

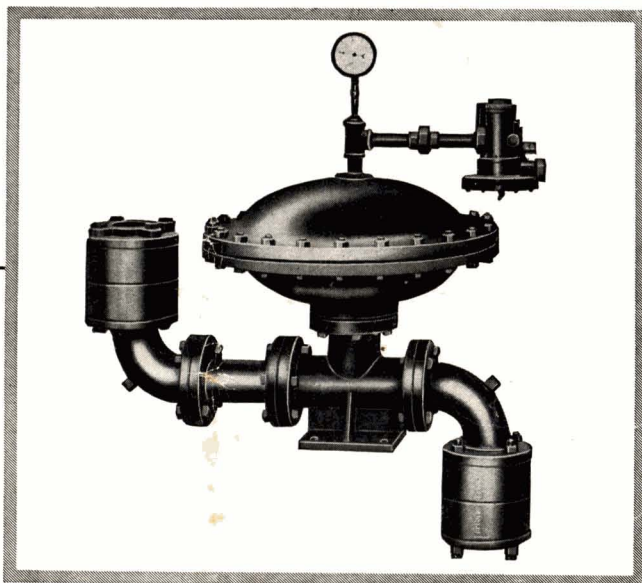
# The Chemical Age

VOL. LXXVI No. 1947

3 November 1956

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(See page 205)



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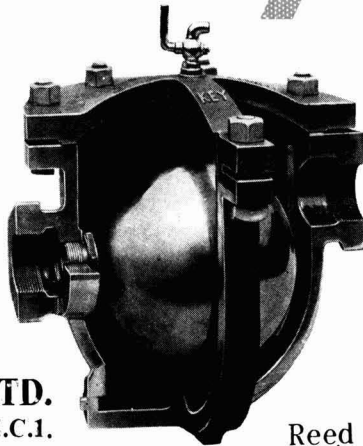
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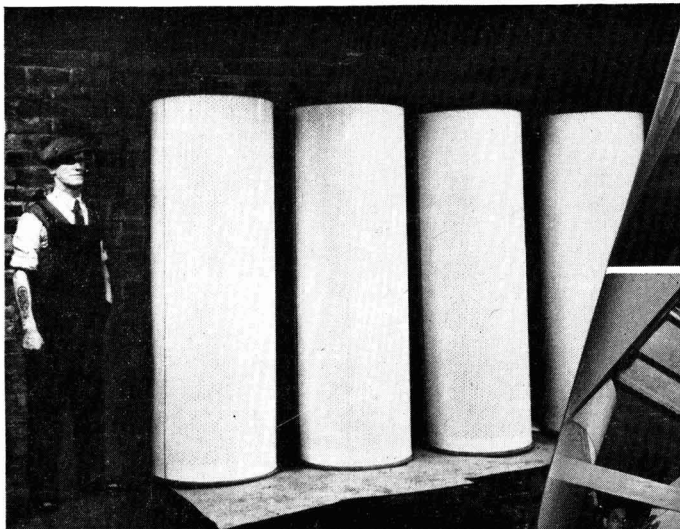
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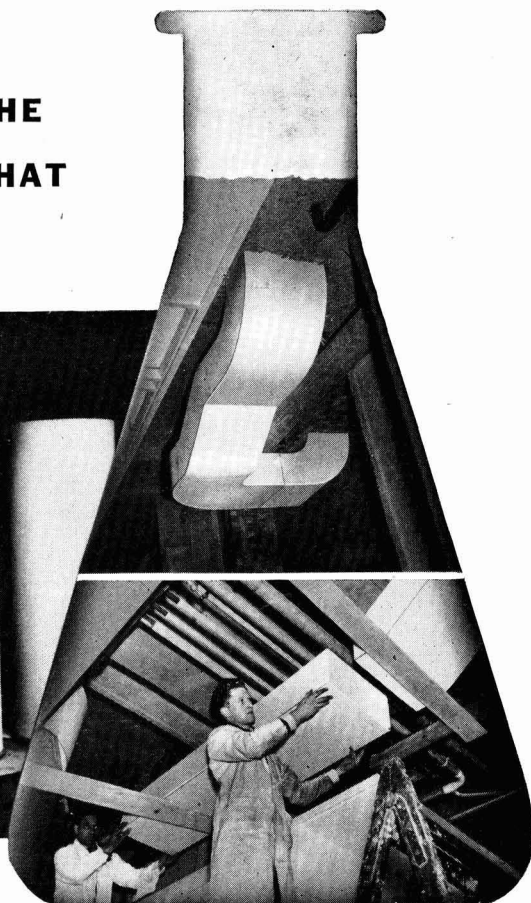
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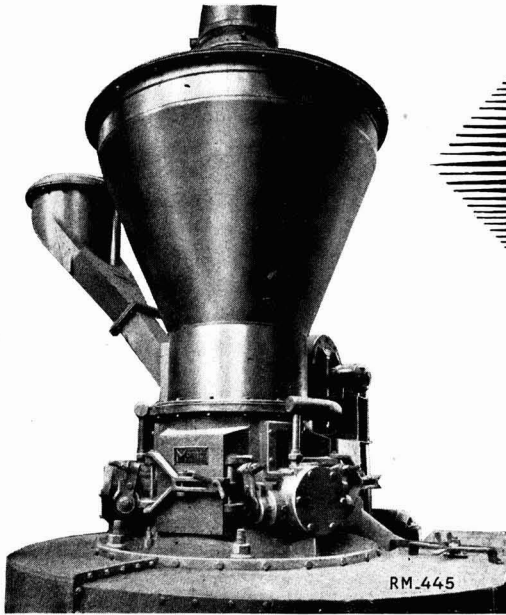
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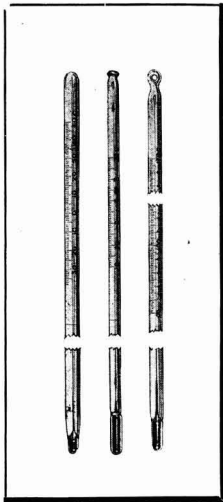
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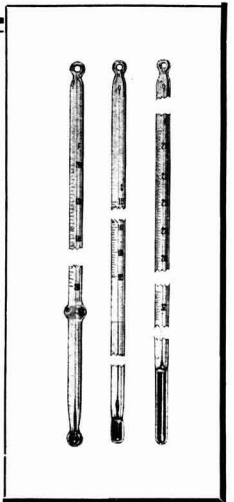
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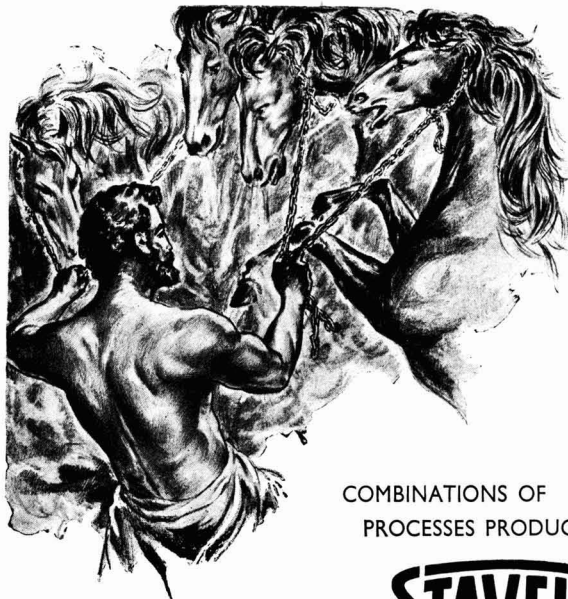
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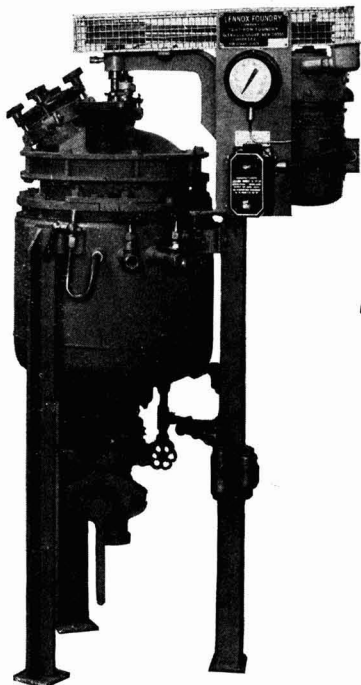
Hercules contrived the death of the King (after capturing the horses in their mountain fastnesses) by throwing the head monarch into their corral. Afterwards he turned the horses loose individually and other wild beasts devoured them in turn.

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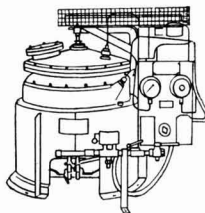


