institution of Chemical Engineers

London: Burlington House, Piccadilly, W.1, 5.30 p.m. S. J. Green: 'Agitation in Process Design.'

The Chemical Society

Leeds: University, 6.30 p.m. R. Heslop: 'Pernitrous Acid & its Nitrating and Hydroxylating Properties.'

Institute of Metals

Oxford: Cadena Cafe, Cornmarket Street, 7 p.m. D. A. Oliver: 'Metal Economics.'
Swansea: University College, Singleton Park, 6.45 p.m. D. Williams: 'The Search for Metalliferous Mineral Deposits.'

WEDNESDAY 4 NOVEMBER

Society of Public Analysts and Other Analytical Chemists

London: Burlington House, Piccadilly, W.1, 7 p.m. Papers on 'The Determination of Niobium in Minerals & Mineral Dressing Products.'

Incorporated Plant Engineers

Southampton: Polygon Hotel, 7.30 p.m. R. Hughes: 'Employers' Liability.'

Purchasing Officers' Association

Sheffield: Grand Hotel, 7 p.m. L. Yarker: 'Plastics.'

THURSDAY 5 NOVEMBER

Royal Institute of Chemistry

West Ham: Municipal College, Romford Road, E.18, 7 p.m. London Section meeting with College Chemical Society. R. C. Tincknell: 'Synthetic Soil Conditioners.'

The Chemical Society

London: Imperial College of Science & Technology, S.W.7, 7.30 p.m. Tilden Lecture. Dr. A. W. Johnson: 'Aromatic Character in Seven-membered Ring Systems.'

Bristol: The University, 7 p.m. Joint meeting with RIC and SCI. Sir William Ogg: 'Some Aspects of the Work at Rothamsted.'

Institute of Fuel

London: Institution of Mechanical Engi-

neers, Storey's Gate, S.W.1, 5.30 p.m. J. Couture: 'French Power Resources & Their Utilisation.'

Institute of Metals

London: Royal School of Mines, South Kensington, 7 p.m. Professor F. A. Forward: 'The Preparation & Properties of High Purity Nickel Powder.'

Birmingham: James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Discussion: 'Metals or Plastics.'

Incorporated Plant Engineers

Peterborough: Gas Board Demonstration Theatre, Church Street. 'The Heat Pump.'

FRIDAY 6 NOVEMBER

The Royal Institution

London: 21 Albemarle Street, W.1, 9 p.m. J. H. Schulman: 'Molecular Interactions at the Solid/Liquid Interface, with Special Reference to Flotation & Solid Stabilised Emulsions.'

Institute of Physics

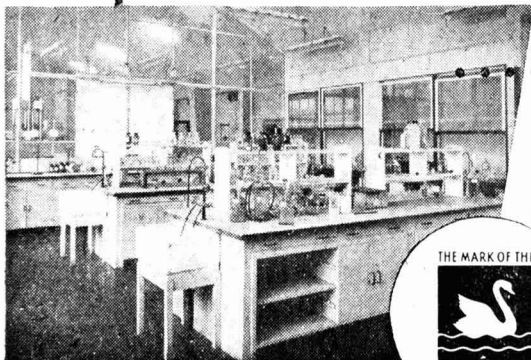
London: 47 Belgrave Square, S.W.1, 5.30 p.m. Professor R. E. Peierls: 'Recent Progress in Our Knowledge of Fundamental Particles.'

Society of Chemical Industry

Glasgow: Royal Technical College, 7.15 p.m. C. L. Hewett: 'Some Problems in the Manufacture of Steroid Hormones.'

Pollution by Oil

THE Minister of Transport and Civil Aviation was asked in the House of Commons last week by Brigadier F. Medlicott what chemical research was being undertaken to discover means of dispersing oily waste, since the greatest single factor in the problem of the pollution of the sea by oil is the persistence and indestructibility of the oil. Mr. A. T. Lennox-Boyd stated in a written reply: 'The committee on the prevention of pollution of the sea by oil recommended that the desirability of initiating such research should be considered. This will be followed up, but I am advised that any research into the chemical treatment of oil must take time to produce results and that an early solution of the problem of oil pollution must be sought in other directions. These I have under urgent consideration.'



