

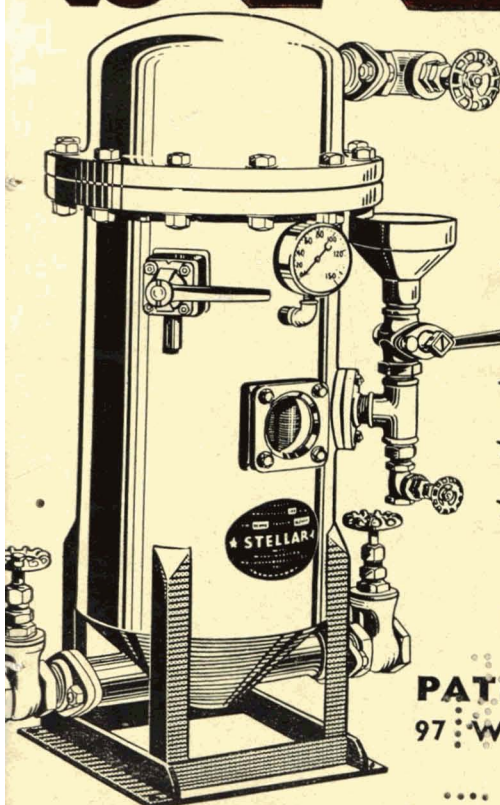
THE Chemical Age

VOL. LXXIV

9 JUNE 1956

No. 1926

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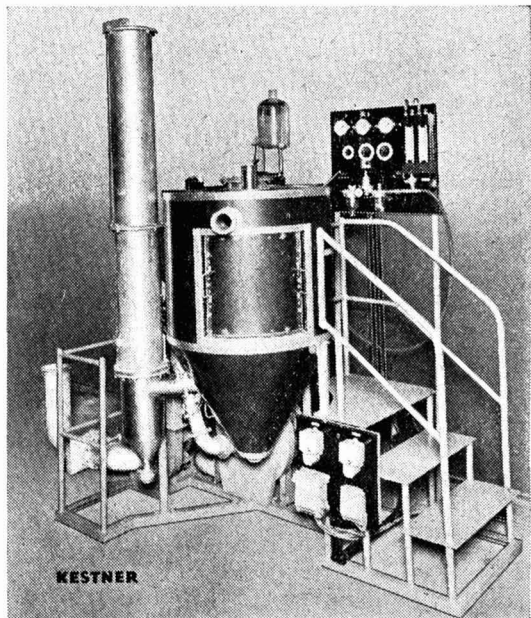
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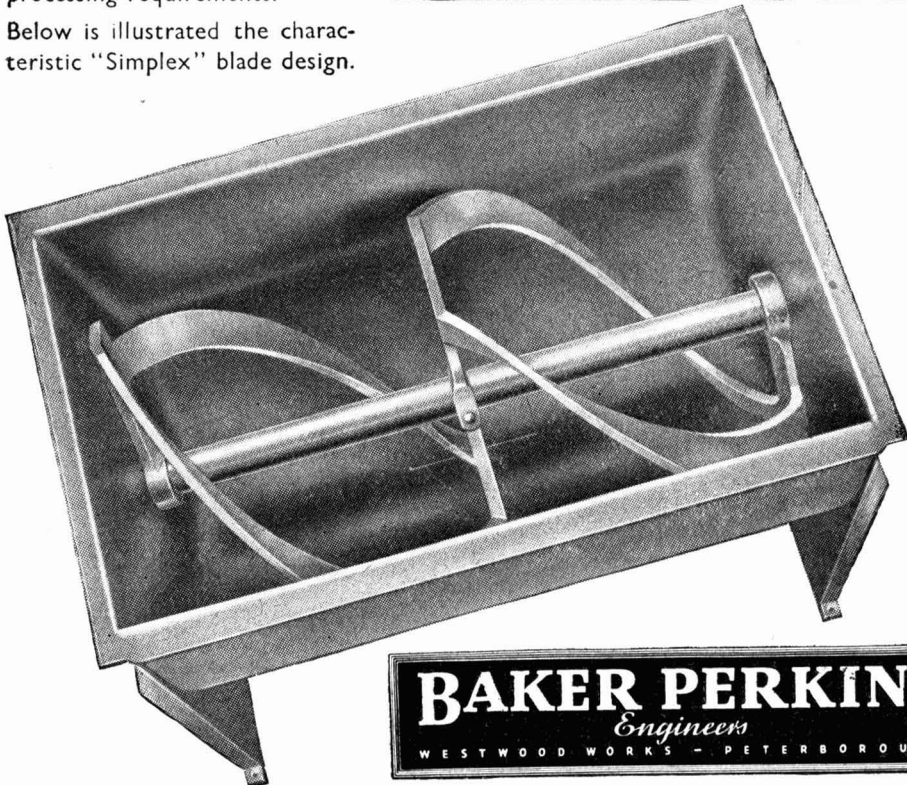
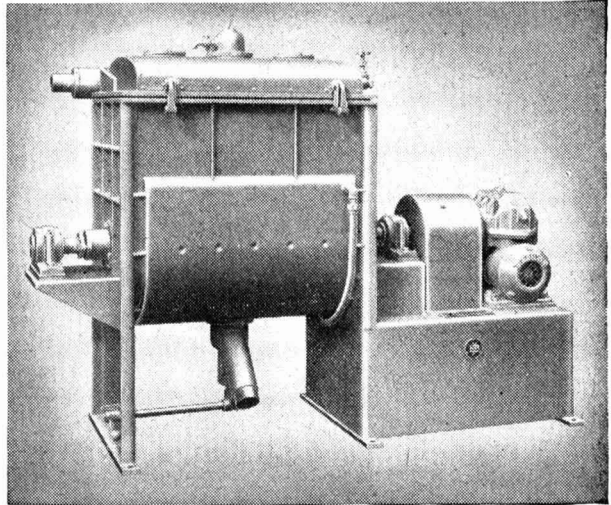
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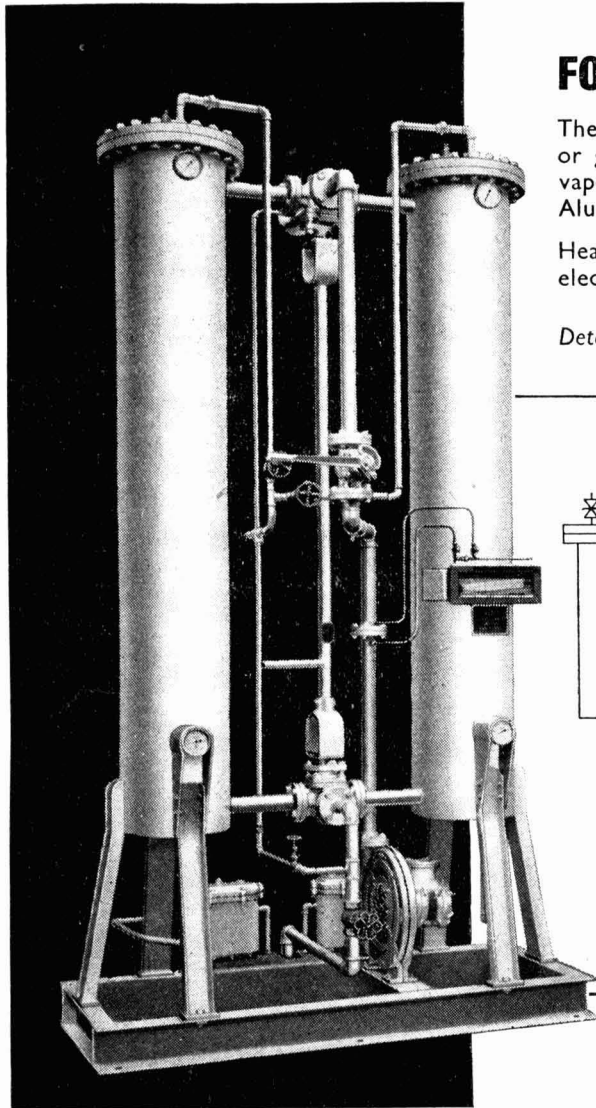
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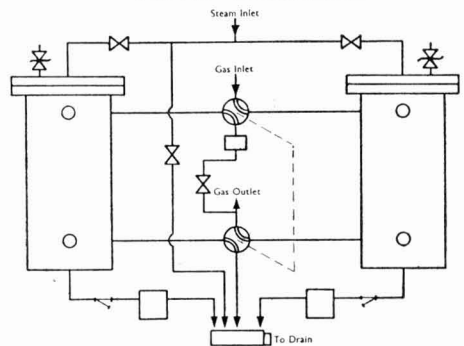
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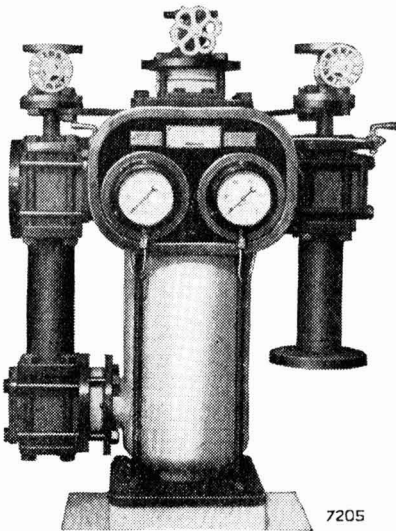


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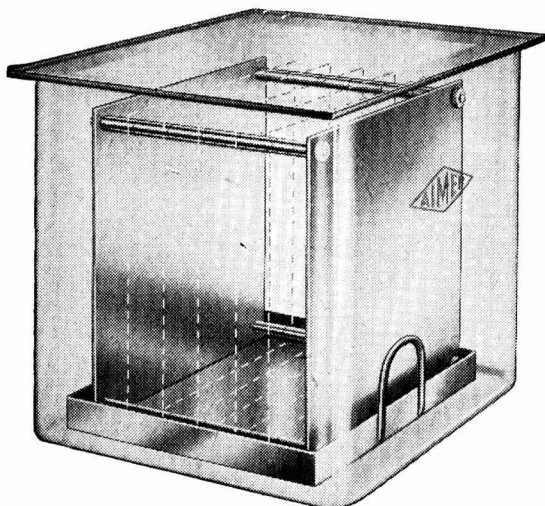
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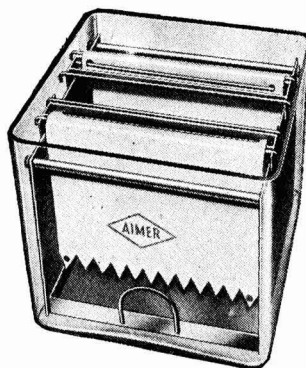
See CHEM. & IND., February 27th, 1954. Page 243



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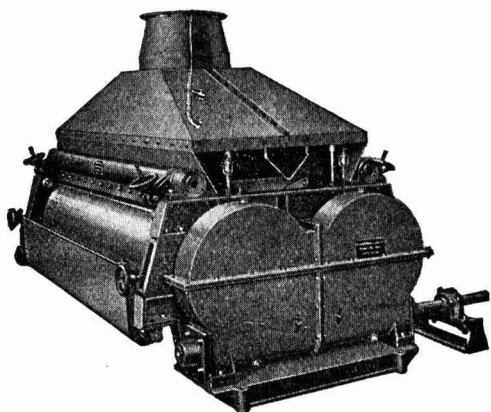
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Collective Research

THERE may be little that is new to say about the jointly funded State-and-Industry research associations, but a recently published booklet, prepared by DSIR and the Central Office of Information (*Combining for Research*, HMSO, 1956), is so attractive that the theme is given fresh life. The publication, aimed at a general and non-technical readership, is an encouraging sample of the new public-relations-minded outlook of the DSIR. At first glance it had all the appearance of a US Government public relations booklet; official publications here seldom give such an impression, even fleetingly. The text is well presented, photographic illustrations are numerous, the treatment and sequence are clear without condescending oversimplicity.

There are now over 40 research associations with a total staff of about 4,500, of which almost a third—1,400—are graduates or qualified personnel of equivalent standard. Associations may have only a few supporting member-firms—as few as 20—or there may be many more, even more than a 1,000. The total individual-firm membership of all the associations is given as 15,000. On the seventh page of the new booklet a useful diagram gives the 1954 incomes of each association, with circles in black for each £10,000 of privately subscribed income and similar circles in red for each £10,000 of grant income. The economic growth pattern shown is certainly a tribute to DSIR. The proportions of 'private black' and 'public red' vary, and they vary according to need. Associa-

tions that have expanded on a large scale have more 'black' income than 'red'; for smaller associations, the proportion of 'red' income is higher. Thus, £440,000 of the income supporting the British Iron and Steel Research Association comes from industry, with a little over £70,000 by Government grant. The British Jute Trade Research Association, with an annual (1954) income of just under £40,000 is almost equally supported by member firms and Government grant.

Size of research effort may not, in all cases, be the measure of need, but it is a rough measure; for if a research association starts as, or soon becomes, a large organization, the amount of investigation required for the industry concerned must itself be large. The need for such an effort by an industry must be more obvious than the need for a smaller-scale effort; and from this it follows that the need for *£ s d* incentive in founding and expanding the association should be smaller. In effect, then, naturally big associations have had less grant-aid (proportionately) than naturally small ones. It is easy to say that this is as it should be, but only a little reflection is required to realise how unusual is such sensible flexibility in any Government Department's approach to allocation. Treating all applicants alike is a *sine qua non* of Whitehall administrative principle; that this has been 'bent' for the purposes of varying incentive with the need for it is both remarkable and valiant. Had this not been done, the total public cost of our 41 associations would today be con-

siderably higher, or else there would be considerably less than 40 of them.

It should be said that this claim to have handled public money so effectively is not made in the booklet—it is simply deducible from the well-presented information. What is officially said is modest enough: 'The financial terms consequently vary considerably from one RA to another as their circumstances differ widely.' In 1954 the total income of associations was £4,700,000, of which £1,300,000 came from grants. The grant-derived proportion—28 per cent—is another measure of DSIR efficiency, for in 1946 the figure was approximately 33 per cent on an aggregate annual figure of about £1,550,000. Thus, in less than 10 years a trebled budget—probably representing a doubled effort after allowing for rises in costs—has involved little more than a doubled contribution from public money.

The booklet contains a broad account of research association contributions of a practical and directly applicable kind. Possibly the cited examples are hand-picked as success stories; however there will be little quibbling over the claims made for the financial savings to British industry through applying RA results. Not all the advances can be measured by reductions in production costs; some investigations have shown how less scarce materials may be used in the traditional place of supply-difficult materials, e.g., the new plating methods worked out by the Non-Ferrous Metals Research Association to ease the nickel shortage. The section dealing with basic or fundamental research will be interesting to readers of this paper, not so much for any greater attention to detail, but because research association attention to this field is not as well known.