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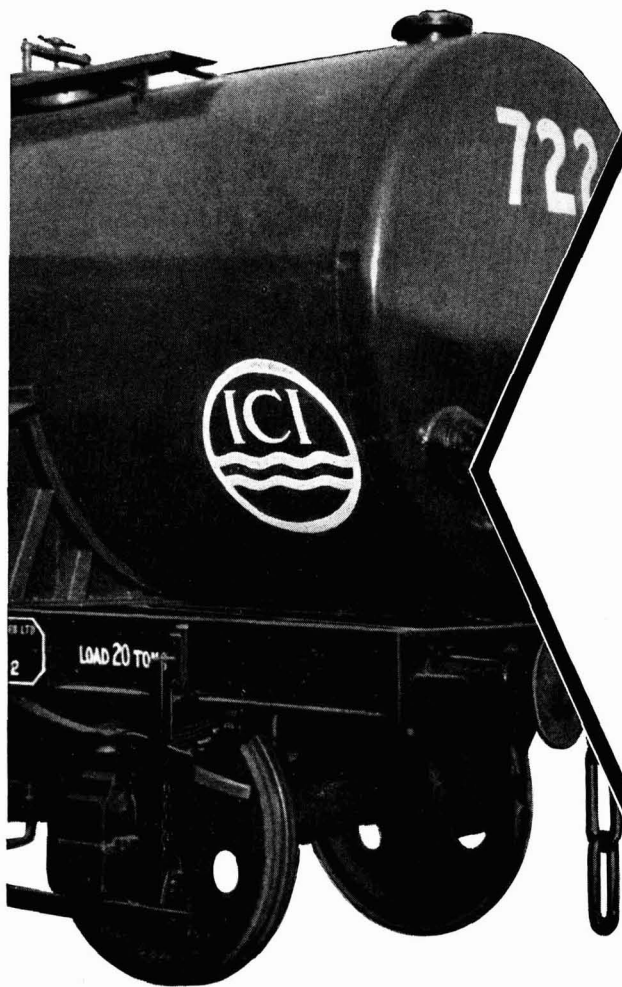
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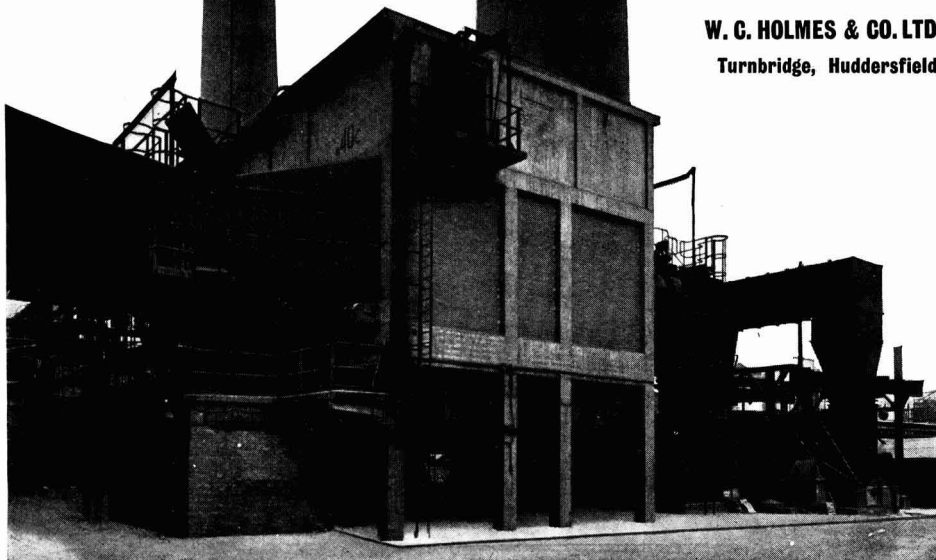
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## VIEWPOINT

# Chemical Education

VIEWS expressed at the RIC conference on the Education and Training of the Chemist on 26 October are particularly important when considered in relation to the recent report of the Scientific Manpower Committee, considered in this issue (see p. 209). This states that the annual gross flow of graduates in basic and applied sciences is a little over 10,000. By 1959 this number should rise to 12,000 a year. However, to meet estimated demands the average annual flow from 1960 to 1965 would have to reach 16,000.

The report states also that of the total of qualified scientists and engineers employed in the UK, manufacturing industry absorbs 43 per cent, and nationalised industries 12½ per cent. Two-thirds of the qualified personnel in industry are in chemical industry.

It is obvious from Dr. Neville Booth's paper (*Some Views of Industrial Employers*), at the RIC conference, that the chemical industry is seeking, firstly, chemists having a sound training in the fundamentals and, secondly, men so educated that they can acquire an understanding of the problems of industry. He made the suggestion that there might be a common course lasting two years and a third year in which the student could continue the type of course now in vogue or an alternative course aimed at training the student in tackling practical problems. A second suggestion was that there might be a three-year course, as at present, with a finishing year in research or in applied industrial chemistry.

Sir Owen Wansborough-Jones, Chief Scientist, Ministry of Supply, speaking on the needs of Government Service for chemists, said that the chemists required were those who, besides being well qualified, had a very good understanding of discipline and an ability to think.

Dealing with the universities' place in training chemists, Professor E. G. Cox, University of Leeds, considered that if it took more time initially for students to absorb modern theory, the ultimate systematisation of ideas eventually saved time. He also said that departments of pure chemistry had been relieved of obligations to provide instruction on chemistry's industrial aspects by the separate development of technical colleges.

Professor Cox disagreed with Dr. Booth about students deciding at an early date their future career in chemistry. Another suggestion with grave implications was that while in general he was against reducing time spent on practical work for most students, it might be decreased for the more able students.

Spokesman for the technical colleges was Dr. E. G.

Edwards, Principal, City of Liverpool College of Technology, who was concerned with the development of students entering industry direct, but who had potentials equal to full-time students. He said a major question that had now arisen was whether there was scope for the sandwich-type of course for chemical industry, with alternative periods in industry and college. He hoped the chemical industry would help in planning the future of such courses.

Needs of the schools were dealt with by Sir Eric James, High Master, Manchester Grammar School. He considered there was not much wrong with the teaching of science in schools, as evidenced by the fact that this country was producing more chemists than Western Europe. This would seem to be a very short-sighted view, when chemical education in the US and USSR is considered. He pointed out that science could not be taught either efficiently or humanely if no really good people go into science teaching. He also put in a plea for those schools with scientific departments suffering from lack of equipment and he appealed for funds from industry.

Discussion on these papers was opened by Professor T. S. Wheeler, Professor of Chemistry, University College, Dublin. He took the view that Dr. Booth's proposals suggested lowered university standards. Quite bluntly, he stated that the universities could not drop their standards.

An interesting discussion on these papers ensued but it was apparent that there was no close contact between chemical industry and technical colleges on the one hand and the universities and the RIC on the other. Despite the urgent need for more scientists, the universities seem to wish to keep the courses which 'alpha-type' undergraduates (at the most amounting to 10 per cent of students) can take in their stride. The good solid 'beta-men' (excellent material according to the spokesmen for industry) would be left to struggle on gaining indifferent degrees or failing to graduate.

A remark by Dr. D. C. Griffith, Bolton Technical College, about a marked gap between university training and chemical industry's needs, gave rise to much comment. Speakers from the industry made it quite evident that because a man is well qualified academically, it is no guarantee that he has the ability to think, to plan experiments or to administer a section or department. Is this because such a man is the product of cramming? It seems likely that the 'beta-man' succeeds in industry because, being aware of his shortcomings, he tends to seek all possible avenues of study and, indeed, now appears to be the chemical industry's main hope for the future.

## European Customs Union

### ICI Executive Discusses Britain's Position

SPEAKING at the presentation of awards to long-service employees at Billingham works of Imperial Chemical Industries Ltd., Mr. D. M. Bell, commercial managing director, expressed the belief that Britain would join the proposed European Customs Union. He suggested that the Government considered that the advantages of the plan outweighed its disadvantages.

If Britain stayed outside the proposed union, much trade would be lost and Britain would have to rely almost entirely on the Empire to maintain its standard of living. There were already strong indications that Canada, Australia and India were raising tariffs against Britain to support their own industries, so that imperial preference was, to a certain extent, on its way out.

Under the proposed customs union, continued Mr. Bell, large firms would become bigger and small firms would have a struggle to keep going. Germany would be a dangerous competitor. If tariffs were abolished, imports would increase, and they would be the sort of thing Germany could make better than Britain.

Britain would have to make certain there were enough things it could make better than others to pay for the increased imports. If the imports could not be paid for Britain would go down.

### NCB Plant Opened

THE MINISTER of Fuel and Power, Mr. Aubrey Jones, opened the Avenue carbonisation and chemical plant at Wingerworth, near Chesterfield, on Tuesday. Said to be the most modern and completely integrated carbonisation plant in Britain and probably in Europe, it was completed in four years at a cost of over £10 million.

A description of the plant will appear in next week's issue of THE CHEMICAL AGE.

### Extrusion Symposium

OPENING the Symposium on Extruded Rubbers and Plastics at the National College of Rubber Technology on 30 October, Mr. A. J. Pickett, editor of *The Rubber & Plastics Age*, sponsors of the symposium, said that he hoped as a result of the lectures that greater use would be made by local authorities and others of plastics pipes. The symposium was well attended.

## WORKS SAFETY IS 'GOOD BUSINESS'

### West German Minister's London Statement

'IN ALL COUNTRIES the view is gaining ground that the prevention of accidents goes hand in hand with the planning of production,' declared Professor Dr. S. Balke, West German Minister of Atomic Affairs, in London, on 29 October. The Minister, who is a professor of Munich University and a well-known expert on industrial safety, was addressing a meeting called by the ABCM to consider safety organisation in the German chemical industry.

He said safety from accidents necessitates intrinsic safety of the plant and accident prevention is no more than good business for management. In West Germany every works accident is estimated to result in a loss of about 20 working days.

### International Exchange

Dr. Balke declared that international exchange of experience and of the results of research work into accident prevention would lead to the improvement of works safety. Accidents which are directly connected with chemical operations are relatively rare; the main causes are to be found in transport, moving heavy goods etc.

Dealing with West German chemical industry, the Minister pointed out that the accidents per 1,000 insured persons are 99.65 for reported accidents as compared with 100.88 for all industry. About 40 accidents occur every million working hours. But the view that the world's chemical workers are exposed to worse conditions than the rest of the population is quite wrong. Support given by the International Federation of Trade Unions to the reduction of working hours because of the alleged special hazards in chemical industry is unjustified. Chemical industry in general may well have the lowest rate of accidents in relation to production, but the number of accidents is still far too high having regard to the present level of technology.

Development of chemical process technology has made it possible nowadays to control with complete safety, various reactions which were once considered dangerous. For example, the replacement of batch processes by continuous methods contributes greatly to works safety, remarked Dr. Balke.

Considering laboratory hazards, he thought that particular care should be taken in studying literature describing experiments because vital information might be omitted from extracts or abstracts.

The statistics of all industrial coun-

tries show that in general about 75 per cent of all accidents are avoidable; about 60 per cent could have been avoided by better works procedure and only about 15 per cent by the use of better technical arrangements. But many technologists believe that technical safety precautions can be considerably improved,' continued Dr. Balke.