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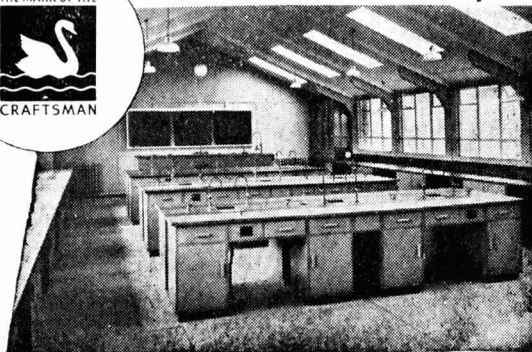


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ECONOMIC BOILERS—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p. Twenty others, all sizes. Whessoe Open Top Riveted Steel **MIXING TANK**, 13 ft. diam., by 15 ft. deep, 9/16 in. plate.

NEW GALVANISED PIPING. Immediate delivery. Johnson Filter **PRESSES**, 25 in., 18 Frame, practically new.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS**. **ONE** Stainless **CONICAL HOPPER**, 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.

TWO Broadbent **WATER-DRIVEN CENTRIFUGES**, 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.

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Six Aluminium **CONDENSERS**, 14 ft. long by 2 ft. 6 in. diam. 386 Tubes, 7/8 in. o.d.

FORTY Riveted **RECEIVERS**, 8 ft. 6 in. long, 5 ft. 9 in. diam., 76 lb. w.p.

CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in. **NEW VALVES** in Stainless, Gunmetal, Enamel Lined. Free Catalogue. "Watkins Machinery Record," available

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FOR SALE. JOHNSON PLATE & FRAME FILTER PRESS, HARD RUBBER COVERED THROUGHOUT. 17 in. sq. cakes, 14 frames; side feed and side discharge; hand screw closing. Price £375. **BOX No. C.A. 3273, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

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8 brand new jacketed STERILIZING VESSELS, 7 ft. long by 3 ft. diam., complete with fittings.

3 excellent VACUUM OVENS, complete with vacuum pumps, trays and belongings.

2—18 in. KEK PLATE MILLS, complete with feeders delivery bins, motors and entablature.

9 Worssam ROTARY PRESSES.

POWDER DRESSING OR SIFTING MACHINES, various sizes.

1 Johnson FILTER PRESS, 36 in. square, plate and frame type, double inlet and enclosed delivery ports.

1 Johnson FILTER PRESS, 47 plates, 32 in. square, centre feed, bottom corner open delivery.

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5 sets of A.A. CRUSHING ROLLS for linseed, cottonseed, etc., 48 in. long, belt driven, with feed hopper, side frames, baseplate and striking gear.

Bennett Copper-built EVAPORATOR, 4 ft. diam. by 4 ft. 6 in. high, steam jacketed bottom, mounted on legs, with swan-neck vapour pipe and separate vertical belt driven vacuum pump.

"U" shaped horizontal jacketed MIXER, 7 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven.

3-5 roll REFINERS, fitted chilled iron, water-cooled rolls, 40 in. long, 16 in. diam. belt and gear driven, with clutch drive suitable for motor, by Baker Perkins, Ltd.

1 No. 1A water-cooled CIRCULATOR MILL.

6—Excellent Nickel-lined Jacketed TILTING PANS, 60 gallons capacity and for 40 lb. working pressure.

1—MICRO-PULVERISER, size 2, complete with motors and all belongings.

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WERNER TYPE MIXER having G.M. trough 13 in. by 12 in. by 12 in. and double "Z" G.M. agitators belt driven through spur gearing from f. and l. pulleys. Hand tilting.

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STEAM JACKETED COPPER BOILING PANS, 30 galls. capacity. Arranged for hand tilting. Jacket working pressure 40 lb. p.s.i.

STEAM JACKETED COPPER BOILING and EVAPORATING PANS, 50 and 100 galls. capacity. Open top. Jacket working pressure 40 lb. per sq. in.