'No scientific work can progress with-

out probing into basic physical, chemical or biological behaviour . . . it is indeed from these deeper sources that all technical activities are fertilized and nourished. . . . The most far-reaching developments stem from such basic research, and this can be said without in any way detracting from the achievements of the inventor and the practical man.' That as much as this—and indeed more—is so firmly stated in a booklet of generalized purpose is heartening. A frequent method for research associations to adopt in getting basic investigations carried out is to co-operate with universities or colleges. A worker may be seconded, fellowships and bursaries may be endowed, or direct payments for research at these more academic centres may be made. In one recent year research associations provided £75,000 for work of this nature. Set against the current background of research in general, this is commendable enough; but, if fundamental research was being adequately carried out in the world, the proportion of £75,000 out of £4,700,000—1.6 per cent—would be open to attack. As and when the new plan for technical colleges is turned into reality, it should be much easier for research associations to delegate fundamental work, and by 1966 they could be devoting 10 per cent of their income to basic research.

It is to be hoped that this excellent booklet will have a wide distribution in British industry itself. For an important fact is left out of it—not as an omission by error, but as a proper omission by context. However, it is an omission many industrialist readers will notice quickly enough. There still remain important sectors of British industry which have *not* formed research associations. Yet success at a low cost is the general record of those which have been formed.

Notes & Comments

No Daggers Please

AN American scientist pleaded recently for the abandonment of the dagger sign in scientific papers. Its use to denote a footnote in a recent American journal led to a letter of condolence on the sudden death of the scientist after whose name the dagger appeared. The scientist who was still vigorously alive could well reply that the deduction was a considerable exaggeration. When we first read this we felt that the matter itself had been exaggerated, and that the use of the dagger as a second sign to the asterisk in making two foot-note references on the same page was being trivially attacked. However, consulting the authoritative *Authors' and Printers' Dictionary* we found that † does also mean 'dead' when placed against a name. In England confusion is unlikely for it should be placed before the name to signify death; in Germany the necrological position is after the name, a position much more likely to lead to confusion. But we think a better plea would remove all danger of misinterpretation — let scientific literature abandon the old and untidy system of footnotes. Occasionally we are obliged to adopt the footnote method to make a reference that would otherwise encumber the normal text, but this is done for items that customarily do not carry a final set of literature references. All authentic scientific papers should have their final reference list and this also is the place for footnote matter. The straightforward numerical system for tying reference items with appropriate parts of the text is entirely adequate.

Iron Curtain Publicity

THE iron curtain may be coming somewhat less ferrous nowadays but the idea in most minds this side of it is that the state control and centralization of peoples' republic's industry must bring drab patterns of salesmanship. A lavishly produced bulletin, *Rumanian Foreign Trade*, edited by the Chamber of Commerce of the Rumanian People's Republic, speedily disposes of any such

ideas. That it is to be a regularly issued publication seems clear from its description as 'No. 1, 1956'. Chemical output has quite a sizeable share of attention. The high grain output of Rumania has enabled furfural production to be expansively developed—'Bidistilled Furfural' (*chemically pure*) is offered by the 'Chimimport' foreign trade company. High purity carbon electrode paste made from coal and oil materials is offered for carbide and ferro-alloy processes, in specific grades suitable for each purpose. However, greater attention at present is paid to heavy engineering products, from new types of blast furnaces to locomotives and farm tractors. This would seem to reflect the 1951-55 Five-Year Plan, and even the new second Plan for 1956-60, both concentrate upon heavy industry requirements. The latter programme aims at an 80-85 per cent increase in power output, a 28 per cent increase in crude oil production; and huge jumps in the outputs of methane (2.6 times), metallurgical coke (5 times), pig-iron and steel (twice), chlorine (4 to 5 times), chemical fertilizers (4 times) etc. Any expectation Rumania has of fulfilling these ambitious targets will depend upon two-way trading. This seems to be appreciated by the following sentence: 'In the future Rumania will play an ever more active part in the development of international exchanges as a means of strengthening co-operation among nations'.

Italian Centenary

DURING this week the centenary of Amedeo Avogadro's death (5 June) has been commemorated in Rome by the Accademia Nazionale dei XL, of which Avogadro was a member. Avogadro is of course, principally remembered for the hypothesis he put forward in 1811 when he was 35. But for this contribution, Dalton's atomic theory might well have had to be rediscovered much later by somebody else; even so, it was some 40 to 60 years before Avogadro's hypothesis was generally accepted by 19th century chemists, and it is doubtful whether he died with any realization that

his name would become a school text-book word. The chemists of Avogadro's age distrusted theories. Avogadro's suggestion that atoms in gases could form pairs as molecules was supported in vain by Dumas in the 1830s; and it was not until a chemists' conference took place at Karlsruhe in 1860 that fresh support made itself felt. Then a pamphlet written by another Italian, Cannizzaro, pointed out that only the acceptance of Avogadro's theory could reconcile the contradictions of atomic theory. Even this strong effort required the further support of Lothar Meyer who adopted the theory in writing a new treatise on chemistry. Today schoolboys probably have more difficulty in spelling

Avogadro's name, or remembering it, than in accepting his ideas. As one famous text-book of this century puts it, 'Avogadro's hypothesis has proved to be one of the most suggestive and fruitful hypotheses in the development of chemistry.' Perhaps the most brilliantly foreseeing part of the hypothesis was that Avogadro, in his original statement of it, explicitly guarded against the assumption that atoms in gases must always associate in pairs; he suggested that more than two atoms could make a gaseous molecule, although all the experimental contradictions of his own time could be explained by the single idea of the pair of atoms.



The Queen pauses to look at a dress made of 100 per cent Terylene during a visit to the ICI works at Wilton, near Middlesbrough, on Monday afternoon (4 June). Accompanied by the Duke of Edinburgh, she drove round the site which now has 15 plants in operation and 6,000 workers engaged in production. The Queen and the Duke were received by the Lord Lieutenant of the North Riding (Col. Sir William A. Worsley), who presented to them civic representatives from Middlesbrough. Sir Alexander Fleck, chairman of ICI Ltd., and other members of the company's staff were also presented. After touring the Terylene plant they visited a specially staged exhibition of materials and fabrics made from Terylene

Jet Fuels Laboratory

THE Texas Company announced on 28 May the opening of the nation's largest privately financed jet fuels laboratory at its principal research centre at Beacon, NY. Frederic H. Holmes, vice-president in charge of the company's research and technical department, said the new quarter-million-dollar installation would enable Texaco to continue to expand its research in the growing field of jet fuels.

'The Texas Company pioneered in jet fuels research more than a decade ago,' Mr. Holmes pointed out. 'Our early work helped formulate the first military jet fuels in the years following World War II.'

The new laboratory, which took a year to complete, is believed to be the first company-financed installation in the petroleum industry capable of testing jet fuels in full-scale combustors. Company officials point out that this 'full-scale' approach permits highly accurate reproduction of actual operating conditions.

Copper in March 1956

The production of recoverable copper at domestic mines established a new monthly record of 98,045 tons and refined copper prices reached new peaks in March, according to the Bureau of Mines, United States Department of the Interior. Output of smelters and refineries and consumption of refined copper also showed notable gains over the preceding month.

SASOL Extends Petrol Marketing Wax Production to be Increased

SASOL, the South African oil from coal plant, has extended its marketing of petrol to Vredefort, Heilbron, Vanderbijl Park and Viljoensdrift. With the nine pumps now at Sasolburg and the seven at Parys, Sasol has now raised the total number in use to 34.

Announcing the extension of its marketing areas, the chairman of Sasol, Dr. F. J. du Toit, said that the policy of Sasol was to assess results from one marketing area before rushing to the next. 'Results at Parys exceeded all our expectations. We find that we are supplying just under half the sales of petrol there'.

The chairman added that about half the country's requirements of ammonium sulphate were being produced at Sasolburg, one fifth of its creosote for wood preservation, and 10,000,000 cu. ft. of liquid oxygen a month. Crude phenols—the plastics raw material—were a new South African product. 'A few months ago Sasol began supplying wax to South African polish manufacturers and solvents to the paint industry. Formerly wax was imported.

22,000 Gallons Sold

Since January, 22,000 gallons of liquefied petroleum gas for industry had been sold to distributors. This was half the country's annual imports before Sasol came into the field.

At the present rate of production, chemicals produced at the oil-from-coal plant are saving the Union more than £1,000,000 a year of foreign exchange. When the plant is in full operation, total production of chemicals will be valued at £4,000,000 of foreign exchange a year. A large part of this sum will be earned from exports.

More than £750,000 worth of one product—a special type of wax—will be sold abroad, mostly to the US. Sasol's ultimate production of this wax, which has a high melting point, will, it is claimed, be more than 10 times greater than the present total world output. This Fischer-Tropsch wax has aroused considerable world interest because of its qualities for impregnating

paper cartons for hot drinks, milk and other liquids which might acquire a 'taste'.

By the end of April, 21,000 tons of ammonium sulphate—more than twice South Africa's annual production before the advent of Sasol—had been supplied to the fertilizer industry.

The Case of Mr. Lang

A NUMBER of questions have been tabled in the House of Commons, and some were due to be asked on Thursday, about the case of Mr. J. H. A. Lang, assistant solicitor of ICI Ltd, whose dismissal is pending because, according to the company, the Government have 'declined to give him an official security clearance in respect of certain matters in which the company is interested'.

Mr. Lang is reported to have said that he had a security examination in 1951, 'the result was adverse and entirely in connection with my wife's former affiliation to the Communist party'. He added that last January he was told, in effect, by one of the deputy chairmen of ICI that the Government were putting 'extreme pressure' on the company and threatening to withdraw all contracts unless he (Mr. Lang) was prevented from having access to all secret information.

A spokesman for ICI Ltd, told THE CHEMICAL AGE that Mr. Lang was offered a chance of resigning, but refused. On Tuesday evening (5 June) Mr. Lang went to the House of Commons to see MP's of all parties and present to them details of his case.

EDITORIAL CHANGES

Mr. E. Arnold Running, editor of 'The Chemical Age' since December 1950, resigned at the end of last month to return to Canada. He has been succeeded by Geoffrey F. D. Pratt, who joined the staff of Benn Brothers Ltd., proprietors of 'The Chemical Age,' in 1948. Mr. Pratt has been associated with several papers in the Benn Group, latterly as editor of 'Fire Protection Review' and associated publications.

Whitening Agent

AN optical whitening agent which is soluble in hydrocarbon, ketonic and other organic solvents and has good stability to heat and light has been developed by The Geigy Co. Ltd. Known as Tinopal PCRP, this agent acts by absorbing ultra-violet radiation and re-emitting it within the visible (violet-blue-green) range of the spectrum. In this way the total light reflectance of the material is effectively increased.

Tinopal PCRP dissolves in the plasticizers used in the manufacture of cellulose acetate and pvc plastics as well as in unplasticized materials such as polythene and polystyrene, and can be incorporated directly during the compounding process. It is claimed to be stable up to 550°F, a temperature which is usual in polystyrene injection moulding.

Other applications in the plastics industry are claimed for Tinopal PCRP. It can be used to give brilliance to plastics lightly tinted, for pastel blues and pinks, or for the corresponding transparent crystal shades. The transparency of cellulose acetate packaging films can also be improved by adding Tinopal PCRP.

'Extended Credit' Drag

RECORD turnover, though profit margins lower and increasing competition and overheads, are reported by Mr. Stanley Bayliss Smith, chairman of Greff-Chemicals Holdings Ltd. in his address circulated to shareholders with the company's report and accounts for 1955.

He refers to difficult trade conditions and makes the point that longer credit has to be given, particularly in the export market. This restricts the circulation of the company's working capital, 'And if the present set-back in the motor industry were to extend, our results could be affected adversely', he adds.

Net profit of the group was £137,736 against £134,916 in 1954; after providing for taxation there remains £67,897 as compared with £66,006.

A final dividend of 11 per cent (less tax) on the ordinary capital, as increased in January (£500,000), making, with the interim dividend paid in November last year, a total dividend equivalent to 15 per cent on the increased capital, will be recommended to the annual meeting of the company in London on 21 June.

European Agents Visit Lancs Plant

EUROPEAN branches and representatives of Armour & Co. Ltd., Chemical Division, were in London for a week's sales conference from 28 May. Meetings took place at Butchers' Hall which is the home of the City of London Butchers Company. On 29 May the party went to Littleborough, Lancs, to see the Hess Products Ltd. plant which is producing the range of Armour Chemicals in this country. These are all of the cationic and nonionic types and are all derived from natural fats. They include Armeens, Armacs, Arneels, Arquads, Ethomeens etc.



Foreign agents of Armour & Co. Ltd., Chemical Division at the Littleborough (Lancs) factory of Hess Products Ltd. Here are produced DISTEC fatty acids and Armour Chemicals

The Queen's Birthday

Honours for Industrialists & Scientists

AMONG the peerages conferred by HM the Queen on the occasion of Her Majesty's official birthday is a viscounty on the Rt. Hon. Baron Cherwell, CH, late Professor of Experimental Philosophy at Oxford, and Paymaster General, 1942/45 and 1951/53; and a barony on Lieut. General Sir Ronald Weeks, KCB, president, British Scientific Instrument Research Association, and formerly chairman of Vickers Ltd.

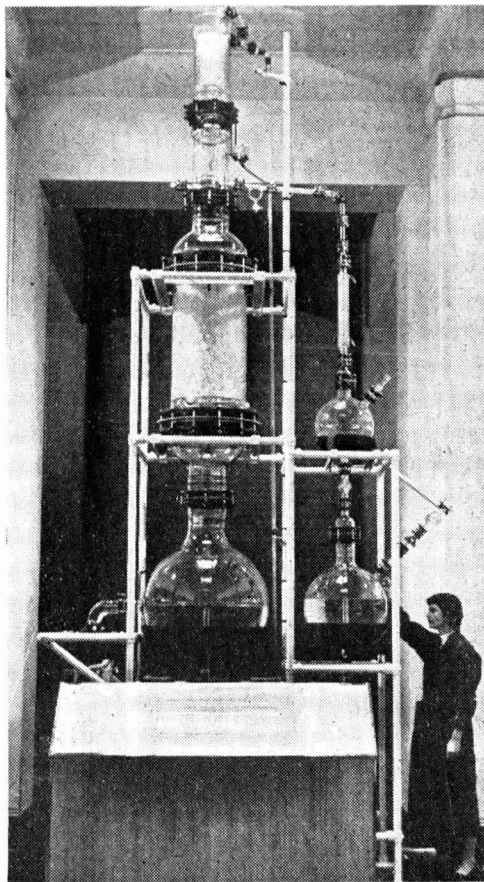
Those who will receive Knighthoods include: Samuel P. Bedson, MD, Professor Emeritus of Bacteriology, London University; Horace W. Clarke, chairman, Aluminium Industry Council and Horace S. Gibson, CBE, managing director, Iraq Petroleum Co. Ltd.