Special risks connected with the materials used in chemical industry made it necessary for a worker to be specially trained in safe practices, declared the Minister, who then went on to discuss the psychological aspect of accident prevention, including training and propaganda.

In conclusion, he drew attention to the treatment and care of occupational diseases and protection against radioactive materials. Dr. Balke also displayed numerous examples of German safety posters and literature.

Dr. W. H. Garrett, chairman of the British Chemical Industry Safety Council, presided at the meeting.

### Rowett Institute

FIVE new laboratories were opened at the Rowett Institute, Aberdeen, on 20 October by Mr. Niall Macpherson, Under Secretary of State for Scotland. The laboratories include an applied nutrition laboratory and an applied biochemistry laboratory, both made available through the generosity of the Kellogg Foundation; two other buildings have been made available through gifts from British sources and the four other buildings are part of the national extension of research facilities.

Sir Alexander Fleck, chairman of Imperial Chemical Industries, speaking at the opening, stressed the ability of the Rowett Institute to reduce imports of feeding stuff materials, and so make money available for oil imports at a cost of between £600 and £1,000 million per year.

### Research Grant

THE University of Missouri has received a research grant of \$7,500 from Olin Mathieson Corp. of Little Rock, Arkansas, to support fundamental research to be conducted in the department of soils, College of Agriculture, it was announced recently by Dean John H. Longwell. Dean Longwell said the three year project was to be conducted under the direction of Dr. C. Merrill Woodruff, associate professor of soils, and the general supervision of Dr. William A. Albrecht, chairman of the department of soils.

# NOTE & COMMENT

## SALESMANSHIP FOR RCS

IF ANY further justification is needed for the plans to expand the Imperial College it may be found in *Research Report of the Royal College of Science 1953-56*. In a foreword to the report Professor P. M. S. Blackett, Dean of the Royal College of Science, says that a new physics department is being built and the chemistry and biology departments will expand into the present physics wing. Later on, when full development of the central site occurs, more new buildings will become available to the RCS. Even then we wonder if there will be sufficient space.

Twenty pages, out of a total of 63, are devoted to the department of chemistry, showing yet again that this is probably the most prolific branch of science, both in pure research and practical application. The departmental policy is to provide basic scientific information and to broaden understanding of the observed phenomena.

It is interesting to see that old prejudices die hard. RCS provides an excellent training in inorganic analytical chemistry. Nevertheless few students can be persuaded to take up this subject for post-graduate research. There is a case for a little salesmanship on the part of lecturers in analysis, both at RCS and elsewhere, if their subject is not to remain the Cinderella of science.

## FAIR OR FOUL ?

TRUTH of the old saying—adversity makes strange bedfellows—is borne out by the report in *THE CHEMICAL AGE* last week of a trade union resolution calling for an amendment to the law relating to river pollution. An official of the union appeared to be echoing remarks made in July by Sir Miles Thomas, chairman of Monsanto Chemicals Ltd., on the subject of 'sporting fish' in relation to effluents.

Monsanto has spent, and is spending, much time and money in trying to solve this problem. In addition it has paid nearly £20,000 in damages and costs to eight riparian owners on the river Dee in settlement of an action over alleged pollution of the river by effluent from its works at Ruabon. A perpetual injunction granted against the company has been suspended until 30 June 1958 to enable a means of dealing with effluents to be found. Sir Miles Thomas was reported as saying that it was important for the company to be given support because Britain must hold her own in world markets. The contrast was the interests and livelihood of 2,000 workers compared with a few sporting fish.

While appreciating the views of Sir Miles and the trade union official on this subject, we feel that the 'sporting fish' angle represents over-simplification.

More than fish is involved in river pollution by chemical factory effluents and certainly more than the livelihood of the employees and landowners.

Toxicity in a river may well be accumulative, leading to most undesirable conditions over a very wide area and, after all, processes which cannot apparently be operated without the creation of harmful effluents must be looked upon as technically incomplete. There has to be some limit to the principle that industrial pollution should be tolerated because of the economic importance of the processes involved. Today, at least, this is the general view. In the 18th century it was different, for then the first run of the industrial revolution was allowed to wreck many amenities of the countryside.

There is little doubt that Monsanto will ultimately solve its pollution problems. Certainly, it is working hard to that end. It is hardly in the company's interest, however, for 'sporting fish' statements to be made without qualification. Besides, if an industrial process is causing pollution, whether of the air or of a river into which wastes are passed, a balance sheet for the virtues of production and the losses of pollution cannot soundly be drawn up either in financial or moral terms.

## PRINT v DRINK

THE PRINTED WORD has made a most unusual contribution in the battle with alcoholism—a drug which may be as good as Antabuse or even better has recently been chance-discovered as a result of occupational 'illness' on the second floor of a large US printing firm. Men working on that floor complained of unpleasant reactions after drinking alcohol—red-swollen faces, red ears, increased skin temperature, palpitations, and drowsiness. Because these symptoms persistently followed drinking alcohol, most of the men in the department were forced to stop drinking. This naturally led to investigations and the trouble was traced to an anti-skimming compound used in colour inks, especially in the yellow ink. Confirmation that this compound was the cause of the trouble came when it was found that men at the ink works experienced the same symptoms after alcohol consumption.

As a result, the new anti-alcoholism drug, N-butylaloxime, has been announced. The objectional symptoms follow within 10 or 15 minutes of drinking half an ounce of whisky when persons receive a dose of this substance prior to drinking. The symptoms are more intense if more than this amount of alcohol is taken. Like Antabuse the use of the drug should foster strong anti-alcohol impulses in over-indulgers. Details of this unusual drug discovery are given in the September 1956 issue of *Medical Annals*, the journal of the Medical Society of the US District of Columbia.

# People in the NEWS



- A number of appointments have been announced by Bakelite Ltd. MR. B. T. FRANCIS becomes sales manager, (moulding materials), MR. R. J. CHILVERS chief representative (moulding materials) for the midland area, and MR. H. J. FUSSELL chief representative, southern area.
- The Acheson medal of the American Electrochemical Society for 1956 has been awarded to DR. R. M. BURNS, a senior scientific adviser to Stanford Research Institute. The medal, a biennial award, and a cash prize of 1,000 dollars was presented at the Society's convention in Cleveland, Ohio, on 2 October.
- An assistant to the managing director, of Chemstrand Ltd., London WC2, has been appointed. He is MR. N. IRELAND-SMITH, a former general manager of Drum Reconditioners Ltd., Colnbrook. Mr. Ireland-Smith served in the army from 1928 to 1952 when he retired with the rank of colonel. He was created CBE in 1951 and is a member of the MCC.
- Mancuna Engineering Limited has moved its London sales and design office to 59 Victoria Road, Surbiton, Surrey (ELMbridge 9793). MR. R. A. LEPAGE is manager and MR. N. S. STEDMAN, who recently joined the company, will be responsible for the design work of the office.
- MR. G. G. ROBERTS (44), who has been appointed to the board of Smiths Aircraft Instruments Ltd. as director of research, took B.Sc. with honours at the University of Wales, and M.Sc. with distinctions at the University of London.
- Secretary since 1937 of the Glass Manufacturers' Federation, MR. DENNIS RIDER, has been given the

appointment of director, and for the time being he will carry out the duties of both offices. Mr. Rider is also chief executive of several other organisations of glass manufacturers, and is a member of various committees of national organisations and of the council of the British Glass Industry Research Association.

● MR. RICHARD FRANCIS LEVY, Q.C., has been appointed to take over the chairmanship of the reconstituted Monopolies and Restrictive Practices Commission on 1 November in succession to SIR DAVID SCOTT CAIRNS, Q.C.

● DR. B. F. CAIN, a research chemist who has been doing research work for more than two years at the Dyson-Perrins laboratory at Oxford University, has returned to New Zealand where he is to investigate the possible anti-cancer properties of New Zealand plants. He has been appointed senior cancer research fellow in Auckland, and will be attached to the chemistry department of Auckland University College as senior lecturer.

● MR. R. P. MARSHALL, B.Sc., A.I.M., has been appointed manager of the TA Division of Impregnated Diamond Products Ltd., Gloucester.

● Changes at A. J. White Ltd. and Menley & James Ltd. are announced: MR. RICHARD PFIZENMAIER has been appointed managing director and MR. STANLEY FENWICK assistant managing director of the companies. MR. TAYLOR MARSH and MR. BLACK have now relinquished their positions as managing director and director of medical promotion respectively. The telephone number of Menley & James Ltd. has been changed to BRIXton 7722.

## OBITUARY

MR. HENRY NICHOLAS RIDLEY, described as one of the 100 men still alive in 1955 whose personal efforts helped to shape the modern way of life, died at his home in Kew on 24 October, aged 100. Mr. Ridley went to Malaya to become the first director of Singapore's botanic gardens. For 10 years he nursed an experimental set of rubber trees and planted more from seeds smuggled from the Amazon. He discovered how to obtain latex without injuring the rubber tree and the first rubber boom began. In his hundredth year he was made a fellow of the Institute of the Rubber Industry.

## Uranium in Nyasaland?

### Mineralogical Survey Reveals Interesting Fields

IN THE QUARTERLY REPORT on mineralogical survey issued in Zomba by the Director of Geological Survey, Mr. J. H. M. McNaughton, it is revealed that a mineral containing a high proportion of uranium, betafite, is present in the Tambani area of Nyasa. A representative of the UK Atomic Energy Division, who visited the Federation recently, reported that uraniferous pyrochlore from the Tambani area contained such a high proportion of uranium that it was better classed as betafite than pyrochlore since the uranium content of the latter is never above 15 per cent.

Another mineral, monazite, occurring in sand deposits near Monkey Bay of Lake Nyasaland, is stated to have a thorium oxide content of 6.2 per cent. Radioactive sulphide bearing rocks have been located to the south of Mpupya Hill and an area of more than normal radioactivity was located near Dedza, some 125 miles from Zomba.

## Mobile Laboratory

A MOBILE laboratory is now operating from the Coryton refinery of the Mobil Oil Co. It is being used for sampling and analysing the air in any district. The Company believes that this will be a valuable aid in its efforts to pinpoint air pollution.