KESTNER HORIZONTAL TUBULAR EVAPORATOR, having six turns 1½ in. bore copper tube, complete with copper reception pot.

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STEAM JACKETED M.S. VACUUM DRYING OVEN, 3 ft. I.D. by 7 ft. long internally fitted 5-bank steam heating coil supporting 15 aluminium trays in five tiers of three. Rear end dished; domed door secured by eight swivel clamps. Jacket and coil working pressure 20 lb. per sq. in.

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PASCALL PIN DISC MILL, Type No. 1, motorised 400/3/50. Conical feed hopper approx. 24 in. diam. Permanent magnet of chute type. Discharge chamber enamel lined, with bagging outlet 5½ in. diam.

No. 3 **KEK MILL**, comprising M.S. galvanised bin 48 in. diam. by 29 in. deep, tapering to two 8 in. diam. outlets. Grinding chamber 18 in. diam. Underdriven through enclosed gearing with bare shaft extension. Suitable for grinding fibrous materials.

Unused Vertical **MIXER** by Brierley, Collier, with stainless steel lined pan 18 in. diam. by 10 in. deep, jacketed 15 lb. w.p., with spiral-type agitator. Fast and loose pulley drive.

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Two **VERTICAL MIXERS**, 3 ft. 6 in. diam. by 2 ft. 6 in. deep, of ⅜ in. mild steel plate. Twin underdriven scraper agitators. Hinged cover with 12 in. diam. feed. Bottom side 5 in. diam. outlet. Motorised 400/3/50.

Three Peerless **MIXERS**, 80-qt. capacity, fitted integral motor, 400/3/50, with various whisks and beaters. M.S. Lead-lined **MIXER**, 2 ft. 3 in. i.d. by 3 ft. deep, with 12 in. cone bottom, 2 in. flanged bottom outlet. Vessel totally enclosed, lead-covered paddle type agitator. Motorised 400/3/50.

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ONE—800 gallon **DITTO**.

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IMMEDIATE DELIVERY

25 Tons—8'×4', 12'×3'×⁵/₁₆"

25 Tons—8'×4', 6'×3'×³/₄"

20 Tons—5'×5', 6'×3'×⁷/₈"

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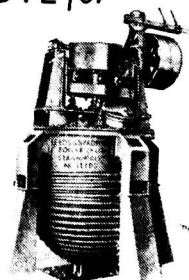
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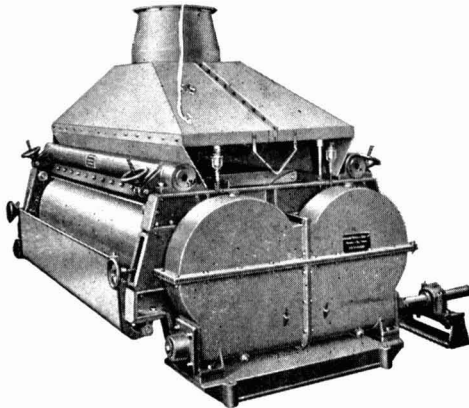
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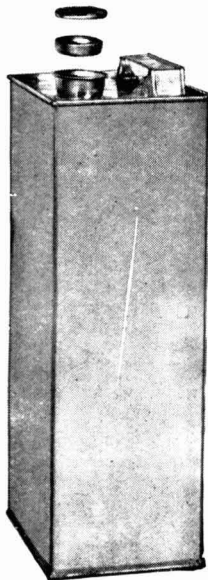
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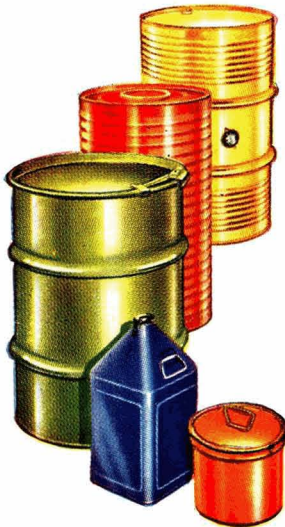
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