Many Names

Others in the Birthday Honours list are: **CB** Harold S. Gilham, Assistant Comptroller, Patent Office; Gordon Grant, Under-Secretary, Board of Trade; **OM** the Rt. Hon. Baron Hailey, GCSI; **KBE** Sir Thomas Merton, treasurer, Royal Society; **CBE** Frank P. Bowden, Reader in Physical Chemistry at Cambridge; Russell Mackenzie Currie, head, Work Study Department, Imperial Chemical Industries Ltd.; Geoffrey V. B. Herford, Deputy Chief Scientific Officer, Pest Infestation Laboratory, Department of Scientific and Industrial Research; Foster N. Woodward, director, Institute of Seaweed Research; **OBE** Arnold H. Lewis, director, Jealott's Hill Research Station, Imperial Chemical Industries Ltd.; William G. Sharp, director, Armour & Co. Ltd.; Francis G. Willson, lately assistant director, Materials & Explosives Research & Development, Ministry of Supply; **MBE** John B. Brennan, general secretary, Institution of Chemical Engineers; Charles H. Shaw, chief cashier, Imperial Chemical Industries Ltd., Wilton; Ralph E. Tugman, safety officer, Imperial Chemical Industries Ltd., Alkali division; **BEM** Daniel H. Smith, foreman, Shell Refining & Marketing Co. Ltd., Stanlow; Roderick A. Urquhart, laboratory attendant, Royal Botanic Garden, Edinburgh; Percy R. W. Ward, warden, David Bruce Laboratories, War Office, Marlborough.

The Centre-Piece

CENTRE-PIECE of a new chemical plant display which is to run indefinitely at the Science Museum, South Kensington, London, is an all-glass distillation unit manufactured by QVF Ltd., of Stone, Staffs. It comprises a 200-litre flask, a 15 sq. ft. steam-heated boiler, an 18 inch diameter packed column with reflux ratio head, and a product cooler with twin glass receivers. The unit, which can operate under full vacuum, is evidence of the progress made in the fabrication of large technical glassware.



All-glass distillation unit at the Science Museum in London. The unit has been manufactured by QVF Ltd., Stone, Staffs

From 15 June, KDG Instruments Ltd., manufacturers of thermometers and recorders, will be situated at Manor Royal, Crawley, Sussex (Crawley 25151).

Atoms, Electrons & Industry

SIMA Stage Exhibition in West Country

DEMONSTRATED at the exhibition, Atoms, Electrons and Industry, organized by the Scientific Instrument Manufacturers' Association, and held at Bristol from 6 to 8 June, were the latest electronic and nucleonic techniques as applied to industry.

Nucleonic thickness gauges, made by Ekco Electronics Ltd., and Baldwins Instrument Co. Ltd., which measure and control the thickness of sheet materials such as paper plastics, rubber and steel to a thousandth of an inch were shown, together with nucleonic weight controllers which are used by cigarette factories to control the weight of tobacco in cigarettes.

Thallium activated sodium iodide crystals, which are grown from the melt, were shown by Hilger & Watts Ltd. These crystals can be supplied in sizes up to four inches in diameter and $2\frac{1}{2}$ inches thick, and they can be used with a pulse height discriminator for *gamma-ray* spectrometry.

Conductivity & Measuring

W. G. Pye & Co. Ltd. were showing a small selection of their range of instruments, including conductivity and pH measuring apparatus. A complete range of spectrophotometers and colorimeters for the analysis of chemical compounds were shown by Unicam Instruments Ltd., including the SP500 quartz spectrophotometer for ultra-violet and visible investigation and the SP600 spectrophotometer for the visible range only.

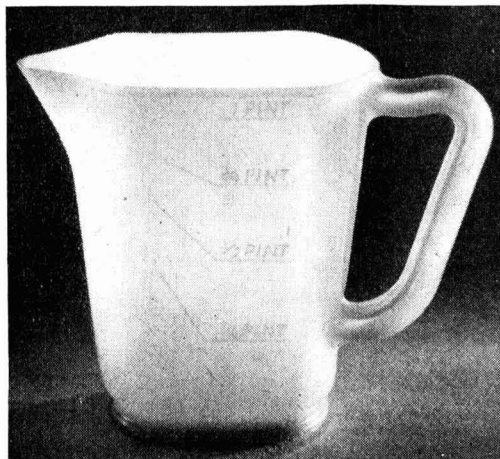
New developments in their range of measuring instruments were shown by Electronic Instruments Ltd. These include direct reading pH meters, portable pH meters and automatic titrimeters.

Other exhibitors were: The Atomic Energy Research Establishment, South Western Electricity Board, Fleming Radio (Developments) Ltd., The Wayne Kerr Laboratories Ltd., Bristol University, EMI Electronics Ltd., Newport Instruments (Scientific & Mobile) Ltd., Southern Instruments Ltd. (Oscillograph Division), Philips Electrical Ltd., Labgear (Cambridge) Ltd., Edwards High Vacuum Ltd., Foster Instrument Co. Ltd., Isotope Developments Ltd.,

Evans Electro Selenium Ltd., Goodmans Industries Ltd., Burndept Ltd., Ericsson Telephones Ltd., Nash & Thompson Ltd., Solartron Electronic Group Ltd., Kelvin & Hughes Ltd., Chance Brothers Ltd., Dawe Instruments Ltd., Cossor Instruments Ltd., and The Ediswan Electric Co. Ltd.

High-Density Polythene

ONE pint graduated measuring jugs in high density polythene, low pressure moulded, are offered by Foot Treatments (Chemicals) Ltd., Colliery Road, Birmingham Road, West Bromwich, at 5s 6d (including purchase tax). Vessels produced in high density polythene can, it is claimed, be used with boiling water, or with strong acids and chemicals without deterioration or distortion to breakage point. The jugs are light in weight and semi-transparent and have a high-gloss finish.



One-pint graduated measuring jug in high density polythene, low pressure moulded

Will

MR. DAVID WINGATE GILLESPIE MARSHALL (47), of Firs Hill Court, Pool-in-Wharfedale, joint managing director of the Yorkshire Dyeware & Chemical Co. Ltd., left £6,986 (net £4,095).

A Review of Organic Phosphorus Insecticides

VI Parts—Part IIIb : Titrimetry & Polarography

by R. G. BARRADAS, B.Sc., A.R.I.C., A.R.T.C., M.R.S.H.
(Government Laboratory, Hong Kong)

O'KEEFE and Averell (38) proposed a titrimetric method for the analysis of technical parathion and parathion formulations, which has found very widespread use. It involved the separation of free *p*-nitrophenol impurity from ether by a mild aqueous alkaline wash of one per cent sodium carbonate. The amount of free *p*-nitrophenol was determined colorimetrically. The unextracted parathion was reduced with zinc and hydrochloric acid and titrated with standard sodium nitrite solution using the conventional potassium iodide-starch paper end-point technique. This method was very extensively studied by many laboratories.

Collaborative Studies

The results of the collaborative studies were critically reviewed in a report by Edwards (39). The collaborator's report confirmed Edwards' findings that solvents in the parathion formulations prevented the excess of zinc from being destroyed by hydrochloric acid and that solutions for *p*-nitrophenol determination were also turbid, making results doubtful. Generally the method of O'Keefe and Averell was found to be most satisfactory. The only complaint which could be lodged against it was the unreliability of the starch-potassium iodide paper end-point. The difficulty was in the variation of the end-point. This variation occurred in tests by different individuals, and in day-to-day tests by the same operator.

One of the collaborators recommended the use of a potentiometric method such as that used by La Rocca and Waters (40) in their work on sulphur drugs, to obtain end-point which could be located with greater precision and reproducibility.

Giang (41) described the application of the potentiometric titration technique in his report on parathion for 1953, as an associate referee, for the Association of Official Agricultural Chemists. The technique is repro-

duced here in some detail because of the great success achieved by this method:

Apparatus: Beckman potentiometer (equipped with an adaptor for outside electrodes) or some other type of potential titrimeter, a platinum electrode, a calomel electrode and a suitable stirrer.

Procedure: Place the electrodes and stirrer in the reaction mixture which has been reduced (by the O'Keefe and Averell method) and cooled to room temperature. Add five grammes of potassium bromide to the mixture, start the stirrer and then add the standard sodium nitrite solution in five ml portions up to within one ml of the calculated equivalence point. From this point on, add the nitrite solution in 0.1 ml portions until the maximum rise in potential occurs. At first the potential after each addition of the nitrite solution requires some time (three to five minutes) to become constant; however, as the equivalence point is approached, especially after the 0.1 ml additions, the reaction is completed within one minute.

Dead-Stop End-Point Technique

Giang also favoured the use of the dead-stop end-point technique of Scholton and Stone (42) since this is equally as good as the method involving the maximum rise in potential. In the 1954 report on parathion for the Association of Official Agricultural Chemists, Giang (43) proposed further modifications to the Averell and O'Keefe method. A notable modification was the use of anhydrous sodium sulphate in the determination of free *p*-nitrophenol. This prevented emulsion formation which gave rise to questionable results.

Hartley, Heath, Hulme, Pound and Whitaker (44) proposed a selective extraction and hydrolysis method with a titrimetric finish for the analysis of Schradan. It was based on the partition coefficients in chloroform and carbon tetrachloride of the three main

constituents of technical Schradan, namely decamethyl triphosphoramidate, octamethyl pyrophosphoramidate, and hexamethyl phosphoramidate, and the different speeds of alkaline hydrolysis of these respective substances. Decamethyl triphosphoramidate hydrolyses readily in a normal solution of sodium hydroxide at 100° C, while octamethyl pyrophosphoramidate, and hexamethyl phosphoramidate hydrolyse only after a considerably longer time.

The last two substances are readily extracted with chloroform, and the first can be extracted with carbon tetrachloride. The dimethylamine obtained by hydrolysis was distilled and determined by titration with standard hydrochloric acid. The Pittsburgh Coke & Chemical Co. (45) published a differential hydrolysis method which also employed a titrimetric finish. It was based on the principle that the oxygen isomer in technical demeton, which has been dissolved in an acetone-indicator solution, could be readily hydrolysed in 50 ml of 0.1 N sodium hydroxide, while demeton could only be hydrolysed in the same manner if heat was applied.

The amount of each of the isomers present in a sample was obtained by back-titrating the excess of sodium hydroxide which remained after hydrolysis, with standard hydrochloric acid. Geigy & Co. proposed two elegant titrimetric methods for the determination of Diazinon in their commercial preparations of this insecticide, namely Diazinon Wettable Powder (46) and Diazinon ES 20-G 28809 (47).

Active Ingredient Content

In the determination of the active ingredient content of Diazinon Wettable Powder, the procedure involved the extraction of Diazinon by repeated shaking with ether. The ether solutions were then extracted with three portions of 50 ml. of water, then with as many portions of 0.05 N sodium hydroxide until the phenolphthalein added to the water layer remained red. The ether solutions were then washed with two 50 ml portions of water. The ether was then removed and the dried and purified residue of Diazinon was taken up in 20 ml of glacial acetic acid and titrated with perchloric acid in glacial acetic acid using one per cent α -naphtholbenzein solution in benzene as indicator until the solution became dark green.

For the determination of the pure active ingredient of Diazinon ES-G 28809, the recommended procedure was to dissolve the insecticide preparation in petroleum ether. Anhydrous sodium sulphate was added to the solution as a desiccant. The decanted liquid was then allowed to pass through an alumina-charged column, and eluted with petroleum ether. The alumina column absorbs the emulsifier, isopropyl-methyl-hydroxy-pyrimidine, isopropyl-methyl-mercapto-pyrimidine and any other impurities. The eluate was heated to remove the petroleum ether, and the residue was dissolved in glacial acetic acid and titrated with anhydrous perchloric acid as in the previous method. If the end-point was not clearly visible the solution was titrated potentiometrically.

Investigation With Polarograph

Nitrobenzene was the first organic compound which was investigated with the polarograph (48). This, and the fact that the nitro group in parathion could be so readily reduced, led Bowen and Edwards (49) to initiate polarographic studies in the determination of parathion, which was easily reduced at the dropping mercury electrode. They experimented with solutions of pure and technical parathion in acetone. Specified quantities of potassium chloride, acetic acid, gelatin and water were added. The addition of acetic acid prevented any hydrolysis of the insecticide during the electrolysis.

Normal curves for the polarograms were obtained with the technical material as well as with the purified sample. The decomposition potential of -0.30 volt and a half-wave potential of -0.39 volt were obtained when measured against the saturated calomel electrode. Paraoxon was found to interfere with the determination when present in small amounts. This is not a very common contaminant of parathion, but *p*-nitrophenol, which is invariably present, does not interfere with the curve obtained in the analysis.

The decomposition potential and half-wave potential for *p*-nitrophenol under the conditions prescribed for the determination of parathion were found to be -0.45 and -0.68 volt respectively. The accuracy of the determination was ± 1 per cent. This method permitted the determination of

parathion in the limiting concentration of 1 part per 50,000. This is a low limit of sensitivity; however, if polarographs are equipped with resistors, so that a sensitivity of 0.003 micro-ampere per millimeter may be used, it would be possible to determine parathion at a concentration of less than one part per million. The method of Bowen and Edwards received as much attention and popularity as did the sodium nitrite method of O'Keefe and Averell. A collaborative study reported by Edwards (39) showed that both methods gave results which were in excellent agreement.

Kovac (50) examined technical parathion preparations polarographically and discovered that the presence of an impurity in parathion, 0-ethyl di(0-p-nitrophenyl) thiophosphate, interfered because its wave coincided with that of parathion. Kovac overcame this difficulty by dissolving the parathion sample in ethyl alcohol which was saturated with 0-ethyl di(0-p-nitrophenyl) thiophosphate, and corrected for the increase in height of the wave caused by the addition, by subtracting the height of the wave given by an electrolyte containing an aliquot part of ethyl alcohol saturated with 0-ethyl di(0-p-nitrophenyl) thiophosphate in the form of an additive constant. The electrolyte used by Kovac was composed of 10 ml of 88 per cent aqueous ethyl alcohol in 0.01 N hydrochloric acid saturated at room temperature with potassium chloride, plus 2 ml of 96 per cent ethyl alcohol.

Technical Malathion

Jura (51) proposed a polarographic method for the assay of technical malathion. Unchanged diethyl fumarate in the insecticide was determined by measurement of the polarographic wave it gave in a mixture of hydrochloric acid and ethyl alcohol. In such a medium malathion is stable and does not give a polarographic wave. This insecticide was hydrolysed with 0.1 N sodium hydroxide, and this resulted in the formation of disodium fumarate from the diethyl fumarate and the malathion. The polarographic wave of fumaric acid was measured after acidifying the solution. The calculation of the malathion content was based on the difference in the wave heights of portions of the untreated sample and the hydrolyzed sample.

The number of published polarographic investigations of organic phosphorus insecti-

cides are few. The success of the Bowen and Edwards method does point the way, however, to future fruitful research on polarographic methods of analysis.

(To be continued)

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Chemical Standards Wanted?

STANDARDIZATION and simplifications are now of such key importance on the industrial front that the practice of firms in making at least one of their executives responsible for standards matters is becoming a widely accepted policy. Nearly 120 of these executives met in London recently for the second annual conference of standards officers.