The laboratory consists of a light van fitted with a bench and analytical equipment. Samples of air can be taken and passed through a meter and then through a series of chemical scrubbers. These will retain pollutant gases which can be analysed and the quantity estimated.

By analysing the atmosphere over a wide area from Coryton to Southend and under various climatic conditions, information will be obtained regarding the nature and sources of the pollution. It is intended that when a fully authenticated complaint is received, the mobile laboratory will be sent to the spot to enable an immediate investigation to be made.

## Petrochemicals in Iran

A CONTRACT has been signed between Union Chimique Belge and the Planning Organisation of the Persian Seven-Year Economic Development Programme for the construction of a chemical fertilizer plant using natural gas. Union Chimique Belge are to study the matter and decide on a site (in the Khuzistan province) and the productive capacity of the new factory.

## SCIENTIFIC MANPOWER NEEDS

### Industry Wants 30,000 More in Next Three Years

INFORMATION given in a report entitled *Scientific and Engineering Manpower in Great Britain* (Her Majesty's Stationery Office, price 1s 6d net) shows that industry and other main users of scientific manpower have told the Ministry of Labour that they will require at least 30,000 more qualified scientists and engineers in the next three years. According to estimates of the Scientific Manpower Committee of the Advisory Council on Scientific Policy, at least 85,000 more, an increase of 63 per cent, will be needed. Therefore, the annual output of qualified scientists and engineers must be increased by over 60 per cent by 1966 and 100 per cent by 1970.

#### Scientists and Engineers

At present there are 51,230 scientists and 68,470 engineers employed in the UK. Some 15,000 are employed in fields outside the scope of the survey. Of the total of 119,700, about 43 per cent are in manufacturing industry, 12½ per cent in nationalised industries, 21 per cent in teaching, 10 per cent in central government, 5 per cent in local government and 8 per cent in miscellaneous occupations. Nearly half of the qualified scientists are engaged in teaching, and three-quarters of the qualified engineers are in industry.

#### Distribution

In manufacturing industries, of the total of 48,000 qualified scientists and engineers, two-thirds (8,300) are in chemicals, other plant and machinery 6,700; electrical engineering 12,000; and aircraft manufacture, 4,300. Of nearly 14,000 scientists and engineers in Government service, just over half are in the Defence Departments, just over one-quarter in the Civil Departments, and one-sixth in the Research Departments. Of the total qualified scientists and engineers employed in manufacturing industry, some 45 per cent are engaged in research and development, 47 per cent in production, maintenance and installations and 8 per cent in 'other work.'

Demand for scientists and engineers in 1959 for the industries surveyed is estimated at 150,000, an increase of 30,300 or 26 per cent. Demand for scientists is estimated to increase by 18.5 per cent (from 51,200 to 60,700), and for engineers by 30 per cent (from 68,500 to 89,300). Manufacturing industry considers it will need an increase of 57 per cent; building and contracting 22 per cent; research asso-

ciations 24 per cent; nationalised industries 22 per cent; central government 14.5 per cent; local authorities 27 per cent; and teaching 11 per cent. The greatest demand in the next three years will be for chemists, and an increase of 47 per cent will be required in chemical engineers.

To maintain an annual growth rate of 4 per cent in total industrial output, there would have to be an increase of scientists and engineers to about 220,000 in 1966 (60 per cent increase). Increased demand for engineers is estimated at 70 per cent between 1956 and 1966 and at about 50 per cent for scientists. Present gross annual flow from universities and technical colleges is about 10,000 and should be about 12,000 by 1959. However to meet the requirements suggested in this survey some 16,000 qualified personnel a year will be needed. By 1970, the number of persons qualifying in science and engineering would need to rise to about 20,000 a year, i.e. double the present rate.

## Fire Prevention

### FPA Give Advice on the Use of Watchmen

MILLIONS of pounds of damage has resulted from the failure of watchmen to take effective action in the event of fire. Nevertheless the occasions on which watchmen carry out their duties correctly and so help to minimise fire damage outnumber those where they are at fault.

This is made clear in an article published in the *FPA Journal* for October. The article discusses how the work of a watchman can be arranged to obtain the most efficient fire protection. Other items of particular interest which are dealt with in the *Journal* (published by the Fire Protection Association, 15 Queen Street, London EC4) include: Electrical Equipment, and Flammable Vapour and Gases.

Technical information sheets recently issued by the Association cover such subjects as: Nitrate and Cyanide Baths for the Heat Treatment of Metals; Protection of Buildings from Lightning, and Fire Hazards associated with the Thermal Insulation of Buildings.

## CHEMICAL EDUCATION IN US

TO STIMULATE greater numbers of America's youth in choosing science as a career, the US Manufacturing Chemists Association is launching a nation-wide programme to reach every level of education. The programme will be carried out over a five-year period and will cost approximately \$1 million.

A study carried out by the MCA and published in June of this year, shows that by 1965, the US will have a shortage of 457,000 scientists and engineers. The chemical industry alone will be short of 93,000 scientists and engineers. The new science education programme is being undertaken in the hope that more boys and girls will take science as a career.

#### Supplementary Aids

State and county officials have been advised of the availability of supplementary aids to general science teaching. A 16-page careers booklet is also offered. A pilot programme at senior high school level is planned using a demonstration manual, teaching chart and film strip. The programme will then be offered to the 11,700 US high schools now teaching chemistry, and estimated to cover 400,000 students. The MCA programme also envisages

awards for college teachers who have done outstanding instructional work.

Development or expansion of chemical manufacturers' co-operation with schools in their respective areas will have special attention. The MCA will issue a manual giving detailed suggestions on how to execute various projects, ranging from plant tours and science fairs to science teacher institutes.

### Industrial Safety Week

THIS year's National Industrial Safety Week, organised by the Royal Society for the Prevention of Accidents to secure safer working in industry, begins next Monday, 5 November. The theme is 'Beware of Booby Traps'—a collective name for hazards that range from defective tools to careless behaviour.

### Iraq Sulphur Plant

APPROVAL has been given by the Iraq Government Development Board to the report of its industrial section for a plant to produce sulphur from natural gas at Kirkuk. The Ministry of Development has been asked to invite offers from contractors for construction of the plant.

## MONDAY 5 NOVEMBER

**Royal Institute of Chemistry**

West Norwood: Norwood Technical College, Knights Hill, 7 p.m. 'Laboratory Techniques in Radiochemistry' by E. N. Jenkins.

**Chemical Society**

Oxford: University Alembic Club, 8.15 p.m. 'Organometallic Compounds' by Professor G. E. Coates.

**Society of Chemical Industry**

London: 14 Belgrave Square SW1, 6.30 p.m. 'Recovery of Uranium from Low-grade Ores' by Dr. T. V. Arden.

Leeds: Chemistry Lecture Theatre, The University, 7 p.m. 'The Stress Corrosion of Steel in Caustic Soda Solutions' by Dr. F. A. Champion.

## TUESDAY 6 NOVEMBER

**Society of Chemical Industry**

Bristol: University Chemical Department, Woodland Road, 6.30 p.m. 'Stress Corrosion' by K. R. Wilson, and 'Corrosion Fatigue' by T. D. Weaver.

**Incorporated Plant Engineers**

London: Royal Society of Arts, John Adam Street, Aldelphi, Strand WC2, 7 p.m. 'The Use of Radioisotopes in Industry' by C. W. Jones.

## WEDNESDAY 7 NOVEMBER

**Chemical Society**

Glasgow: Chemistry Department, The University, 4 p.m. 'The Structure of Vitamin B<sub>12</sub>' by Mrs. D. M. Hodgkin.

**Institution of Chemical Engineers**

London: The Royal Institution, Albemarle Street W1, 3 p.m. to 7 p.m. Symposium on grinding.

**Society for Analytical Chemistry**

London: Meeting room of the Chemical Society, Burlington House W1, 7 p.m. 'The Structure of Dithione and its Metal Complexes' by H. M. N. H. Irving.

**Institute of Metal Finishing**

Glasgow: Institution of Engineers & Shipbuilders in Scotland, 39 Elmbank Crescent, 7.30 p.m. 'Paint? Why and What?' by A. McLean.

**Manchester Metallurgical Society**

Manchester: Manchester Room, Central Library, 6.30 p.m. 'The Properties of Hyduminium 100 (SAP) by Dr. W. M. Doyle.

## THURSDAY 8 NOVEMBER

**Chemical Society**

Bangor: Department of Chemistry, University College of North Wales, 5.45 p.m. 'Allene Chemistry' by Professor E. R. H. Jones.

**Royal Society**

London: Burlington House W1, 4.30 p.m. 'The Cubic and other Structural Forms of Ice at Low Temperature and Pressure' by M. Blackman and N. D. Lisgarten, communicated by Dame Kathleen Lonsdale; 'The Distribution of Stress and Velocity in Glaciers and Ice Sheets' by J. F. Nye, communicated by M. F. Perutz.

**Royal Institute of Chemistry**

London: Acton Technical College, High Street W3, 7 p.m. 'Some Aspects of Modern Theoretical Chemistry' by Professor M. J. S. Dewar.

**I.Chem.E. (Graduates & Students Section)**

Loughborough: Lecture Theatre, Loughborough College, Greenclose Lane, 7.30 p.m. 'Chemical Engineering Problems in the Manufacture of Fine Chemicals' by Dr. B. Edgington.

**Incorporated Plant Engineers**

Glasgow: Scottish Building Centre, 425-427 Sauchiehall Street, 7.15 p.m. 'An Introduction to Atomic Energy' by J. A. Dixon.

**Institute of Metal Finishing**

London: British Institute of Management, 8 Hill Street W1, 6.30 p.m. 'Mass Painting of Small Parts—Barrel Enamelling' by W. S. Field; 'Centrifugal Lacquering' by J. G. Lemon.

**Textile Institute**

Manchester: 10 Blackfriars Street, 7 p.m. 'What an Industry can Expect from a Research Organisation' by Dr. D. W. Hill.