Professor H. W. Martin (Rensselaer Polytechnic Institute, New York), speaking on standards engineering in its widest economic implications, assured the conference that the standards officer's function came well within the sphere of top management. The primary aim of such an officer was to bring control to bear on manufacturing processes, to eliminate wasteful work and to raise productivity, thus making possible higher earnings for workers, executives and investors. During the conference there was much commendation for the standards published by the BSI. However, there was also some criticism and among the critics was a representative of a chemical firm who appealed for more standards—not for his company's end-products but for the raw materials they bought.

Three policies which outlined ways and means of simplifying world trading, were welcomed by the conference.

UK Record Oil Consumption

LAST year UK oil consumption increased by more than 10 per cent over the 1954 level, according to figures published by Petroleum Information Bureau. These show that total inland consumption of petroleum products (excluding bunkers for ships engaged in the foreign trade) was 23,237,144 tons compared with 21,044,243 tons in the previous year.

Gas /diesel and fuel oils (7,543,968 tons, apart from quantities used in the refineries) again constituted the largest single item. Demand for oil for central heating has more than doubled in the past five years and last year totalled 847,710 tons, while consumption of gas/diesel and fuel oil by agricultural power units (268,911 tons in 1955) has multiplied nearly fivefold in the same five year period. Use of these fuels for gas making (535,820 tons in 1955) was slightly less than in 1954, but was still well above that for the previous years.

Motor spirit—second largest item—accounted for 6,240,391 tons, which was 5 per cent above the 1954 figure.

Consumption of aviation fuels amounted to 1,697,805 tons against 1,488,148 tons in the previous year.

Kerosene (1,381,151 tons) also showed an increase over 1954, due to higher sales of burning oil—consumption of which for the first time exceeded that of vaporising oil. The former rose by nearly 15 per cent, whereas sales of vaporising oil declined by nearly 3 per cent.

Among other products, lubricating oil consumption (888,490 tons) showed an increase of 5 per cent. Bitumen accounted for 865,355 tons, a 7 per cent rise.

Total refinery production in 1955 (27,597,871 tons) was nearly half a million tons down on the previous year, the decline falling entirely on motor and aviation spirit and fuel oil.

Shell Haven Refinery Gas

A 10 year agreement has been reached between the North Thames Gas Board and Shell by which Shell Haven refinery, on the Thames Estuary, will supply 25 million therms of refinery gas each year to the Board. The agreement is due to take effect from about mid-1958. To meet these demands, Shell will construct a unit at the refinery to purify and dry the gas.

Properties of Rubbers

AT a one-day conference organized by the London section of the Institution of the Rubber Industry, on 11 May, 300 members discussed the effects of various polymers on the properties of the finished material. Mr. H. C. Baker was in the chair.

In the opening paper Mr. L. Mullins discussed the shortcomings of laboratory tests for tear and abrasion resistance and presented data showing the effects of temperature and rate of tearing. The behaviour of GR-S and butyl rubbers was contrasted with that of natural rubber.

Behaviour of various polymers at high temperatures was discussed by Mr. E. G. Williams who emphasized the long term effects resulting from simultaneous oxidative degradation and continued vulcanization.

Mr. R. H. Norman dealt with the chief electrical properties of a range of rubbers and pvc, showing that these properties depend largely upon the degree of purity of polymer used, extent of oxidation and temperature of test. The relationship between chemical type of polymer and dielectric loss in the vulcanizate was discussed and some data on anti-static rubbers given.

Mr. S. E. Bolam classified and compared the many types of polymer dispersion or latex now available in this country, indicating the major features of each type of vulcanizable elastomer: GR-S for low cost, neoprenes for flame- and oil-resistance, nitriles for solvent resistance and compatibility with vinyl and phenolic resins.

The concluding paper dealt with Neoprene and Hypalon. Hypalon is outstanding in resistance to ozone, high temperatures and corrosive chemicals. Neoprenes also possess high stability to many such influences.

Reclaiming Land for Refinery

As part of the £26 million expansion of BP's Kent oil refinery on the Isle of Grain, about 500,000 cubic yards of sand are to be pumped ashore from the Medway to use as filling for low-lying areas, on which part of the new plant will be built. In some areas piles will be necessary to support units and storage tanks. During the construction of the main refinery, 6,000 piles were used. Nearly one million cubic yards of sand were pumped ashore to reclaim marshy ground.

PERSONAL

DR. GEORGE BROWNLEE, lecturer in pharmacology at King's College, London, and MR. HERBERT GRAINGER, chief pharmacist at Westminster Hospital, have now completed a lecture tour of the Loire valley and Brittany under the auspices of the Franco-British Pharmaceutical Commission. In Angers, Tours, and Rennes, Dr. Brownlee has given a paper to Schools of Medicine and Pharmacy on 'Antibiotics and Host Resistance to Infection'; Mr. Grainger on 'The System of Controlling Poisons in Great Britain.'

MR. R. S. JOHNSON has been appointed to the board of Midland Tar Distillers.

Russian members of the UNESCO mission of scientists and engineers now working in India with the Indian Government in establishing an institute of technology in Bombay are, PROFESSOR S. V. RUMJANZOV, Soviet Deputy Minister of Higher Education, PROFESSOR N. S. TOROCHESNIKOV, specialist in chemical technology, PROFESSOR M. A. GLINKOV, specialist in ferrous metallurgy, PROFESSOR RICHKOV, specialist in chemical engineering, and MR. B. A. FILLIPOV, a specialist in electrical engineering.

MR. PETER WOODWARD, resident plant manager for ICI at Rhyd-y-mwyn, Mold, a member of Mold Urban Council for four years, was elected chairman at the annual meeting on 22 May. Mr. Woodward is a native of Runcorn.

The following officials have been elected by the Industrial Pest Control Association for 1956/7:— *president*, MR. K. F. GOODWIN-BAILEY; *vice-president*, MR. A. FRASER MCINTOSH; *honorary treasurer*, MR. S. W. HEDGCOCK; *honorary auditors*, MESSRS. G. ARNOT, W. A. JESSER; *executive committee*, MESSRS. G. A. CAMPBELL, S. FARROW, R. A. H. FREEMANTLE, D. J. S. HARTT, G. L. WINDRED; *secretary*, MR. W. A. WILLIAMS, M.B.E., B.Sc.

There is to be a new president of the British Food Manufacturing Industries Research Association. He is PROFESSOR A. C.

FRAZER, M.D., D.Sc., F.R.C.P., Professor of Medical Biochemistry and Pharmacology at Birmingham University, whose work in the field of food science is of international repute. Professor Frazer will be formally elected at the Association's annual meeting on 5 July. He succeeds SIR FRANK ENGLDOW, C.M.G., M.A., F.R.S., who has held office since 1947. Professor Frazer is a member of the Medical Research Council Committee on Food Adulteration, the Committee of Management of the Low Temperature Research Station at Cambridge, and the Colonial Medical Research Committee.

Group labour manager of British Chrome & Chemicals Ltd., London and Bolton, Lancs, MR. L. W. GRAINGE, has been appointed to the board of that company, and to the board of British Chrome & Chemicals (Holdings), as a special director.

For the first time a woman has won one of the prizes awarded annually by the Industrial Association of Wales & Monmouth to technical college students. She is MISS SHEILA ANN HUGHES, of Pant House, Oswestry, who is doing chemical research at Monsanto Chemicals Ltd. and attends part-time at Wrexham Technical College. The awards, which were introduced in 1947 and are worth £250 a year, are made to students who achieve high standards in part-time courses.

MR. H. W. PALMER, managing director of Glaxo Laboratories Ltd., DR. A. H. CAMPBELL and MR. W. J. HURRAN, executive directors of Glaxo Laboratories Ltd., have been appointed to the board of the Murphy Chemical Co. Ltd.

The following staff changes have been announced by ICI Nobel Division: DR. W. A. CALDWELL, joint repute research manager since 1952, became manager of the development department on 1 June, DR. WILFRID TAYLOR, an assistant research manager since 1945, became a joint deputy research manager on 1 June, and MR. R. T. PIRIE, head of the method study department, who has left the company to take up a post in Venezuela, has been succeeded by MR. J. E. FORLIN, works superintendent.

SCI Chemical Engineering Group

Annual Meeting & Dinner

THE annual general meeting and dinner of the Chemical Engineering Group of the Society of Chemical Industry was held in the Cafe Royal, Regent Street, London W1, on 30 May. Mr. G. Brearley, B.Sc., F.R.I.C., M.I.Chem.E., who was re-elected chairman of the group for a second year, presided at both functions.

The annual report of the general committee for 1955, presented by the hon. secretary, Mr. R. C. Odams, M.A., M.I.Chem.E., recorded an increase in membership, which was 781 at the end of 1955, compared with 669 at the end of 1954.

Representation on Committees

The report stated that the group continued to nominate representatives of various committees of the British Standards Institution and other bodies, and continued to be responsible for the preparation of the chemical engineering section of the Society's *Annual Reports on the Progress of Applied Chemistry*. Dr. T. K. Ross had again undertaken the compilation of that section. Mr. H. W. Thorp had accepted the group committee's invitation to prepare a section on industrial hazards.

The chairman paid tribute to Mr. Odams at the end of his term of 5½ years as hon. secretary of the group.

Elections to the general committee were as follows:— W. E. CASH, W. G. DAROUX, J. N. C. HUTCHEON, D. C. FRESHWATER, R. C. ODAMS, P. M. GRIFFITHS, Honorary officers for the year 1956/57 were declared elected as follows.— *chairman*: GEORGE BREARLEY; *hon. secretary*: J. L. SWEETEN; *hon. treasurer*: F. A. GREENE; *hon. editor*: D. M. WILSON; *hon. recorder*: H. W. THORP.

The principal guest at the annual dinner was Sir Cecil Wakeley, Bt., K.B.E., C.B., past president of the Royal College of Surgeons. Replying to the toast of 'Our Guests', he said that the medical profession today depended more on chemistry than it had in any other period of its existence, and that dated from the period of creation. Medicine's debt to chemistry had been and still was a very great one. To mention only a few, anaesthesia, antiseptics and antibiotics had completely changed the face of surgery.

Now surgery was made safe for the patients, thanks to the chemists.

Who would have thought, even twenty years ago, that we should be able to cure tuberculosis, one of the killing diseases of all time. Yet such was the case; and streptomycin and other drugs which the biochemists had discovered were putting the chest physician out of business. Many of the tropical diseases were now curable, thanks to the many-sided activities of the biochemists.

Cancer in some forms reacted to chemical preparations such as stilboestrol, and he was convinced, having worked in cancer research for 40 years, that the cure of cancer was just round the corner, and the cure would be a chemical substance which, when injected into the blood stream, would kill every cancer cell. We needed to step up cancer research from the chemical and biochemical side.

Obituary

MR. SPENCER H. SULLIVAN, managing director of the Carbon Dioxide Co., a division of The Distillers Co. Ltd., died on 22 May 1956.

MR. J. BRUCE MILLER, a director of Scottish Agricultural Industries (Aberdeen) Ltd. and a director and former partner of John Miller & Co., chemical manufacturers, of Sandilands, Aberdeen, died recently at the age of 89. He was the only son of Mr. George Miller, who founded John Miller & Co. Joining the family business in 1889 after studying at Manchester University and working in Edinburgh and London, he became a partner with his father. He later became a director and when the Sandilands Chemical Works were taken over by Scottish Agricultural Industries (Aberdeen) Ltd., he continued as a director of the larger firm.

MR. GILBERT HENRY TRIPP, formerly factory manager at Glaxo Laboratories Ltd., Greenford, died on 9 May at the age of 70. Mr. Tripp retired from the staff of Glaxo Laboratories Ltd. in 1951 after having served 35 years with the company.

Indian Newsletter

Our Own Correspondent Reports

AN agreement has been signed recently in New Delhi between Canada and India for the establishment of an atomic reactor in Trombay near Bombay. The reactor has been given by the Government of Canada as a gift to India under the Colombo Plan and the experimental facilities of the reactor will be available to Colombo Plan countries in South and South East Asia. The atomic reactor, which will be of the high power flux Canadian NRX type, will be erected at the Atomic Energy Establishment of the Government of India at Trombay. The building to house it will be a rotunda in the shape of a hermetically sealed shell about 135 feet high and about 120 feet in diameter. The rotunda will be surrounded by buildings for auxiliary equipment and laboratories.

Canadian Contribution

The total cost of the project will be about \$14 million of which the Canadian contribution amounts to \$7.5 million while the remainder will be met from Indian resources. Thus Canada is providing the reactor itself and the steel for the rotunda which will surround it. The designing of the reactor and rotunda is being undertaken by Canada. Indian contractors will carry out the major part of the construction work at the site under Canadian supervision. Work on the basement has already started and the Indian Atomic Energy Department expects to have the work on the foundations and basement of the reactor complete by the middle of the current year. The erection of the steel rotunda to house the reactor will start soon after and it is expected that the reactor will go into operation by 1958.

It has been stated that the reactor has been specifically designed to provide excellent facilities for fundamental research in physical, chemical, biological and metallurgical problems pertaining to atomic energy. It is ideally suited for making engineering studies and research on reactor materials which can be tested under conditions of high neutron intensity. The research and development facilities of the reactor will permit advanced engineering experiments being performed in connection with the design of future power reactors.

Above all, it is an efficient producer of radioactive isotopes for use in medicine, agriculture and chemistry. Arrangements have been made for training Indian personnel at Chalk River, Canada.

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An announcement has been made to the effect that a new company to be known as JK Chemicals Ltd. will be formed and that the consent of the Government of India has been obtained for this purpose. The company was incorporated in 1947 for setting up chemical industries in Western India and its factory at Wadala, Bombay, was first established in 1913 by the Eastern Chemical Co. Ltd., which was incorporated in England. The assets and goodwill of the English company were acquired by the present company. In accordance with a decision of the board of directors to put up additional lines of manufacture of chemicals, it has now been proposed to set up a new factory for the manufacture of sodium hydrosulphite (1,400 tons) by the modern electrolytic process, caustic soda, rayon grade (1,000 tons), liquid chlorine (1,740 tons), hydrochloric acid, 32 per cent (1,500 tons), zinc chloride (300 tons) and liquid sulphur dioxide (300 tons) per annum.

Swiss Equipment

The capital outlay is expected to be about Rs 6,700,000 (£502,500) of which a little over half will be contributed by the Industrial Finance Corporation of India. The factory is expected to be set up at Thana, a Bombay suburb. Krebs & Co. Ltd., Zurich, have designed the equipment for the manufacture of sodium hydrosulphite and other products. Orders have been placed for plant and equipment with Krebs & Co. Ltd., Zurich, Krebs et Cie SA, France, and L. De Rolls SA, Zurich. The agreement provides for the supervision of construction and the commissioning of the plant and also the training of Indian personnel abroad.