**Institute of Metals**

Birmingham: Birmingham Exchange & Engineering Centre, Stephenson Place, 6.30 p.m. 'The Metallurgy of Steel for Deep Drawing and Pressing' by A. J. K. Honeyman.

## FRIDAY 9 NOVEMBER

**Royal Institution**

London: 21 Albemarle Street W1, 9 p.m. 'The Chemical Substances Influencing Mental and Physical Development' by Sir Charles Dodds.

**Chemical Society**

Aberdeen: Marischal College, 7.30

p.m. 'An Aspect of Conformational Analysis' by Professor D. H. R. Barton.

Newcastle-upon-Tyne: Chemistry Building, King's College, 4 p.m. Meeting for the reading of original papers.

St. Andrews: Chemistry Department, St. Salvators College, 5.15 p.m. 'Application of Modern Techniques to Problems in Brewing' by Professor I. A. Preece.

**Society of Chemical Industry**

London: Chemistry Lecture Theatre, King's College, Strand WC2, 7 p.m. 'The Chemistry of Insulin' by Dr. F. Sanger.

**British Association of Chemists**

Derby: The Lecture Theatre, College of Art, Green Lane, 7.30 p.m. 'Management in Many Lands—The Chemist as Manager' by J. F. Neilson.

**Oil & Colour Chemists' Association**

Liverpool: Engineers' Club, Dale Street, 6.30 p.m. 'Automobile Finishing' by D. H. Lloyd.

**Society of Glass Technology**

St. Helens: Co-operative Society, 6.15 p.m. 'Lehrs Past and Present' by C. J. S. Atkinson.

## SATURDAY 10 NOVEMBER

**Institution of Chemical Engineers**

Manchester: Reynolds Hall, The College of Technology, 3 p.m. 'Animal Foodstuffs Plant—Some Considerations' by H. Holdsworth.

**Society for Analytical Chemistry**

Coleford: Visit to factory of H. W. Carter & Co. Ltd., 9.30 a.m.

**Butyl Rubber Modifier**

CLAIMED to be the first commercially practical chemical modifier for butyl rubber, Elastopar has been developed by Monsanto Chemical Co. in the US, in co-operation with Esso Research & Engineering.

According to Dr. C. A. Thomas, president of Monsanto, Elastopar will double the strength under strain of unmodified butyl rubber 'and did this in the course of conventional processing steps.' Elastopar is being produced in semi-commercial quantities. Samples are being distributed to the rubber industry for large-scale tests.

**Swedish Plastics Convention**

REPRESENTATIVES of the British plastics industry, led by Mr. W. Charles Waghorne, president of the British Plastics Federation, are attending the 10th Swedish Plastics Federation Convention, which was opened by Prince Bertil in Stockholm on 27 October. The Convention continues until 4 November.



## CHEMICAL ARTS ASSEMBLY

### Massive Programme in France Later This Month

FROM 18 November to 3 December in Paris, the Assembly of Chemical Arts 1956, and the fourth Chemical, Rubber and Plastics Exhibition will present the 24th International Congress of Chemical Industry, the European Congress on Corrosion, the European Conference of Engineering Chemistry, the Technical Days of Paris, the fourth Symposium of Functional Organic Analysis and the second International Symposium of Natural and Synthetic Perfumes and of Cosmetology.

Organiser of these 'omnibus' proceedings is the French Society of Chemical Industry.

Sessions of the 21 sections of the chemical industry congress will be held in the mornings (18-24 Nov.) and those of the eight sections of the corrosion congress in the afternoons at the Maisen de la Chimie. Visits to laboratories and factories will also take place.

Many papers will be presented at the chemical industry congress; a number deal with nuclear energy in the chemical industry. There are also papers relating to synthetic organics, plastics and rubber.

A new venture is the Congress on Corrosion (18-24 Nov.). One of the speakers will be J. C. Hudson, of

the British Iron and Steel Research Association.

At the chemical engineering conference, there will be three symposia: 'Calculus of Converters' (22 Nov.); 'Calculus of Reactors' (23 Nov.); and 'Extraction by Adsorbant Solids' (24 Nov.).

For the Technical Days of Paris, Symposium A (25 Nov.) is on the adaptation of materials to polar and tropical conditions. Symposium B (26 and 27 Nov.) is on grafting and reticulation of plastic and rubber materials. Symposium C (28 Nov.) will be on infra-red spectrophotometry. Symposium D (29 Nov.) is on automation in the chemical industry and Symposium E (30 Nov.) is on special steels.

The fourth symposium on functional organic analysis will be held on 26 and 27 November and the second international Symposium of Synthetic and Natural Perfumes and of Cosmetology, on 1 December.

On 22 November, the fourth Chemical, Rubber and Plastics Exhibition will open at the Parc des Expositions; some 1,100 exhibitors from 16 nations are expected to be there. Full details may be had from the Société de Chimie Industrielle, 28 rue Saint-Dominique, Paris (VII<sup>e</sup>).

## FLEXIBLES CENTRE OPENED

THE NEW and enlarged London flexibles centre operated by the flexibles advisory service of the Compoflex Co. Ltd. was officially opened on Thursday 25 October at 23-25 Northumberland Avenue, London WC2, by Sir Norman Kipping, director-general of the Federation of British Industries. During the opening ceremony Sir Norman announced publication of the first issue of *Arteries of Industry*, a quarterly journal which the company is introducing as part of its advisory service.

The new journal is to be distributed each quarter to users and potential users of flexible tubes and hoses, and will contain technical and general interest articles written by outside contributors on the importance of flexibles to their own particular industries.

The London flexibles centre was originally opened in 1952 at Grosvenor Gardens as the first step in the formation of a comprehensive flexibles advisory service, but the increasing use made of the service by industry, both at home and abroad, soon made the facilities inadequate. To relieve

pressure on the London centre, a northern flexibles centre was opened at the company's Oldham factory in Huddersfield Road in 1954, to cope with inquiries from industry in the Midlands and the North. Earlier this year it was obvious that the London premises were still not large enough, and new showrooms and offices were found in Northumberland Avenue to house both the increasing head office sales and administrative staff and the advisory experts.

Basically the four main types of flexibles are rubber, metallic, plastics and composite, and great advances are being made in all types. Plastics tubes and hoses are, as yet, in a comparatively early stage of development but will, without doubt, play an ever increasing part in industry. Composite flexibles were practically unknown before the war, but the rubber shortage during the Japanese occupation of Malaya forced their rapid development. This type of flexible consists basically of one or more wire spirals used in conjunction with plastics, synthetic rubbers, canvas etc.

## Fertiliser Output

### Current Production of Billingham Being Reserved for Home Market

UNTIL it is clear what surplus of nitrogenous fertilisers there will be for shipment overseas the whole of the Billingham Division of ICI Ltd. current output of sulphate of ammonia is being reserved for use in the home market next spring.

This has been announced by Mr. W. J. V. Ward, the divisional chairman. He said that demands for sulphate were so high last spring that some had to be imported—and, despite unfavourable weather, sales since June had been higher than in the same period of last year.

Mr. Ward went on to say that requirements of methanol and urea had risen very rapidly after the usual lull in sales during the August holiday period. He added that there was no sign of their consumption in the UK being affected by the credit squeeze. The explanation, said Mr. Ward, might be that more plastics material was being exported.

## Russian Visit

THE FIRST trade mission from the British plastics industry to visit Russia left London Airport for Moscow on Friday 12 October. The object of the visit, which is being made at the invitation of the USSR Government, is to follow up an exchange of views which took place at the time of the visit to London of Marshal Bulganin and Mr. Krushchev and of the recent trade delegation. The mission consists of three members of the British Plastics Federation—Mr. Herbert Bridge (British Moulded Plastics Ltd.), Mr. Jack Lesser (Crystalate Ltd.) and Mr. R. Sternberg (Sterling Moulded Materials Ltd.).

## Smoke Nuisance Alleged

WHITEHAVEN (Cumberland) Corporation is in touch with Solway Chemicals Ltd., regarding the dense clouds of smoke emitted from the firm's works. It is reported that the firm is taking steps to deal with the nuisance.

## Sebacic Acid Prices

THE GEIGY CO. announces that it has increased the prices of sebacic acid as follows: 5s 10d per lb. for 10, 5 and 1 ton quantities; 5s 11d per lb. for 4 cwt. quantities; 5s 11½d per lb. for 1 cwt. quantities; and 6s 0½d per lb. for ½ cwt. quantities and under. These prices apply to all deliveries made on and after 17 October.



# From all Quarters



## Developments in Spain

TWO PROPOSALS for the production of synthetic detergents in Spain are being considered by the National Institute of Industry: One at Puertollano from petroleum products and the other at Palencia from fat alcohol. In each case the products obtained would be intermediate and the preparation of the detergents carried out by separate enterprise.

Two national companies (Union Española de Explosivos and Sociedad Iberica del Nitrogeno) have applied for permission to install a factory for the manufacture of nitrogenous fertilisers, superphosphates and other fertilisers at Seville.

Titania SA and the Lithium Corporation of America Inc. are to form shortly a new Spanish company to investigate and work 'espodumena' (lithium) deposits in Lalin (Pontevedra). The US company are authorised to supply up to 40 per cent of the capital of the new company, such participation to be in the form of foreign exchange, technical services or machinery.

## Chilean Nitrate

FOLLOWING the ratification by Congress earlier in the year of the Nitrate Referendum (Law No. 12,018, 23 April 1956) a new Law (No. 12,033, 20 August 1956) has been promulgated revising Law No. 5,350, the basic law governing nitrate production which has been in force for more than 20 years. The new law confirms the Government's monopoly of the nitrate and iodine trade, and lays down regulations covering the aims, administration and activities of the Nitrate and Iodine Sales Corporation. Sociedad Soda Chilena SA is to install a plant in the Province of Tarapacá to produce soda alkalis, using chiefly nitrate as raw material.

## Chemicals for Formosa

AN ORDER for textile chemicals worth over 2,000 American dollars has been obtained from Formosa by Newell (Chemicals) Ltd., of Hawick, Roxburghshire. Mr. E. M. Cassett, managing director of Newell, said on Tuesday 16 October that the order

was for chemicals used in woollen, cotton and rayon manufacture.