* * *

The deputy chairman of the Imperial Chemical Industries Ltd. (Mr. S. P. Chambers) announced in Calcutta recently that a factory to manufacture polythene in India would be established. The use of

Alkathene brand polythene in India has already been developed by Imperial Chemical Industries (India) Ltd., and Alkathene film has been manufactured for a considerable time at Tiljala near Calcutta. An ICI discovery, polythene is a plastic of outstanding importance throughout the world and it is likely to prove of great interest in agricultural development and in the packaging of food and other commodities. The new polythene plant will involve an investment of Rs 30 million (£2.25 million) in the near future. It was pointed out that it was ICI's policy to manufacture products overseas, especially in India, in view of important developments. The Imperial Chemical Industries (India) Ltd. are already engaged in India in a co-ordinated and planned programme of development in the fields of explosives, dye-stuffs, chemicals and plastics and the range is likely to be widened as further schemes are examined.

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The Government of India has given tentative approval to an Uttar Pradesh Government scheme for the establishment of the first synthetic rubber factory at a suitable site in that State. The State is the biggest producer of the main raw material in the form of power alcohol for the production of synthetic rubber. A pioneer project, it is expected to cost Rs 120 million (£9 million). Meanwhile some private firms have offered to open a factory for the production of chemical pulp used in rayon manufacture from fir and spruce wood available in UP forests. Apropos the above, the next two items would be read with interest.

Developing Alcohol Industry

The Minister for Commerce of the Government of India, at the recent 12th annual general meeting of the All-India Distillers' Association, said that high priority would be accorded for the development of the alcohol industry. With the coming in of the Indian Power Alcohol Act, it was expected that about 800,000 gallons of power alcohol would be utilized per month by admixture with petrol in the State and its environs. The Minister said that alcohol would be used as a raw material for the manufacture of chemicals such as DDT and other products and referred to the synthetic rubber scheme. He announced that the Government of India had sanc-

tioned two schemes for the manufacture of polythene which would consume considerable quantities of alcohol.

* * *

The Government of Orissa and the Government of India have agreed to a plan for setting up a Mining Corporation to exploit the mineral wealth of Orissa, according to the Chief Minister of Orissa. The capital for the corporation would be provided equally by the two Governments and for the present the corporation intends to take up only new mines and avail itself of the facilities of the port of Paradip, about 55 miles from Cuttack. The corporation will have as its immediate object an export target of one million tons of ores, principally iron ores. It is learnt that State trading in minerals will not preclude the Government from granting licences to private owners. The Government, it has been pointed out, is anxious to establish a steady export market for ores and the corporation would enter into long term contracts with foreign buyers as also with private firms. The formation of the Mining Corporation has been received with mixed feelings in the country, and private enterprise regards this act of the Government as an incursion into their normal activity.

New Laboratory

AN elastomers laboratory costing £1 million has recently been opened by E. I. Du Pont de Nemours & Co. in America. The installation is designed to provide technical service on Neoprene and Hypalon synthetic rubbers, and will be in addition to the facilities already offered by Durham Raw Materials Ltd., the UK distributors of these Du Pont products.

The new laboratory is thought to be the largest and most complete unit of its kind ever assembled. It can duplicate on a pilot plant scale many operations in rubber manufacture, and it includes separate laboratory areas for isocyanate work, adhesives, paper, dry-polymer processing, latex, physical testing and consumer-product testing.

'The Titanium Pigment Story'

'The Titanium Pigment Story', a short film in Eastman colour, produced by British Titan Products Co. Ltd., of York, was presented to an invited audience in London last month.

OVERSEAS

Empire Raw Materials

Empire developments are outlined in a report published on 30 May by HMSO at 2s. The *Colonial Territories Report 1955/6* states that the copper-cobalt mine at Kilembesi, Uganda, was brought nearer production while the smelter at Jinja is expected to be complete by the autumn of this year. A lease for the extraction of manganese ore was issued over a large area in British Guiana and production should start within three years. Bauxite production rose in British Guiana and in Jamaica where it was announced that alumina production would be increased to half a million tons a year.

Toxic Effects of Fluorides

Fluoride contamination is becoming an increasing problem in agricultural and urban areas due to the growth and spread of certain industries. According to Mr. H. M. Benedict of Stanford Research Institute, US, there is some concern with the toxic effects of fluorides on vegetation, but the primary consideration is the effect that fluorides might have upon livestock eating contaminated vegetation. Speaking before the 49th annual meeting of the Air Pollution Control Association in Buffalo, New York, recently, Mr. Benedict described methods for determining the fluoride content of natural vegetation. The first step toward solving this problem, he said, was to determine how far from the suspected sources these fluorides were found in concentrations sufficient to cause injury to livestock.

Secondary Zinc in February 1956

Recovery of secondary zinc in zinc-base products in the US during February was 12,500 short tons compared with 12,000 tons recovered in January, according to the Bureau of Mines, United States Department of the Interior. Stocks of all types of zinc scrap rose 6 per cent to 35,200 tons on 29 February or to the highest level since March 1949.

Weedkiller Demand Increases

North American Cyanamid Co. has begun construction of extensive facilities for the production of Amino Triazole, a new weed-killing and defoliant chemical. The facilities are at Cyanamid's Welland, Ontario, plant, where ammonium nitrate and nitro-

gen solution fertilizers are manufactured. The new facilities are expected to triple production capacity for Amino Triazole by 1957. The company states that tests have shown that Amino Triazole is particularly effective against deep-rooted, hard-to-kill annual and perennial weeds and grasses.

Canadian Chemical Plant

One of the features of the new hydrogen peroxide plant being constructed at Hamilton, Ontario, by Canadian Industries Ltd. is the electrolytic process to be used. CIL will obtain full knowledge and use of the manufacturing process through patent licence agreements with the Becco Chemical Division of the Food Machinery & Chemical Corp., Buffalo, NY. The plant will be of five storeys with steel framework and asbestos cladding.

Delegation to W. Germany

At the invitation of the Interparlamentarische Arbeitsgemeinschaft of West Germany, a delegation from the British Parliamentary and Scientific Committee visited Western Germany during last month. The delegation consisted of:— Mr. Austen Albu, M.P. (leader); Dr. R. Bennett, M.P., Mr. R. Frost, M.P.; Mr. G. W. Lagden, M.P.; Mr. A. M. F. Palmer, M.P.; Mr. J. Rankin, M.P.; Mr. E. Bolton King and Lt. Cdr. Powell. Among the numerous places of interest visited by the delegates were the Technische Hochschule, the Institute of Inorganic Chemistry and the Institute of Electrotechnology and High Frequency, all at Aachen. They also attended a meeting of the Arbeitsgemeinschaft fuer Forschung (Research) of North Rhein Westphalia in the Landtag.

Activated Carbon Recommended

Activated carbon removes all odours and many other contaminants from industrial plant exhausts, Mr. H. L. Barnebey (vice-president of the Barnebey-Cheney Company in Columbus, Ohio) told members of the Air Pollution Control Association recently. He went on to recommend that activated carbon be considered as a solution or as a treatment step for each pollution control problem—even though it would not always be the best solution in all cases. As for the future, Mr. Barnebey said the use of activated carbon would increase.

What the NPL is Doing

Annual Report & Open Day at Teddington

AN open day was held at the National Physical Laboratory on Friday, 25 May. This, combined with the report for the year 1955 which has just been published by HM Stationery Office, price 5s, allows a fairly complete picture of the activities of the NPL to be obtained.

The Metallurgy Division has now published the results of an investigation on the constitution of the titanium-oxygen alloys up to about 35 per cent oxygen, and a partial study of the titanium-aluminium-oxygen alloys up to about 1,200°C has been completed. The results of this work form a basis for a systematic study of the effect of oxygen on the mechanical properties of the titanium-aluminium alloys which is in progress. The main object of this work is to find out to what extent brittleness can be reduced by studying the effect of heat treatment, microstructure and methods of working.

Boron in Steel

Considerable work has been done on the determination of boron in steel. An ion exchange method developed in the Division is on trial at other laboratories for comparison with the present methyl borate distillation, with a view to adoption as a standard procedure.

At the request of the Ministry of Health the NPL Light Division has undertaken the testing of inhalers intended for use by midwives in the administration of trichloroethylene. The inhalers must supply a mixture of the anaesthetic vapour and air within the limits of 0.4 to 0.6 per cent by volume in all normal conditions.

A 0.5 per cent concentration of trichloroethylene in air results in a change of refractive index of only 0.000,006, but such changes may be observed in a gas interferometer and the required concentration of vapour may thus be found from a measurement of the change in refractive index.

The measurement is facilitated by comparing the vapour mixture with air at the same temperature and pressure. The mixture is passed in a continuous flow through a glass ended chamber alongside a similar chamber full of air, the two chambers forming the arms of a Jamin type interferometer.

In this the movement of a system of fringes indicates a change of refractive index in one of the arms and hence the concentration of the mixture. The new instrument has been arranged to project the fringe movement on to a screen for direct viewing; the screen has been calibrated to read percentage trichloroethylene directly.

Bolometers

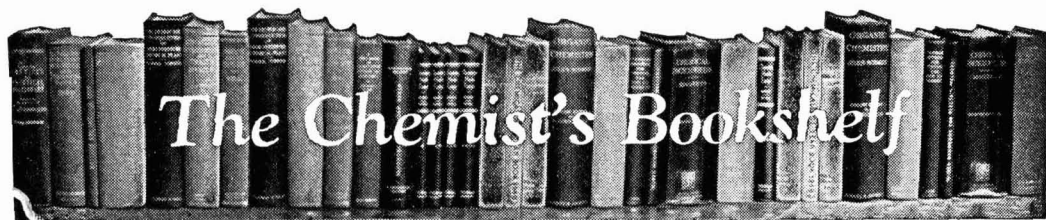
Work has been carried out by the Light Division on the development of bolometers, a type of infra-red detector in which the absorption of the infra-red radiation by a current carrying detector causes the temperature and hence the resistance of the conductor to increase, and a voltage to be developed which can be amplified and used as a measure of the radiation. The bolometers which have been devised are of the thin film type, the electrical conductor consisting of a strip of film less than two millionths of inch thick. The film is deposited on a pellicle of some thicker material such as polystyrene.

Claimed to be the only atomic standard of time and frequency which is yet in operation, the caesium resonator developed by the NPL Electricity Division provides a unit of time which is accurate to three parts in 10 thousand million or one hundredth of a second in a year, which is about 30 times more accurate than the unit derived from astronomical measurements.

The caesium resonator is based on a natural resonant frequency of the caesium atom. A radio oscillator in the laboratory is set precisely at this frequency and is then used to calibrate the quartz clock which acts as the working standard of time and frequency.

Paper Sack Makers' Expansion Plan

An expansion plan which will add 50,000 square feet of floor space to the existing factory is being undertaken by William Palfrey Ltd., manufacturers of multi-wall paper sacks, at Rochester, Kent. A new store for finished sacks is being built and an intermediate floor will be constructed over two bays of the main building.



The Chemist's Bookshelf

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY. Vol. 9 Reactor Technology & Chemical Processing. Compiled and published by the United Nations Scientific Secretariat, New York. 1956. Pp. 771. 70s.

Aptly the volume begins and ends with sessions devoted to the problems of radioactive waste disposal. Fortunately for the future of nuclear reactors, these do not seem insurmountable. An estimate gives the possible annual consumption of nuclear fuels as the complete burn up of between 200 and 1,000 tons for the distant foreseeable future. It is surprising that the enormous quantities of fission products from such a programme on discharge, after an initial storage period of a year, would only build up to an equilibrium activity equivalent to that due to the natural contribution from the present potassium (K^{40}) in all the oceans of the world.

Furthermore, a quantitative removal of the long lived Sr and Cs combined with a 13 years' storage period before dispersion of the remnant activity into the oceans would increase their equilibrium activity by less than one thousandth of that from the natural K^{40} already present. Treatment of radioactive wastes is therefore largely concerned with the separation and comparative short term storage of the bulk of the active materials together with the long term storage ($>1,000$ years) of the long lived Cs and Sr. The prevention of the discharge of radioactive gases from reactor buildings and separation plants is also considered.

Metallurgy Reviewed

Metallurgy of uranium, thorium and their alloys is reviewed comprehensively. There is also a short paper on the intermetallic compounds of plutonium. Some technological aspects of uranium fuel elements are considered in more detail. These include: reactions between uranium and aluminium—

a common 'canning material' for the containment of uranium and its fission products within the reactor; dimensional changes occurring in uranium on thermal cycling and the reduction in these which can be effected by certain treatments; problems of radiation damage and thermal stress within the fuel elements; applications of powder metallurgy and dispersive type fuel elements.

Reactor Fuel Elements

Several proved reactor fuel elements are described. High heat fluxes will be obtained with fast reactors and from these come the potentially most economical power reactors. These necessitate the use of liquid metal coolants. 130 pages record three sessions devoted to the handling, heat transfer and corrosion with such liquid metal systems. This provides a valuable review of liquid metal coolant technology.

Chemical aspects range over a wide field. Many papers consider corrosion problems where water is used as a heat transfer agent or, additionally, as the dispersive medium for the fuel in a homogeneous reactor (the following discussion brings out the fact that metallurgists have also participated in this work). Aluminium alloys are considered over a range of operating temperatures. For a high temperature water cooled reactor zirconium alloys are possible constructional materials. Interim data is reported from irradiation tests with the 'Pressurized Water Reactor.' The importance of this work is self evident, especially when the possible consequences of corrosion products fouling heat transfer surfaces is considered. The corrosion problems associated with gaseous cooled reactors were not discussed.

Usually, spent fuel elements are dissolved and treated by solvent extraction. In this way potential fuel is recovered, and usable fission products separated from those requiring indefinite retention or disposal either immediately or after storage. Types of ex-

traction units are reviewed and a short paper stresses the need for a pilot scale process to define the limitations through hydrolysis, emulsification and so on of any proposed process. Experience with various solvents is detailed for uranium, plutonium and thorium.

Direct maintenance of a highly radioactive plant is shown to be feasible by the description of experience at the Idaho Chemical processing plant. This was specially designed for ease in decontamination. There is a paper on the removal of fission products from stainless steel.

The concluding session on the processing of irradiated fuel elements considered pyrometallurgical processes, purification of uranium during its direct conversion to the hexafluoride, and by other less standard and apparently complex means.

It must not be forgotten that the volume is a conference record and therefore will not have the continuity to be expected from an edited survey compiled by a few specialists. Also, much relevant processing information may be expected in volume 8 ('Production Technology of the Materials Used for Nuclear Energy'). This leaves the impression that this valuable record of 13 conference sessions at which 91 papers dealing with 'Reactor Technology and Chemical Processing' were presented requires, in addition, a detailed index so that its 771 pages of experience may be fully available.—J.S.M.B.

TEMPERATURE: ITS MEASUREMENT & CONTROL IN SCIENCE & INDUSTRY. Vol. II. Editor H. C. Wolfe. Reinhold Publishing Corporation, New York (for the American Institute of Physics). Chapman & Hall, London. 1955. Pp. x + 467. 96s.

Many readers will be familiar with the first volume, a standard work in the field, based upon papers presented at the second symposium on temperature, sponsored by the American Institute of Physics in 1939. This second volume includes papers presented at the third symposium on temperature held in Washington in 1954.