According to Mr. Cassett there are distinct possibilities of trade with Formosa. He said that a large number of the Chinese textile firms which used to operate on the mainland have set up factories on the island. He had been told by the firm's agents in Formosa that Hawick chemicals were not only better than those offered by Japanese competitors but were actually cheaper.

Newell claims to be the smallest firm to be a member of the Federation of British Industries.

## Nitrate Expansion

IMPROVEMENTS are planned by the Anglo-Lautaro Nitrate Corporation. These include the extension of the solar evaporation system for the recovery of nitrate from residues from the Guggenheim process; development of production of by-products, in connection with which a modern laboratory for scientific research will be installed; and enlargement of existing installations in order to increase efficiency and production.

The Cía Salitrena de Tarapacá y Antofagasta plans to treble the present nitrate output of its Victoria plant.

## Danish Ethylene Spirit

A NEW DISTILLERY for the production of ethylene spirit from ethylene gases pumped from A. P. Moller's pyrolytic gasworks has been completed at Amager, Copenhagen, for the Danish Spirit Factories. Production is expected to commence early next year.

## New Uranium Oxide Plant

A PLANT for the treatment of uranium oxide was officially opened on 6 October at the United Uranium Co.'s mine at El Sharana, on the South Alligator uranium field in Australia's Northern Territory. This is the first uranium treatment plant to be established in Australia by private enterprise. The uranium oxide from El Sharana is to be exported to the U.S.

## Peruvian Petroleum

PRODUCTION of petroleum during June reached 1,502,000 barrels (of 42 gallons), an increase of 95,000 barrels compared with the same month of 1955. Production for the first half of 1956 totalled 8,865,000 barrels, which represents an increase of 295,000 barrels over the first six months of 1955.

## Recovering Manganese

FROM BLAST FURNACE WASTE of steel plants of the Broken Hill Pty. Co. Ltd. at Newcastle and Port Kembla, New South Wales, metals such as manganese are being recovered. Breckett Pty. Ltd. controls rights in the process of recovering the metals. Ore used in Australian steel-making contains considerably more manganese than is required for the process. Previously the price of manganese has not warranted processing of the waste, but recent price increases have made its recovery an economical proposition.

## Israel's Uranium Find

PHOSPHATE ROCK available in large quantities in the Negev region is already being worked for phosphates. Now it is reported that the percentage of uranium which can be extracted from the rock ranges from 0.01 to 0.1 per cent. The uranium appears to have been brought up from richer sources of the metal lying at lower levels in the area.

## Australian Coal Plant

ESTABLISHMENT of a coal utilisation plant to cost between £A50 million and £A70 million is to be discussed by the Australian Joint Coal Board and the coal industry. Building of the plant in three stages is suggested by the Board: A low temperature carbonisation plant to produce gas, light oil and tar and costing £A1 million; a plant, costing between £A20 million and £A25 million to produce acetylene, methanol, ammonia, synthetic rubber and nitric acid; and a plant to cost between £A30 million and £A40 million to produce plastics and synthetic fibres.

by  
Peter Cooper F.P.S.

# Toxic Hazards in Industry

## Part I—GENERAL CONSIDERATIONS

**T**HERE is a constant increase in the range of chemical substances such as structural materials, intermediate compounds or solvents, used in industrial processes. It is imperative, therefore, in order to safeguard the health of workers, that as many as possible of the known effects of such materials should be recorded and correlated and that, in the case of new and relatively unknown compounds, the possibilities of poisoning should be visualised and investigated in advance. Industry has proved in the past to be rather neglectful of health precautions, and has yet to overcome its unfortunate heritage of smoke, river pollution and pale-faced coughing workers. It has, however, under the stress of extraordinarily toxic materials, such as the anticholinesterase agricultural sprays and the radioactive compounds, been forced to take toxic hazards very closely to heart. Moreover, the increased ease of litigation has added its stimulus to the technical ones.

### Mechanisms of Poisoning

An important branch of the science of toxicology deals with this particular aspect of modern civilisation and has as its main objectives the study of the mechanisms of poisoning, the development of effective means of treating established poisoning, and the introduction of measures calculated to minimise the risk among persons who have to handle toxic materials. There is, of course, a limited legal obligation to report certain types of industrial poisoning, but over and above this, the intelligent co-operation of all concerned, from process workers to medical officers and analysts, is essential to a speedy reduction of the hazards. Case-histories are of very great value to the investigator in this field where toxicity-studies on experimental animals are not of such value as they are in assessing drugs for human treatment. There are modern techniques whereby the activity of compounds against living cells obtained from the mucous membrane of the nose may be used as a toxicity index but they are, as yet, in their infancy, and very expensive.

### Toxic Substances

Unfortunately, it is impossible to divide chemicals sharply into poisons and non-poisons, except for rather empirical legal purposes. A poison may be defined as 'a substance which, when introduced in small amounts into the body of a normal individual, may produce, by chemical means, death or serious injury to health.' Other substances, not being poisons according to definition, are nevertheless toxic; for example, powdered glass, plaster of paris, asbestos powder. Such substances

are toxic to normal individuals; that is, to people who have no outstanding susceptibility to their effect. Others, such as pollens, antibiotics and proteins, are toxic only to certain peculiarly sensitive people, and appear to act, not directly, but by causing the formation of antibodies in the sufferer's tissues. These antibodies, by reacting with the antigens that produce them, provoke very distressing and often dangerous reactions.

### Protective Devices

People who come within this category present a sharp challenge to medical toxicologists, for they react, sometimes disastrously, to compounds which show no obvious toxicity to their fellow-workers. They may merely be hypersensitive to a given chemical, for no known reason, or may have been sensitised to it at some time in the past.

Other factors may operate. For instance, the handling of an organic solvent may have paved the way for an unusual toxic reaction by removing the protective lipoids normally present in the skin. It is comparatively easy to prevent this hazard by insisting on the routine use of protective clothing and suitable barrier creams.

### Acute and Chronic Toxicity

Toxicity itself may be divided into two categories, acute and chronic. In chronic poisoning, the dose absorbed is too low to have any obvious effect but such a dose, repeated over a long period, eventually gives rise to a reaction. Chronic toxicity is not necessarily dependent upon accumulation in the body (as occurs with the heavy metals), but may result from an altered metabolism of the cells in certain body tissues, leading to some kind of unbalance; the tissues involved will determine what form the symptoms of poisoning take. A single substance, such as arsenic, may exhibit both kinds of toxicity, and the symptoms of each kind may differ considerably. Generally speaking, acute poisoning is alarming and dramatic in quality, but, unless some vital organ is damaged, remedial measures bring about a rapid recovery. On the other hand, chronic poisoning is often insidious in onset, and recovery takes weeks or months. Poisoning may long be unrecognised, since the symptoms are mild—head-ache, lassitude, loss of muscular power, loss of appetite, inability to concentrate. Chronic symptoms, too, tend to be taken lightly by the sufferer, who cannot ignore or conceal acute reactions.

Closely related to chronicity are the phenomena of habituation and addiction, which represent a mixture of mental and physical reactions. Many solvent vapours

## Toxic Hazards in Industry

(e.g. trichlorethylene) have proved habituating in persons of defective personality.

Absorption of a toxic agent may result from its application to the body surface, its inhalation into the lungs and bronchial tree as a spray, dust, fume or gas, its injection below the skin in a puncture wound or laceration, or its ingestion by mouth into the gastrointestinal tract. Most highly toxic agents will prove active by any of these routes, but their toxicity may vary according to the precise route taken. Dusts which are quite harmless by mouth may prove dangerous in the lungs, since they provoke defensive reactions on the part of the tissues. The dangers of inhaling gases or finely divided solids or liquids are, of course, well recognised and extensive use is made of precipitators, absorbers and neutralisers, to reduce this hazard.

### Skin Sensitivity

Skin reactions are extremely common wherever chemicals are handled. They may arise from ingestion of the poison, or from direct contact with the skin. To distinguish it from the signs of generalised poisoning, the term *contact dermatitis* is applied to a reaction arising from the direct effect of a substance on the skin. Its signs are redness and swelling, often with the formation of watery vesicles, and a sensation of itching and burning. Scaling of the necrosed skin follows in severe reactions. There are many chemicals, such as the mineral acids and caustic alkalis, halogenated organic acids and phenol, that inevitably irritate and destroy normal skin. Other substances are more selective in their activity and appear first to sensitise the individual to them.

### Patch Testing

Sensitivity to such compounds is usually detected by performing a patch test on the patient's skin. An area of the arm, defatted by swabbing with acetone or ether, has applied to it a small quantity of the diluted suspected agent, which is kept in position by a pad of lint or gauze. After a period of up to 48 hours, a positive reaction, or the absence of reaction can be affirmed by inspecting the site. Such a procedure, repeated if necessary with other suspected agents, offers the only practicable means of tracking down the source of a cutaneous reaction.

There is almost no limit to the range of substances which can be incriminated; but their specific effect is confined to selected individuals, and others may be quite unaffected by repeated contacts. It is sometimes possible to achieve the desensitisation of a person by giving graduated doses of the offending substance by mouth or by injection, starting with very low quantities; but this process may prove very slow and not always successful.

Potential carcinogens have of late years come into prominence; although much work is being done to elucidate their action, very little is really known about them. Substances, such as the naphthylamines and benzidine, which are proven carcinogens, and processes

## TREATMENT OF LIQUIDS

### New Laboratory Flocculator

A NEW ITEM of laboratory equipment of interest to chemists, water, sewage and effluent plant superintendents and all concerned with the chemical treatment of liquids has recently been developed by the Paterson Engineering Co. Ltd., Windsor House, Kingsway, London WC2. This is a laboratory flocculator by means of which up to four small-scale treatment tests can be carried out simultaneously when, for example, the problem of modifying the chemical treatment of a liquid while at the same time maintaining a high quality effluent has to be considered. It has been designed to fulfil all requirements for 'Jar' tests.

From a black enamelled pressed steel frame are suspended four stirrer paddles driven by a small geared electric motor. The whole is fixed to a black base of chemically resistant material. The speed of each paddle can be individually regulated and can be determined by reference to the position of the pinion on the shaft, and a table mounted on the frame showing paddle speeds over the full range of the instrument. A speed range of 6 to 19 r.p.m. with one setting and 20 to 60 r.p.m. with the others is possible. The flocculator can be supplied to suit any input voltage and speed requirements.

### Key Industry Duty Exemptions

UNDER SECTION 10(5) of the Finance Act, 1926, the Treasury have made an Order exempting the following chemicals from Key Industry Duty for the period beginning 10 October 1956 and ending 18 February 1957: Synthetic organic chemicals, analytical reagents, other fine chemicals and chemicals manufactured by fermentation processes, namely: aminosulphonic acid, ethylenediamine, ethylenediamine hydrate, 2-methylundecaldehyde (a dodecaldehyde), 9-undecenaldehyde, 10-undecenaldehyde.

This Order is the Safeguarding of Industries (Exemption) (No. 7) Order, 1956, and is published as Statutory Instruments 1956, No. 1560. It may be obtained (price 2d net, by post 4d) from HM Stationery Office, Kingsway, London WC2 and branches, or through any bookseller.

which produce carcinogens as by-products (such as the high-temperature treatment of hydrocarbon fuels and paraffin products) are avoided so far as possible, or at least are remotely controlled. It has been established, however, that contact with such agents over very long periods seems to be necessary for their toxicity to develop.

Much more is known about the radioactive materials which constitute the latest and most acute industrial hazard, thanks to accurate physical means of measuring their potency. Since radioactive compounds, or exposure to radiations from a generating source, have an early effect on the blood cells, it is comparatively easy to detect any accidental exposure to them.

(to be continued)

# Analytical Chemistry of Mercury

'The Analytical Chemistry of Mercury' was the subject of a meeting of the Midlands Section of the Society for Analytical Chemistry held at Nottingham on 27 March 1956. The first paper, which was by Mr. G. J. W. Ferrey and dealt with pharmaceutical applications, was published in our issues of 6 and 13 October. We now publish the second paper which was by Dr. R. F. Milton (Analytical and Consulting Biochemist, London) and discusses the micro-determination of mercury. Dr. Milton's paper was read by Mr. W. Duffield.

**I**N INTRODUCING his subject, the micro-determination of mercury, Mr. Duffield said that the chief difficulties arising in the determination of trace quantities of mercury could be summarised as follows:

(1) Its extreme volatility. This raised the problem of the destruction of organic matter without loss of mercury.

(2) The separation from other metals liable to interfere with the final method of determination, and complimentary to this the selectivity of that reaction.

(3) The frequency with which mercury occurred as a contaminant, e.g. in hydrochloric acid, filter papers, rubber stoppers, and in fact any reagent or apparatus exposed to the atmosphere of most laboratories. In this connection it must be remembered that mercury was readily adsorbed on glass, and that care must be exercised in the storage of standard solutions. These should be kept at an acidity of not less than 0.01N if appreciable deterioration was to be avoided.

## Wet Conditions

The destruction of organic matter without loss of mercury must obviously be carried out under 'wet' conditions, and with especially stringent safeguards. Whatever the oxidising media it had been found essential that the neck of the vessel in which the oxidation was carried out should be protected with an efficient, water-jacketed condenser. Experience had shown that this condenser should be at least 12 in. in length, and some workers recommended the use of a 'cold finger' type, cooled with ice water and extended downwards into the oxidation vessel itself (76).

Under these conditions a biological or similar sample could be completely wet ashed to total destruction of organic matter using a nitric-sulphuric acid mixture. The mercury was separated from the resulting solution by precipitation as the sulphide, using cadmium or arsenic as a 'collector'.

This complete oxidation procedure was very laborious and time consuming, and in many cases unnecessary. In the case of urine, milk or similar biological fluids, it had been found that boiling with

sulphuric acid (10 per cent of the total volume of fluid involved) and two per cent potassium permanganate for two hours would sufficiently oxidise the sample (77, 78, 79). The procedure did not completely destroy all the organic matter. Direct extraction with, for instance, dithizone would not be effective owing to the tendency of mercury to form complexes with the undestroyed organic matter. These complexes, however, appeared to be broken up by hydrogen sulphide after the removal of excess permanganate with oxalic acid or hydroxylamine, and 100 per cent recoveries could be obtained, again using arsenic as a 'collector'.

This initial oxidation procedure as related to the determination of toxic residues on crops had been investigated by Arthington and Hulme (76). They had noted that the oxidation was most rapid and effective on dried material. Their work established beyond doubt that appreciable losses of mercury could occur under the most careful of normal drying conditions. They had overcome this difficulty by a technique of 'freeze-drying' which had been found to reduce losses to a negligible amount.

## Arsenic as Collector

The partial separation of mercury as the sulphide had already been dealt with. Arsenic had been recommended as a 'collector' chiefly because of the fact that it did not form a dithizone complex and would, therefore, not interfere in the final determination with that reagent. Cadmium and antimony were equally good, although cadmium could precipitate oxychlorides under certain conditions. The mixed sulphides were separated by centrifuging and dissolved in a mixture of nitric and hydrochloric acids. Nitric acid was then destroyed with hydroxylamine.

Selective extraction of mercury from this solution could best be carried out with dithizone, under very carefully controlled conditions. It had been established that a dithizone extraction of a solution of the sulphides must be carried out at a pH of 0.75-1.0. Below this range copper would interfere, and above it the extraction of mercury was incomplete. Within the pH range 0.75-1.0 it was found that a preferential complexing with mercury occurred so long as the dithizone was not added in excess.

This condition was obtained by successive extractions of the test solutions at the requisite pH with small quantities of a very dilute solution of dithizone in chloroform (1 ml. of 0.005 per cent) until the golden brown colour of the mercury dithizonate was no longer visible. The chloroform extracts could then be bulked and used for the final determination.

Of metals other than copper which might be present,

Pb, Zn, Ni, Co, etc., only would interfere if present in very high concentrations, since at the specified pH the equilibrium constants of their dithizonates were much smaller than that of mercury.

Bismuth might interfere, but only if present in appreciable amounts, and silver could be ignored if sufficient chloride was present. Au, Pd and divalent Pt would interfere and must, therefore, be almost completely absent.

Mercury dithizonate could also be separated from copper by shaking the chloroform solution of the dithizonates with acid thiosulphate solution, when the mercury would pass into the aqueous layer and could be re-oxidised and re-extracted as the dithizonate.

### Electrolytic Deposition

Another method of separation of mercury was the electrolytic deposition method (80, 81), which could be applied, either directly to an oxidate solution, or to a solution of the previously separated mixed sulphides. In this method the test solution was made just alkaline with ammonia, cooled in ice and then acidified with a one to two ml. excess of N nitric acid in a total volume of 20 ml. This solution was then electrolysed at three to four volts, 0.05 amps for 16-20 hours, using a gold or platinum foil cathode five by two cm. and a gold or platinum anode in the form of a spiral of the same length as the cathode. At the end of the electrolysis, the deposited mercury could be dissolved and estimated colorimetrically.

A further method of separation was the passage of the test solution at pH 5-7 through an asbestos pad impregnated with cadmium sulphide. Good recoveries of amounts of mercury of the order of 5  $\gamma$  per 200 ml. had been recorded. This separation might advantageously be used prior to determination with dithizone in which cadmium did not interfere.

### Recent Technique

The paper chromatographic separation of inorganic ions was a comparatively recent technique and presented enormous scope for investigation and development. Such work as had been done to date indicated that this method could provide a rapid, inexpensive and simple means of separating and determining many metals including mercury. Many systems had been worked out for separating different groups of metals in varying combinations too numerous for mention here. Having special regard to mercury, one system was particularly worthy of mention since it specifically separated mercury from: Pb, Cu, Bi, Cd, As, Sb, Fe, Al, Cr and Ni (82). The solvent system used was methyl acetate 87: methanol 3: water 10. Metals should be present in the test solution as chlorides.

The spot of test solution was applied near the bottom of a paper strip, which was dried and suspended in a closed vessel with the end of the paper immersed in the solvent mixture. The solubility of mercuric chloride was such that it would migrate up the paper with the solvent front, while all the other metals mentioned would remain at the starting point. When the separation was adequate the portion of paper containing the mercury could be cut off and mercury determined straightforwardly. It was, of course, essential that the volume of solution applied to the paper be accurately

## ANALYTICAL CHEMISTRY

measured, and it would be found that it was difficult to apply satisfactorily more than about 0.01 ml. of solution per cm. width of paper.

This resume of the paper chromatographic technique was of necessity brief, but it was hoped to indicate the potentialities of a method which should amply repay more detailed study.

The following methods were available for the micro-determination of mercury:

### (a) Diphenylthiocarbazono (Dithizone)

Most of the dithizone technique within the scope of this paper had been dealt with in the section concerned with the separation of mercury from other metals. The combined mercury dithizonate extracts obtained from this separation were diluted to 15-20 ml. or if necessary aliquots of that size could be taken. Excess unchanged dithizone was removed by shaking with two successive portions of five per cent  $\text{NH}_3$  and the colour of the separated chloroform solution was measured on a photo-electric instrument after clarification with anhydrous sodium sulphate. Using the Spekker Absorptiometer, optimum readings were obtained using the No. 8 violet filter.

### Spectrophotometer

On a variable waveband spectrophotometer the maximum absorption of the mercury dithizonate colour occurred at about 530  $\text{m}\mu$ . The mercury dithizonate was appreciably sensitive to light and care had to be taken not to expose the solutions for too long a period prior to colour measurement.

Another application of the dithizone method was the 'reversion' principle (83) whereby the mercury dithizonate was reverted to dithizone by treatment with six per cent KI at pH 4. This method would separate mercury from a mixture of dithizonates containing a twenty-fold excess of copper and up to 20 mg. of Bi, Pb and Fe.