Physicist, Chemist or Engineer

It fully maintains the high standard of the first and, while essentially a work of reference for the physicist interested in the basic concepts of temperature and temperature measurement, it will also be of value

to the chemist or engineer. In fact, one chapter 'Temperature Measurement in Engineering' presents a useful general survey of the methods available, together with advantages and disadvantages.

Most of the papers are, however, specialized in nature and include in the first section: 'The Temperature Concept'; 'The Concept of Temperature Near Absolute Zero' and 'Astrophysical Temperature'.

The second section deals with standards and scales and includes papers on 'Gas Thermometry'; 'High Temperature Gas Thermometry'; 'The International Temperature Scale'; 'Precision Resistance Thermometry'; 'Low Temperature Scales from 90° to 5° K'. The section also deals with new determinations of fixed points, and magnetic thermometry.

Two Papers

Section III comprises two papers: 'Thermodynamics of Irreversible Processes and Fluctuations' and 'Relaxation of Partial Temperatures.'

Section IV is concerned with experimental measurements and contains papers on 'Temperature Measurements in Flames and Hot Gases', 'Superconductors as Thermometers', 'Semiconductors as Thermometers' and 'Sound Velocity as a Measurement of Gas Temperature.' Among the miscellaneous topics dealt with in Section V is one on 'Temperatures in Atomic Explosions.'

In all there are 24 papers written by specialists; each paper includes a valuable collection of references to original works and there are many illustrations. Author and subject indexes are excellent.

This book should be in all science libraries, and while far less comprehensive than volume I, it is, nevertheless, a valuable supplement to the first volume.—R.L.

POLISHES AND CLEANING MATERIALS. 3rd Edition. By A. Davidsohn. Leonard Hill Ltd., London, 1956. Pp. xiv + 298. 21s.

Originally published in 1938 under the title *Polishes*, this book has now been revised and extended, as indicated by the title of this third edition. The first part discusses natural and synthetic waxes, solvents, emulsifiers, and other raw materials for polishes. Then follows a description of the composition and manufacturing processes for a variety of polishes for different purposes. A final, smaller section (79 pages) deals with synthetic detergents and cleaning composi-

tions for a wide range of industrial and domestic purposes.

Particularly valuable and up to date is the account of waxes. Recent promising progress in the refining of sugar-cane wax is described; currently, about 60,000,000 lb. of this wax are thrown away annually in wastes from American sugar mills alone. Interesting experiments, which we would do well not to overlook, have been carried out on the extraction of waxes from British lignite (Bovey Trace deposits) and peat.

The book is well and authentically written. Intelligible to the practical man, it is also a valuable reference work for the expert. It is an excellent example of what a technological monograph can be, and the price is very reasonable into the bargain.—W.W.

GLASS. By G. O. Jones. Methuen & Co. Ltd., London. 1956. Pp. 120. 8s 6d.

The style of most modern Methuen monographs will be familiar to many readers—they tend to be academic and theoretical in approach. This particular volume has much less mathematical content than usual for the series due, by and large, to the inability of mathematicians to deal readily with the main topics of interest.

The text can be taken as a good general technical introduction to the topic, but one in which few aspects are considered in full detail, for the chapters average only 16 small pages. Main chapter headings are:—chemical structure, stability, properties near transformation temperatures, behaviour under stress, and the effect of metallic ions.

Main mathematical approach is via thermodynamics. A set of formulations for glass types and a bibliography are included, together with an index. The style implies a catholic knowledge and is in no sense verbose.

As is usual with this series, the book is not cheap, but should interest all students, at least in the less difficult sections. In the main, only common glasses were discussed.—H.M.

Increasing Fertilizer Output

Answering a question in the House of Commons recently, Mr. A. R. W. Low, the Minister of State, Board of Trade, said that in the next two or three years the increased output of fertilizers resulting from plans now in hand should be broadly sufficient to meet an increasing UK demand.

Portable Foam Appliance

THE development of a new type of self-contained, portable foam fire fighting appliance has been announced by The Pyrene Company Ltd.

The new appliance, Model AF30C, is a trolley-mounted unit of 30 gallons capacity which produces more than 400 gallons of fire-smothering mechanical foam for use against outbreaks involving quantities of oils, spirits, fats and other inflammable materials. It has been designed to meet a wide variety of fire risks. It is suitable for use where water mains do not provide sufficient pressure for other forms of mechanical foam-making equipment. Additional advantages are that it can easily be manoeuvred and operated by only one man and that recharging can be completed on the spot.

A 30 gallon cylindrical tank which comprises the main body of the unit contains a pre-mixed solution of water and Pyrene foam compound. Discharge pressure is provided by a cylinder of CO₂ gas which is connected to the main container by a short length of flexible high pressure hose. The CO₂ cylinder is fitted with a sealing disc and a lever-operated piercing head. A syphon tube fitted in the tank is coupled to a 30 ft. length of hose which is carried on a hose saddle clamped to the main container. Foam is generated at the delivery end of the hose by a specially designed miniature Pyrene foam-making branchpipe. The unit is operated by unwinding the hose and pulling the CO₂ lever in an upward direction.

The unit is mounted on a two wheeled trolley of light, tubular steel construction and is designed to operate in the upright position. The unit weighs 670 lb. when charged, is 4 ft. 11 in. in height and 2 ft. 7 in. in width overall.

The council of the Mineralogical Society has nominated the following for election at the anniversary meeting on 1 November:—*president*: PROFESSOR L. HAWKES, D.Sc., F.R.S.; *vice-presidents*: PROFESSOR L. R. WAGER, M.A., Sc.D., B.Sc., F.R.S.; DR. A. K. WELLS, D.Sc., F.G.S.; *treasurer*: PROFESSOR J. H. TAYLOR, M.A., B.Sc., Ph.D., F.G.S.; *general secretary*: DR. G. F. CLARINGBULL, B.Sc., Ph.D., F.G.S.; *foreign secretary*: DR. L. J. SPENCER, C.B.E., M.A., Sc.D., F.R.S.

Consolidated Zinc Corporation Report

Profits for 1955 Are Down

A NET profit of £2,344,928 for 1955 has been announced by the Consolidated Zinc Corporation Ltd. This is after providing for mining royalty and taxation, and is a decrease of £38,450 compared with 1954. After allowing for dividends and a transfer to general reserve of £1,000,000, a balance of £967,005 was left to be carried forward to 1956.

The distribution proposed for the year on the ordinary shares amounts to £1,129,521, which compares with £852,597 for 1954. This represents a distribution of 4s 6d per share, compared with 3s 9d per share for 1954, which included an interim dividend of 1s 3d per share on a lower issued capital.

As the result of an offer dated 24 January 1955, the company acquired the entire preference share capital of the Imperial Smelting Corporation Ltd., in exchange for 3,104,714 of the company's preference shares and a small cash payment per share.

In his statement, which has been circulated with the report and accounts, the chairman, Mr. John R. Govett, said:—

'The story of the year 1955 is one of record output and improved efficiencies of the mine, satisfactory progress by the smelting and other activities, higher realized prices for lead and zinc, and a greater investment income, but a net profit showing little change due to the burden of higher mining royalty and taxation.

'The ore production of the Zinc Corporation's mine at Broken Hill was 645,959 tons, the highest figure achieved there, and approximately nine per cent over the record output of 1954.

Increased Production Costs

'The activities of Imperial Smelting Corporation in the United Kingdom have also been satisfactory. In spite of substantial increases in the price of coal and electricity, higher transport charges and higher wages paid to our own employees, the profits from trading for the year were maintained at approximately the same level as for 1955.

'Our results have also benefited from the higher profits earned by our investments in our associated company, New Broken

Hill Consolidated, whose mine is adjacent to that of the Zinc Corporation at Broken Hill, and in British Titan Products Co. Ltd. in which we have a 30 per cent interest.

'Capital expenditure during the year on buildings, plant and equipment amounted to £1,352,839, of which more than half related to the extension of the plants at Cockle Creek in New South Wales for the production of acid and superphosphate, and at Stradbroke Island, Queensland, for the production of rutile and zircon. The programme of work at Stradbroke was slightly delayed with labour and shipping troubles, but production on a greatly increased scale commenced in the second quarter of 1956.

Imperial Smelting Process

'In the United Kingdom, Imperial Smelting Corporation has continued its development of the Imperial Smelting Process with particular emphasis on the smelting of zinc in association with lead and other metals. The progress has been encouraging and considerable interest is being shown by a number of mining and smelting interests overseas.'

The directors' report goes on to summarize the activities of the various sections of Consolidated Zinc.

The Imperial Smelting Corporation's output of sulphuric acid for 1955 was slightly lower than the record production made in 1954. Virtually the whole of this decrease was caused by the rail strike and the Merseyside dock strike. The prospects for 1956 are believed to be good.

Chlorofluorocarbon chemicals, under the trade name of Isecons are being produced and a new and larger plant which will be in production by early 1957 is under construction.

MR. ROBERT D. LAWRIE (60), foundry manager of Distington Engineering Co. Ltd., Workington, died on 25 May 1956. He took up his appointment with Distington Engineering Co. in March 1952. He is survived by Mrs. Lawrie, a son and daughter.

Publications & Announcements

A CATALOGUE, recently issued by Barlow-Whitney Ltd., of London and Bletchley, describes a range of their smaller and portable industrial heating equipment with wide applications in many industries ranging from radio to rubber, plastics to printing, and aircraft to artificial silk. The appliances, which include glue pots, wax pots and droppers, plastic dip pots and tanks, immersion heaters, hotplates, tinning pots, metal pots, soldering irons, ladles, muffles, furnaces, ovens, kettles, wax tanks, and air heaters are all electrically heated and have automatic thermostatic controls to ensure correct working temperatures. It is claimed that there is Barlow-Whitney equipment for practically every type of industrial heating process and the applications specifically mentioned include melting glue and lead, dip tinning and soldering, impregnating with hot compounds or waxes, curing, drying, stoving, annealing, tempering, and heating liquids of all kinds. Copies of the brochure, which contains many illustrations and technical data, are obtainable from 2 Dorset Square, London NW1.

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IN A COLOURFUL and liberally illustrated 63-page brochure, Simon-Carves Ltd. succeed in outlining the company's practice in coke oven design. The brochure also describes some of the major coke oven contracts received by the company since the war, including plants completed and those at present in the course of design or construction. Among such plants described in words and pictures is the coking plant at the steelworks of the Tata Iron & Steel Co., at Jamshedpur, India, the plant comprising 40 compound ovens of the Great Lakes Carbon Corporation at St. Louis, Missouri, and the plant at Billingham where Simon-Carves have carried out five contracts since 1928, and where 60 of the company's coke ovens are now in service. The brochure can be had on application to Simon-Carves Ltd., at Cheadle Heath, Stockport, Cheshire.

* * *

A BOOKLET describing Plessiflex metallic, seamless, flexible hose has been issued by Power Auxiliaries Ltd. It gives details of potential applications, together with technical data including information on construction and assembly. Plessiflex is said to be

of particular value for the conveyance of liquids or gases at high pressures between junctions which may expand, vibrate, move angularly, or be exposed to high temperatures. It is a continuous, convoluted, seamless metal tube and is produced in various materials including stainless steel and brass. It is covered with single or double wire braid, according to requirements. Copies of the brochure can be obtained from Power Auxiliaries Ltd., Kembrey Street, Swindon.

* * *

DATA on the distribution of iodine in the lithosphere are correlated in 'Geochemistry of Iodine' a bibliography from 1824 to 1954 published by the Chilean Iodine Education Bureau, Stone House, Bishopsgate, London EC2. The iodine chemistry of sea and land waters and of the gaseous atmosphere will be dealt with in a later publication. This book consists of three principal sections: an annotated bibliography of 400 scientific papers known to contain qualitative or quantitative facts about the presence of iodine in the inorganic world; a succession of 20 tables in which these data have been systematically classified; and a review which attempts to summarize and interpret the analytical findings thus assembled. Each one of the 400 papers cited has been individually examined and every paper previously published has been traced to its original source. In the bibliographical section the same rules and standards of spelling, abbreviation, terminology and typography have been observed as in 'Iodine and Plant Life' and 'Iodine Content of Plant Foods.'

* * *

TWO new data sheets on silicones have been issued by Imperial Chemical Industries Ltd. These describe elastomer class E 340 and emulsion M 461. There are at present three members of the E 340 class of silicone rubbers, of 60, 70 and 80 Shore hardness. These materials are claimed to have excellent low compression set characteristics and superior oil resistance compared with other silicone rubbers. They have been designed specifically for O-ring and gasket application in contact with petroleum oils and many hydraulic fluids, both water and organic based. Emulsion M 461 is an oil-in-water emulsion of a silicone fluid and is

specifically designed as a mould lubricant for use in glass manufacture. It is fortified with colloidal graphite in an amount which experience has shown to be universally applicable. Full information on the applications of this material is given in silicones applications data sheet Si.A 28 entitled 'Silicones in the Glass Industry'.

* * *

A LARGE selection of the range of Fleming safety goggles are illustrated in a 32-page booklet recently issued by Fleming Safety Goggles, a division of J. & R. Fleming Ltd., of London, who have specialized in the manufacture of products to aid and protect vision in the past 50 years. The end section of the booklet lists and describes dust respirators.

* * *

ALL the chemicals produced by British Hydrocarbon Chemicals Ltd., a company jointly owned by BP Ltd., and the Distillers Co. Ltd., are intermediates, mostly colourless liquids or gases used in the manufacture of complex compounds. A description of the chemicals used and produced, with brief notes on processes, at the Grangemouth, Scotland, plant is described in a coloured 24-page booklet which can be obtained free of charge from The Distillers Co. Ltd., Devonshire House, Mayfair Place, Piccadilly, London W1.

* * *

A BOOKLET giving details of the company's range of 18 in. diameter industrial plant in glass units has been issued by QVF Ltd. This equipment is introduced to extend the range and scope of glass absorption, fractionating and wash towers, but the 18 in. diameter columns and pipe sections are claimed to be suitable for use under full-vacuum conditions and for positive

pressures up to 6 lb./sq. in. gauge. Incorporated in the British Standards Specification 2598:1955, the 18-in. industrial plant in glass is featured in the booklet, which gives a typical layout of an 18-in. diameter fractionating tower.

* * *

DETAILED technical information on the application of Textone (sodium chlorite) in textile processing is contained in a new booklet available from Olin Mathieson Chemical Corporation. The 16 page, file size booklet describes the use of Textone, a powerful oxidizing agent, in the bleaching of cottons and synthetic fibres, the oxidation of vat and sulphur dyes, and the stripping of nylon in hosiery mill procedure. The booklet may be obtained by writing on your company letterhead to Industrial Chemicals Division, Olin Mathieson Chemical Corporation, Baltimore 3, Maryland.

* * *

A BULLETIN to supplement the company's technical booklet on tower packings has been issued by Weinreb & Randall Ltd., chemical and distillation engineers. It outlines new developments such as the slot-wall ring in metal; Wirbelstron rings and super Berl saddle in ceramic; Spraypak; laboratory packings; high alumina balls for grinding, catalyst support and heat transfer. The slot-wall ring is said to permit 40 per cent greater throughput than conventional types with higher efficiency. The higher production cost of this type is claimed to be more than offset by reduction in volume for the same duty, with saving in metal both of the packing and of the column shell, especially where stainless steel must be used. They are particularly suitable for vacuum distillation by virtue of the low pressure drop. The ceramic equivalents have similar advantages.

Manufacturers' Agents for:

Importers of Produce from:

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15 DEVONSHIRE ROW, BISHOPSGATE, LONDON, E.C.2.

Telephone: Bishopsgate 4333 (10 lines) Telex: London 8466 Telegrams and Cables: "Jasmine London"

BISRA Annual Report

Membership Increasing

THE 12th Annual Report of the British Iron and Steel Research Association announces that there has been an increase in the year 1955 of 19 ordinary members and 32 associate members, making a total membership of 400.

In response to a request, the British Iron and Steel Federation increased its grant to BISRA by £50,000 to £450,000 in the spring of 1955. In addition the Committee of the Privy Council for Scientific and Industrial Research has offered an increase for 1956 and 1957 of £25,000 per annum over the present block grant of £75,000, provided that a minimum industrial income of £450,000 is raised. This offer has been accepted by the council of BISRA.

Part of the work carried out by the chemistry department of BISRA has been concerned with the effects of small amounts of alloying elements on the corrosion resistance of mild steel. The improvement resulting from suitable additions has been found to be greater for atmospheric exposure than for immersion in sea water. The most useful alloying elements for atmospheric exposure are chromium, copper and nickel; for sea water immersion the most efficient is chromium.

In collaboration with the Institution of Water Engineers, tests are being conducted on the corrosion of steel by portable waters. A special fitting to hold specimens of steel has been designed for inserting in a water main. These fittings have been supplied to several water undertakings and the tests will proceed for one year.

During its first year's existence the Corrosion Advice Bureau has received 24 enquiries from members of the association and 142 from non-members. The Bureau was able to give advice in most cases.

To Ignore Knowledge 'Is Industrial Suicide'

Speaking at the laying of foundation stones ceremony at the new Cleveland Technical College, Redcar, Yorkshire, earlier this month, Sir Alexander Fleck, chairman of ICI Ltd., said that to ignore the flow of scientific knowledge was to commit commercial and industrial suicide. Two foundation stones were laid at the ceremony, one by Sir Alexander, the other by Mr. E. T. Judge, chief engineer and director of Dorman, Long & Co.



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HOME

Senior Buyers' Course

Purchasing Officers' Association is running a senior buyers' course at Ashorne Hill, near Leamington Spa, from 7 to 11 November. The course is intended to give senior buyers in industrial and public undertakings the opportunity of studying the various aspects of their function, in company with others of similar experience drawn from as wide a cross-section of industry as possible. The number on the course will be limited to 50, but further courses will be arranged periodically. Mr. J. Ferguson, B.Sc.(Tech), M.P.O.A., Chloride Batteries Ltd., and chairman of the Association's education committee, will be course leader.

Change of Address

Due to the expansion of the company's sales organization, the Birmingham branch office of Midland Silicones Ltd. has moved from Oldbury to larger and more central premises at Union Chambers, 63 Temple Row, Birmingham 2 (Midland 7705).

New Pesticide

Research organization of the Geigy Co. Ltd., Middleton, Manchester, has now perfected a carefully formulated combination of DDT, dimetan and other ingredients specific against fungal diseases and also effective against most of the common insect pests—including aphids. This new product, 'Guesarex', is a multi-purpose garden dust to be used by the gardener as an all-round treatment and is applied directly from a new type of puffer-pack.

Change of Address

From 22 June the divisional offices of Hilger & Watts Ltd. at 48 Aldington Street, London, SE5, will be closed, and the sales and administrative departments of the company will be combined at 98 St. Pancras Way, Camden Road, London, NW1. The telephone number will be GULliver 5636, the telegraphic address, Sphericity London Telex, and the Telex number, 2-3052.

Industrial Disputes

According to the *Ministry of Labour Gazette* for May, the number of stoppages of work due to industrial disputes reported

as beginning in 1955 amounted to nine in the chemical and allied trades. Number of workers involved was 2,700 and the aggregate number of working days lost was 15,000. Total number of stoppages reported to the Ministry of Labour as having begun in 1955 was 2,419, compared with 1,989 in the previous year. The number of people in civil employment in Great Britain rose during March by 3,000 to 22,954,000 at the end of the month. Index of weekly rates of wages, based on June 1947 (taken as 100), was 163 at the end of April. The retail prices index was 103 at 17 April compared with 101 at 13 March. Number employed in the chemical and allied trades at the end of March was 525.6 thousand.

Oiling Systems

Bowser Oil Lubricating & Filtration Systems are now being made and marketed in this country by Liquid Systems Limited, Union Road, Croydon. Bowser, the world's oldest manufacturer of oiling systems, have made available to Liquid Systems all their 40 years' experience in this field.

New Protection Mask

The new Itex dust filter, now being marketed by Safety Service Co. will be welcomed by those who need protection at work against ordinary non-toxic dusts and spraying hazards. This lightweight protective mask is made from flexible sponge material which, it is said, enables the mask to mould itself to all facial contours.

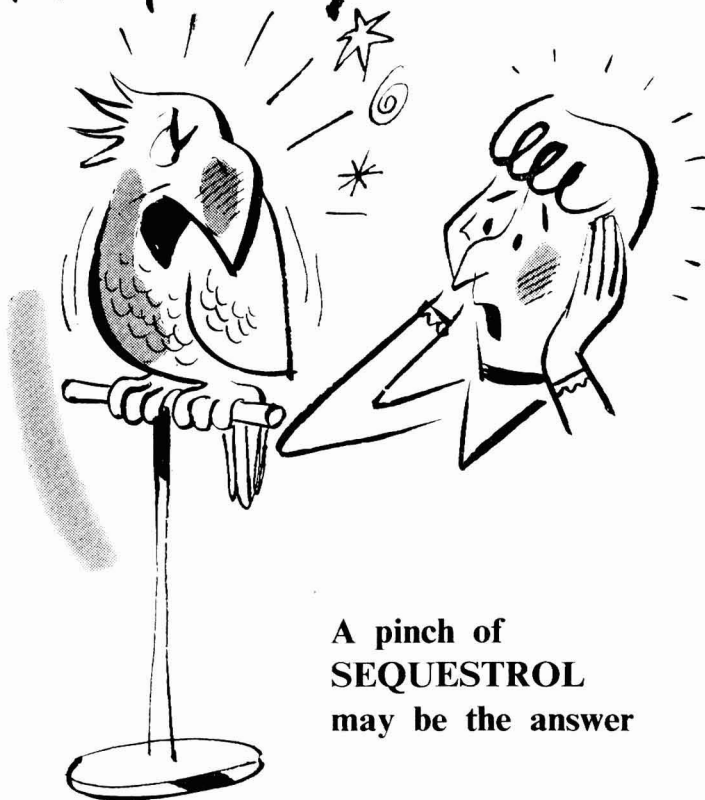
Breathing Apparatus

Soon to be introduced for the first time in Great Britain by Panorama Equipment Ltd. is the German Draeger Semi-Mask No. 74. The firm of Draeger-Werk in Germany produce a wide range of breathing apparatus which, although well known in many parts of the world, has not been brought to this country.

Non-Selective Weedkiller

The non-selective weedkiller, Polybor Chlorate, made by Borax Consolidated Ltd., a combination of sodium borates with sodium chlorate specially formulated to remove fire risk, is now available in 1 lb., 2 lb. and 7 lb. bags. Previously, it has been supplied only in bulk to large-scale users.

Lack of Purity...?



**A pinch of
SEQUESTROL
may be the answer**

Many chemicals, both organic and inorganic, are difficult to free from the last traces of heavy metals such as copper and iron. By the use of SEQUESTROL (ethylene-diamine-tetra-acetic acid Geigy) it is often possible to maintain such impurities in complete solution during a precipitation or crystallisation, thus avoiding tedious purification. Enquiries are welcomed.

THE GEIGY COMPANY LTD. Rhodes, Middleton, MANCHESTER



E19

Law & Company News

Commercial Intelligence

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

New Registrations

Leek Chemicals Ltd.

Private company. (566,687). Registered 29 May. Capital £100,000 in £1 shares. Objects: To enter into an agreement with Sir Thomas and Arthur Wardle Ltd., and to carry on the business of manufacturers of and dealers in chemicals of all kinds, weed killers, insecticides, detergents etc. Directors: Gilbert Tatton, Grange Cottage, Newcastle Road, Leek, managing director of Sir Thomas and Arthur Wardle Ltd.; John W. Reeves, 52 Newcastle Road, Leek; and Francis N. Morris, Bank House, Calton, Stoke-on-Trent. Secretary: F. J. Bode. Solicitors: William Sturgess & Co., 58 Victoria Street, London SW1. Registered office: Bridge End Works, Macclesfield Road, Leek, Staffs.

Winthrop Laboratories Ltd.

Private company. (566,871). Registered 31 May. Capital £10,000 in £1 shares. Objects: To act as production or general managers for, or as consultants to, any company carrying on any business which the company is entitled to carry on. To carry on business as manufacturers of and dealers in substances used in medicine, pharmacy, perfumery and toilet articles of all kinds etc. The subscribers (each with one share) are: James A. Mallows and Patrick J. Gaynor, solicitors, of 12 Whitehall, London SW1. The first directors are to be appointed by the subscribers. Solicitors: McKenna & Co., 12 Whitehall, London SW1.

Mobile Proofs Ltd.

Private company. (566,856). Registered 31 May. Capital £2,000 in £1 shares. Objects: To carry on the business of operators of compressor units for spraying shop blinds and the like with water- and rot-proofing chemicals etc. Directors: Ray F. P. A. McNulty and Mrs. Joan P. McNulty, both of 116 Palace View, Bromley, Kent; and Mrs. Clara S. N. V. H. McNulty, 78 Edgeley Road, London SW4. Secretary: Joan P. McNulty. Solicitors: F. W. Moss,

4 Wharf Street, Godalming. Registered office: Rushwood House, 4 Wharf Street, Godalming.

Company News

Reckitt & Colman Holdings

Reckitt & Colman Holdings is paying a final dividend of 7 per cent, making a total of 11 per cent for 1955. The total distribution for 1954 was also 11 per cent, including a special bonus of 1 per cent. Group trading profit and other income increased from £2,826,806 in 1954 to £3,144,969, after providing £4,077,356 (against £3,541,449) for taxation.

Burmah Oil Co. Ltd.

Group profit of Burmah Oil Co. Ltd. in 1955 was £6,018,174, an increase of £886,963 over 1954. Trade in all areas through the subsidiaries and through Burmah-Shell amounted to over 1,500,000 tons of petroleum products, an increase of 12 per cent. A total of £9,250,909 in dividends and interest, an increase of £5,022,904, was due mainly to larger dividends received from British Petroleum and from trade investments. Total income, after depreciation, was £13,632,789, compared with £8,083,053 in 1954. Dividend on the £41,209,540 ordinary is 17½ per cent, compared with 21 per cent paid for 1954 on half the present capital.

Celanese Corp. Dividend

Directors of Celanese Corp. of America have declared a dividend of 12-1/2 cents a share on the common stock, payable June 22 1956 to holders on record June 4 1956. The board have also voted regular quarterly dividends of \$1.12-1/2 on the Preferred Stock, Series A, and \$1.75 on the 7 per cent Second Preferred Stock. Both preferred stock dividends are payable July 1 1956 to holders of record June 4 1956.

Sadler & Co.

The directors of Sadler & Co., chemical manufacturers, of Middlesbrough and Evenwood, propose a final dividend of 5 per cent, making a total of 10 per cent, less tax, for the year. The proposed dividend repre-

[continued on page 1292]

PERMUTIT

ION EXCHANGE MATERIALS

Ion Exchange today performs many tasks in industry, and Permutit manufactures a wide range of these materials. Their application in roles distinct from water treatment has resulted in the development of numerous new industrial processes giving improved results and lower running costs. Some of the materials now available, with their characteristics, are shown below.

ZEO-KARB Na A sulphonated coal product containing both strong and weak acid groups.

ZEO-KARB 215 A nuclear sulphonated phenol resin containing also hydroxyl groups.

ZEO-KARB 225 A unifunctional cross linked sulphonated polystyrene resin in bead form of high capacity and exceptional chemical and physical stability.

ZEO-KARB 226 A unifunctional cross linked methacrylic acid resin in bead form containing only carboxyl groups as the ion active groups.

DE-ACIDITE E A high capacity anion exchange material of medium basicity.

DE-ACIDITE FF A unifunctional very highly basic anion exchange resin in bead form based on cross linked polystyrene and containing quaternary ammonium groups.

DE-ACIDITE G A unifunctional weakly basic exchange resin in bead form based on cross linked polystyrene and containing diethylamino groups.

DE-ACIDITE H A material similar to "De-Acidite G" but containing dimethylamino groups.

BIO-DEMINTROLIT A mixed cation and anion exchange resin for demineralisation in a single column.

DECALSO F A synthetic sodium aluminium silicate suitable for the separation and concentration of vitamins and hormones.

DECOLORITE-ASMIT A resin of high porosity for removing colour from solutions.

PERMAPLEX C-10 A highly selective cation exchange resin membrane containing SO_3H groups.

PERMAPLEX A-10 A highly selective anion exchange resin membrane containing quaternary ammonium groups.

For full technical information please write to:—

THE PERMUTIT COMPANY LIMITED

Dept. V.A. 150, Permutit House, Gunnersbury Ave., London, W.4. Tel: CH1swick 6431

Company News

continued from page 1290

sents an increase to the shareholders, as it was decided last July to issue bonus shares on the basis of one for every two shares then held. Mr. C. N. Sadler, chairman, reports a group surplus of £168,004, from which it is proposed to allocate £9,295 for the payment of the final dividend of 5 per cent, leaving £158,709 to be carried forward to next year. Mr. Sadler reports that each operating company has been able to pay a satisfactory dividend to the parent company, with the exception of Sadler & Co. (Chemicals) Ltd., which, following an ambitious scheme of renovations, additions and repairs, had incurred an initial loss of £17,506.

Lacrinoid Products Ltd.

The trading profit of Lacrinoid Products Ltd., plastics manufacturers, for 1955 increased from £41,123 to £54,969 and the net profit before taxation from £23,139 to £34,475. Dividend is being maintained at 10 per cent and the undivided profit carried forward has increased from £19,235 to £30,165.

Borax (Holdings) Ltd.

In the six months to 31 March 1956, Borax (Holdings) Ltd. trading profit was £1,408,956, profit before taxation being £1,460,772. These figures are included in the preliminary trading results (subject to audit) just issued by the company. The directors state that, based on results to date, the profits for the year to 30 September 1956 should exceed the group profits of the previous year.

Ashe Chemical Ltd.

The directors of Ashe Chemical Ltd. are recommending the payment of a final dividend of 9 per cent, less income tax at 8s 6d in the £, on the ordinary capital of £273,204. This, together with the interim dividend of 6 per cent, makes a total of 15 per cent in respect of the year to 31 December 1955. The above dividend will be payable on 9 July to members on the register as at the close of business on 4 June. The agm of the company will be held on 29 June.

Union Carbide Plant Contract

Union Carbide & Carbon Corporation has signed a contract with the Rubber Producing Facilities Disposal Commission for the purchase, at the price of \$3,125,000, of the government-owned alcohol-butadiene plant at Louisville, Kentucky.

Market Reports

LONDON.—A steady buying interest has been reported from most sections of the market and there has been a good movement of supplies against contracts. Price changes have been few and mainly affect the non-ferrous metal compounds. The basis price for dry white lead is currently quoted at £143 10s per ton, a drop of 45s per ton. Red lead is quoted at £138 per ton and litharge at £140 per ton. At the time of this report, the price of Copper Sulphate is £100 10s per ton f.o.b., less 2 per cent. Quotations generally have a firm undertone against a background of higher production and freight costs. Business in the coal-tar products market continues to be of satisfactory dimensions with the tar acids in good demand both for home and export account.

MANCHESTER.—A fair number of enquiries for the bread-and-butter lines of chemicals, from home users as well as from shippers, has been reported on the Manchester market during the past week. Caustic soda, soda ash and most other soda compounds are being called for steadily against contracts, and delivery specifications for the potash, ammonia and magnesia compounds are, on the whole, also circulating freely. Quotations generally maintain a steady front. Only a moderate weight of fresh business is reported in fertilizers, but in both the light and heavy tar products, with few exceptions, steady pressure for supplies is reported.

GLASGOW.—Continued improvement has to be reported during the past week from most sections of the Scottish heavy chemical market. Demands both for spot and contract deliveries have been firmly maintained. On the agricultural side, considerable activity has again been shown in relation to reasonable demands. Prices have remained fairly steady, although some slight increases have been made.

Kellogg Reduces Prices

The M.W. Kellogg Co. announces price reductions of more than 30 per cent on its fluorocarbon rubbers, as from 1 June 1956. The new price per lb. schedule for KEL-F elastomer is: \$16.00 in 1-99 lb. lots; \$15.50 for 100-1,990 lb. orders; and \$15.00 for orders of 2,000 lb. and over.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

THE NATIONAL INDUSTRIAL FUEL EFFICIENCY SERVICE invites applications for posts as **ENGINEERING ASSISTANTS**. The minimum qualification is either the National Certificate or Inter. B.Sc. in any branch of engineering or science, particularly in fuel technology. Industrial experience will be an advantage.

Vacancies exist in London and Cardiff, Manchester and Dundee provincial Area Offices. Salary band in London will be from £678 10. 0d. p.a. (age 25) to £845 p.a. and elsewhere £663 10. 0d. p.a. to £820 p.a.

N.I.F.E.S. Engineering Assistants are encouraged to make themselves eligible for promotion by obtaining the necessary qualifications.

Successful candidates will be required to serve a probationary period of not more than one year and will become Members of the Company's Superannuation Scheme after one year's service. Application forms may be obtained from **THE NATIONAL INDUSTRIAL FUEL EFFICIENCY SERVICE, DEPT. E.A., 71 GROSVENOR STREET, LONDON, W.1.**

HER MAJESTY'S OVERSEA CIVIL SERVICE

CHEMIST, GEOLOGICAL SURVEY OF UGANDA.

QUALIFICATIONS—1st or good 2nd Class Honours Degree in Chemistry. Candidates must be prepared to spend the greater part of their time on analysis of ores, minerals and rocks. Preference will be given to candidates with experience in such work.

DUTIES—Analysis of ores, rocks and minerals, with particular reference to the ores of tungsten, beryl, niobium and tantalums and analyses of limestones; to work in close co-operation with the department's ore-dressing laboratory.

TERMS OF APPOINTMENT—On permanent and pensionable or contract/gratuity terms with emoluments in the scale £816-£1,620 per annum. Variable cost-of-living allowance. Outfit allowance. Free passages. Quarters provided at rental. Generous leave. Free medical attention. Income tax at local rates.

Apply to:

**DIRECTOR OF RECRUITMENT,
COLONIAL OFFICE,
LONDON, S.W.1.**

State age, qualifications and experience.
Quote BCD105/9/06.

WILTON



WORKS

Applications are invited from

GRADUATE CHEMISTS

or

CHEMICAL ENGINEERS

with a good Honours Degree, for employment in the planning and operation of the services and facilities required by a large integrated chemical factory.

Wilton Works is expanding fast, and new plants are being designed, constructed and brought into operation each year. It is situated at the foot of the Cleveland Hills and close to the North Yorkshire coast. There is a wide range of recreational facilities in the district, and among the many provided by the Company are golf, tennis and squash racquets.

The appointments are permanent and carry an attractive salary. There are contributory pension and profit-sharing schemes. Assistance can be given towards purchasing a house, and a contribution is made to the removal expenses of married men.

Applicants without industrial experience will receive consideration, as training facilities exist.

Apply for an application form to the Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting advertisement reference ICI/X/304/c

Situations Vacant—continued

THE Product Development and Technical Service Dept. of a company manufacturing chemical products for the Plastics, Rubber, Paint, and Lubricant trades requires a **CHEMIST** or **TECHNOLOGIST**, preferably with industrial experience in one of these fields, and possessing good personality. The work includes customer liaison, answering technical enquiries, and the preparation of technical literature. Salary in accordance with age and experience. Apply: **PERSONNEL MANAGER, A. BOAKE, ROBERTS & CO., LTD., CARPENTERS RD., LONDON, E.15**, marking envelope "Product Development".

RESEARCH CHEMIST wanted by progressive food organisation with laboratory in the City of London. The successful candidate will be required to work directly under the Chief Chemist on immediate and fundamental research problems arising from factories both at home and overseas. This post requires a man capable of working on his own initiative and of developing ideas up to the pilot plant stage. The work will be varied and a generous salary will be paid to the right man. Contributory pension scheme Apply stating previous experience and salary required to **BOX NO. C.A. 3476, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

**Oil and Chemical Plant Construction Project
MANAGERS AND SUPERVISORS
required for work in
Middle East, Far East and United Kingdom.**

VACANCIES exist for Managers and Supervisory Engineers capable of taking charge of field project organisations varying from a single plant or unit to projects comprising complete refineries with field forces consisting of upwards of 150 staff and 3,000 men.

Applicants must have held responsible positions in similar capacity and must have some years of experience in field construction of oil or chemical plants. Chief qualifications required are good organising and administrative ability, with sound knowledge of the following branches of Engineering activity: Drafting, Civil, Mechanical, Electrical, Welding, Vessels and Piping, Field Office Organisation covering staff, labour, costs and materials.

Top age-limit for work outside U.K. is 55 years. Applicants must be physically fit and prepared to reside at site of work with or without family for periods varying from 6 months to 2 to 3 years, according to the magnitude and location of the project. Salary and allowances will be substantial and commensurate with experience and ability of applicants.

Top men only need apply. Applications, giving details of past experience and positions held, should be marked "Confidential" and will be treated accordingly.

**CONSTRUCTION MANAGER (PROCESS PLANTS),
FOSTER WHEELER LIMITED,
3, IXWORTH PLACE,
LONDON, S.W.3.**

BILLINGHAM



DIVISION

GRADUATE CHEMISTS

are invited to apply for appointments in
RESEARCH, DEVELOPMENT
and
PRODUCTION

with the Billingham Division

Since its inception in the early 1920's Billingham Division has grown rapidly and today is one of the largest production units in the world. More than 60 products totalling some 2,000,000 tons are produced annually: the range includes fertilisers, industrial heavy chemicals, building materials and a wide variety of organic compounds.

A vigorous research and development group has played its part in the growth of the Division. Today, men of initiative, who are prepared to accept responsibility and who would be keen to enjoy the experience of contributing to the further expansion of this vital concern are required for work in the laboratories, in production, and in the techno-commercial field.

For these appointments, which are permanent and pensionable and which offer excellent prospects for advancement, a good honours degree is necessary.

The company operates a profit sharing scheme; it gives assistance towards house purchase and makes grants towards removal expenses for married men.

Please write giving age, details of qualifications and experience to the Staff Manager, Imperial Chemical Industries Limited, Billingham Division, Billingham, Co. Durham, quoting advertisement reference 0.6.

FOR SALE

BAKER-PERKINS STAINLESS STEEL Sigma 'Z' Jacketed Mixer, 29" x 27" x 22" with bottom outlet to each trough.

WERNER 'Z' MIXER, 21" x 20" x 19", with 5 h.p. A.C. Motor Drive.

25 GALLON Jacketed Enclosed M/S Vertical Cylindrical Mixer.

30 GALLON 4-speed Detachable Bowl, 3 h.p. Electric Mixer.

COPPER COATING PAN, 22" x 16".

GRINDING MILL, Stainless Steel, 8".

High Speed Vertical Plate Type.

WINKWORTH MACHINERY LTD., 65 High Street, Staines, Tel.: 1010.

BRAND New **COCHRAN** Vertical and **ECONOMIC** Self-contained **STEAM BOILERS** in stock, also all sizes reconditioned and guaranteed. List on request.

STAINLESS STEEL 30 in. **HYDRO**, also **TANKS, PANS, CONDENSERS, PLATES, VALVES AND COCKS** Very wide selection.

4 new ALUMINIUM CONDENSERS, 14 ft. long, 2ft. 3 1/2 in. dia., 336 tubes 1/2 in. o.d.

FRED WATKINS (BOILERS), LTD.,
COLEFORD, GLOS.

Phone: Coleford 2271/2.

CHARCOAL, ANIMAL AND VEGETABLE, Horticultural, burning, filtering, disinfecting, medicinal. Also lumps, ground and granulated. **THOMAS HILL-JONES, INVICTA WORKS, BOW COMMON LANE, LONDON, E.3 (TELEPHONE EAST 3285).**

MORTON, SON AND WARD, LIMITED,

STAINLESS STEEL VESSELS

VESSELS of all shapes and sizes, jacketed or unjacketed—with stainless steel mixing gear to requirements; also stainless steel storage tanks and vacuum vessels.

"MORWARD" "U"-shaped TROUGH MIXERS—up to 2 tons in stainless steel, with agitators, scroll or paddle type, jacketed or unjacketed.

Stainless Steel TROUGHS, TANKS and CYLINDERS made to requirements.

These items can also be fabricated in mild steel.

JACKETED PANS

100g., 150g., and 200g., new in mild steel, for 100 lb. p.s.i. w.p.—with or without mixing gear.

3 cwt. TROUGH MIXERS by **CHALMERS and GARDNER**—stainless steel lined troughs.

50g., 75g. and 100 g. heavy duty **MIXERS** by **FALLOWS and BATES**. Agitators driven through bevel gears from fast and loose pulley.

200g. cast-iron **JACKETED MIXING VESSEL** with nickel-chrome impeller type agitator driven through bevel gears from fast and loose pulley.

BROADBENT HYDRO EXTRACTORS

21" **EQUAL TO NEW**, galvanized baskets, electrically driven through centrifugal clutch or belt driven Safety inter-locks.

PUMPS

Selection of new **MONO** and second-hand Pumps in stock—2 in. to 5 in.

Inquiries Invited.

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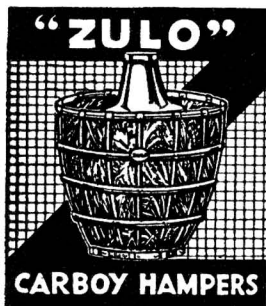
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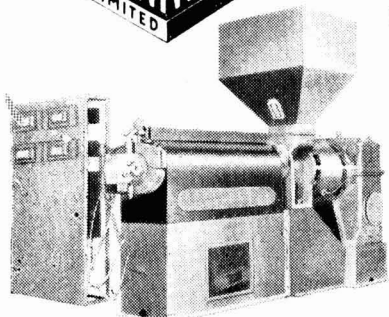
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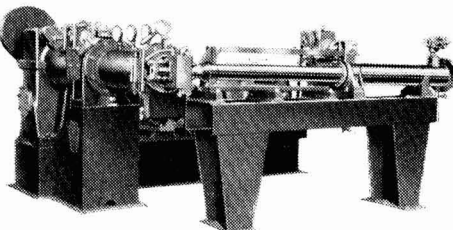


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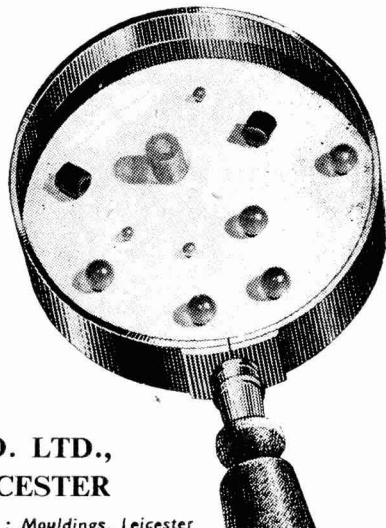
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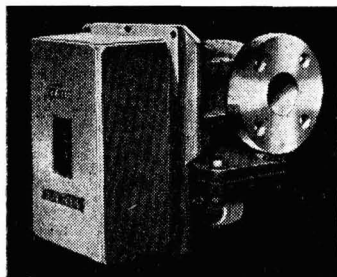
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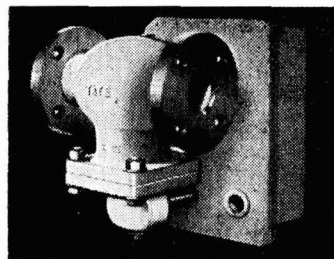
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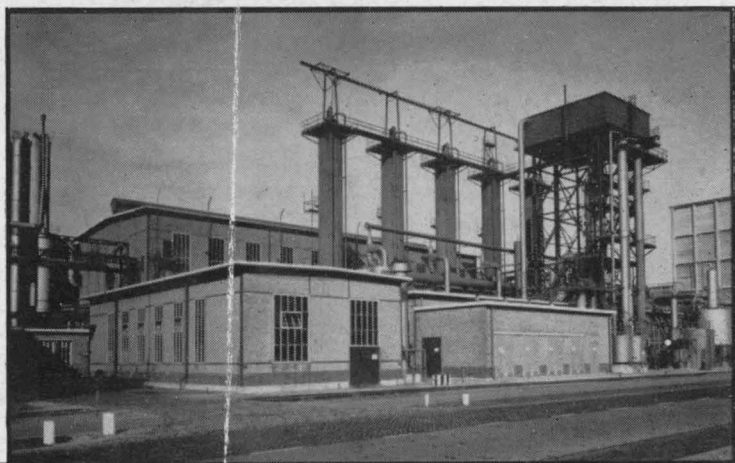


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