### (b) Di-betanaphthylthiocarbazono

This compound produced complexes with metals similar to those of dithizone of which it was an analogue. The mercury complex was in many ways more suitable for colorimetric work than the dithizone, as it was red in colour, more stable to light, and permitted of the determination of smaller quantities of mercury.

Copper and mercury were extracted from the hydroxylamine oxidate treated with a 20 mg. per litre solution of the reagent in chloroform. The chloroform layer was washed with dilute  $\text{H}_2\text{SO}_4$ /sodium thiosulphate solution to complex the mercury and remove it to the aqueous layer. This solution was re-oxidised, re-extracted with the chloroform reagent solution and the colour of the solution measured.

### (c) Diphenylcarbazono

Diphenylcarbazono produced a violet complex with mercury. (Diphenylcarbazono reacted similarly being oxidised to the carbazono by the oxygen of the atmosphere). This reaction was very sensitive but very susceptible to interference. Small quantities of the nitrates and sulphates of ammonia and the alkali metals

## OF MERCURY

caused precipitation; chlorides faded the colour; most heavy metals formed coloured complexes which interfered. The following were the optimum conditions for the use of this reagent (84):

The sample solution was adjusted to pH 4 using an acetic acid/sodium acetate buffer. The reagent was added as a one per cent solution in absolute alcohol, when maximum colour intensity would develop in 15 minutes, after which time it was stable for several hours. This colour was independent of the amount of reagent used so long as it was present in more than a 2 : 1 excess over the mercury.

In general the advantage of the sensitivity of this method was far outweighed by its susceptibility to interference, and the superiority of the dithizone method.

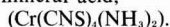
### (d) *p*-Dimethylaminobenzylidene rhodamine

This was a very sensitive reagent for mercury and particularly silver. In the absence of the latter it could be used for mercury although it was not ideal as a colorimetric reagent since the reaction products were insoluble, and had to be stabilised in suspension by the use of a protective colloid.

### (e) *Nephelometric methods*

There were several nephelometric methods for the determination of mercury, but in the main they were insufficiently sensitive to be of real value in micro-analysis. Among the most satisfactory were:

- (1) The formation of colloidal mercuric sulphide.
- (2) Colloidal iodo-mercuriates of alkaloids such as strychnine.
- (3) The almost insoluble complex formed by the reaction of mercury with chromium ammonium thiocyanate in mineral acid,



This method could be made colorimetric by treatment with thiourea which rendered the product soluble in methyl ethyl ketone to give a red solution.

### (f) *Physical methods*

Of the physical methods available, the most sensitive was based on the absorption by mercury vapour of radiation at 253.7 m $\mu$ . This method had been applied to the determination of mercury in the air and would detect as little as 5  $\gamma$  per cubic metre (85).

### (g) *Sampling and estimation of atmospheric mercury*

The estimation of atmospheric concentrations of mercury was important from the toxicological point of view, and merited separate consideration. The sampling of atmospheres involved the problem of whether mercury was present in vapour or particulate form. It had been established (86) that an alkaline hypobromite solution (4 ml. Br<sub>2</sub> in 100 ml. eight per cent NaOH) in a bead-bubbler would effectively trap mercury vapour at reasonable sampling rates (say, one to five litres per minute in a bubbler containing five to 10 ml. of hypobromite solution).

It was, however, an observed physical phenomenon that particulate clouds could not be completely trapped in a bubbler. The reasons for this phenomenon were connected with considerations of particle size, particles from five to 25 m $\mu$  being untrapped. The precise

physical explanation for this was beyond the scope of this paper but its existence made it essential that where particulate cloud material had to be sampled a filter must be used. In the case of mercury it has been found that a No. 3 Whatman paper in a suitable holder, backed by a bead-bubbler, was sufficient to trap completely mixtures of particulate and gaseous mercury.

Differentiation between the two forms was not strictly possible since, although separate analyses carried out on bubbler and filter paper showed mercury in both, it was obvious that some of the particulate mercury originally collected on the paper must have volatilised into the bubbler during aspiration.

Another aspect of atmospheric mercury was the presence of mercury salts in the air. While this did not represent a common hazard, it was found in certain chemical manufacturing environments and had had to be considered. Here the cloud was sampled on a particulate filter, but in view of the high vapour pressure of, for instance, the mercury halides, continuous aspiration caused losses by volatilisation. It was, therefore, essential even with a wholly particulate cloud to back the filter with a hypobromite bubbler as was recommended for the trapping of mercury vapour.

## Final Determination

The final determination of mercury in these atmospheric samples was carried out as follows:

The hypobromite solution was thoroughly washed out of the bubbler, and acidified with a few drops of hydrochloric acid when it would turn brown owing to the liberation of free bromine. This was destroyed by the dropwise addition of 50 per cent aqueous hydroxylamine hydrochloride, and the solution neutralised to litmus with dilute sodium hydroxide. The acidity was then adjusted to 0.1N with hydrochloric acid and the dithizone method already described was applied.

The filter paper containing particulate mercury was boiled with aque regia, which was then treated with hydroxylamine, the pH adjusted, and the dithizone technique applied.

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## German Chemicals for UK

BAYWOOD Chemicals is now offering to British farmers the latest types of agricultural chemicals produced in Germany by Farbenfabriken Bayer AG, of Leverkusen. Baywood was set up about 18 months ago jointly by Burt Boulton & Haywood, of London, and Bayer, of Germany, to market agricultural chemicals produced by the two companies.

## Alkalite Polythene

### Fittings for Joining Tubes Developed by ICI Ltd.

POLYTHENE FITTINGS for joining lengths of polythene tubing have been developed by the Metals Division of Imperial Chemical Industries Ltd., in co-operation with its Plastics Division, under the trade name Alkalite. They are moulded from Alkathene (see THE CHEMICAL AGE, 6 October, p. 21) and are available at present in  $\frac{1}{2}$  in.,  $\frac{3}{4}$  in. and 1 in. nominal sizes for normal gauge Alkathene tube in the form of straight coupling, elbow, tee, reducer and adaptor. Similar fittings for heavy gauge tube will be available at a later date.

### Making a Joint

To make a joint, the end of the tubing is cut square and fitted closely against the shoulder stop of the fitting. Circular resistance elements moulded into the Alkalite fitting lead through the fitting body to two external connector wires. Low voltage current (e.g. from a well-charged 6-volt heavy duty battery) at moderate amperage, passed through the elements via the connector wires, produces sufficient heat to cause localised melting of both tube and fitting, welding both into a homogenous whole. When molten polythene escapes from the point of entry of the connector into the fitting, the circuit is broken and welding stops. After cooling, the connector wires are snipped off. The joint so produced is air-tight and water-tight. As no manipulation of either tube or fitting is required, the fittings can be easily installed in relatively inaccessible corners.

Judging the correct welding time from visual inspection of the joint in the making is a critical factor. An Alkalite timer costing about £10 has therefore been developed which can be pre-set to the size of the fitting involved and automatically controls the intensity of current and length of welding time.

## Nickel Plant Contract

A CONTRACT worth approximately £750,000 has been awarded to W. J. Fraser & Co. Ltd., chemical engineers, of Harold Hill, Essex, for the installation of new nickel refining plant at Clydach, South Wales, for the Mond Nickel Co. Ltd. The plant will carry out the final stage in the production of nickel, in which the pure metal is obtained by thermal decomposition of gaseous nickel carbonyl. The carbonyl process has been operated by Mond Nickel for over 50 years.

## Zinc Consumption

MANY ADVANTAGES have resulted from the acquisition of London offices says the October *Report* of the Zinc Development Association. Members of the Association and users of zinc are making good use of the new centre and the number of enquiries, particularly by telephone, has greatly increased. The basis of all ZDA work, says the report, is its information services. In 1955 nearly 5,000 enquiries on a wide range of subjects were answered. Included in this report are some figures taken from the association's publication *Zinc in Europe 1953-5*.

These figures show a general rise in consumption of zinc in the UK, Belgium, France, German Federal Republic, Italy, the US, Canada and Australia. For example, the UK figures rose from 255,700 long tons in 1952 to 346,600 long tons in 1955.

## CIL Take Over

CANADIAN Industries Ltd. has purchased Witts Fertilizer Works Ltd., at Norwich, Ontario, founded more than 45 years ago as manufacturers of compound fertilisers.

The announcement was made by the president of Witts Fertilizers, Frederick C. Bishop, who is retiring along with Charles F. Bishop, vice-president and general manager. Mr. Bishop stated that all other personnel are remaining with the business, which in future will be known as Witts Fertilizer Co.

This is the second fertiliser plant in southwestern Ontario to be acquired recently by CIL, the first being William Stone & Sons Ltd. of Ingersoll, purchase of which was announced recently.

## Mexican Alcohol

ALCOHOL PRODUCTION in Mexico in 1955 totalled 43,981,195 litres against 43,826,062 litres in 1954. In 1939, production was 24,619,179 litres. Petroleum exports during the first five months of this year totalled 11,141,862 barrels. Imports of petroleum and petroleum products during the same period totalled 6,492,517 barrels, valued at US \$26,504,142. Crude oil production in the same period totalled 39,198,701 barrels giving a daily average production of 257,886 barrels. Daily average production in 1955 was 249,537 barrels.

## Combustion Chambers

### New Form of Design Approaches Theoretically Correct Shape

DEVELOPMENT of twin fluid type atomisers with close control of flame shape and fuel droplet size by Urquhart's (1926) Ltd., Park Royal, London NW10, has made it possible for this company to produce a new form of combustion chamber designed to approach a theoretically correct shape for high intensity combustion. Oil is finely broken up by the high energy atomiser and spread evenly into a specially shaped combustion chamber which aids internal radiation. Pre-heated secondary air is injected through the combustion chamber walls to produce rapid intermixing of reaction products. High rates of combustion are thus promoted. The heat release rate for these new chambers is quoted as 1 million BThU/hr. per cu. ft. of combustion space. Manual or automatic control of both air and fuel supply can be varied to give combustion products from oxidising atmospheres to theoretical CO<sub>2</sub> content or, if required, a relatively high percentage of CO can be obtained by operating below theoretical oil/air ratios.

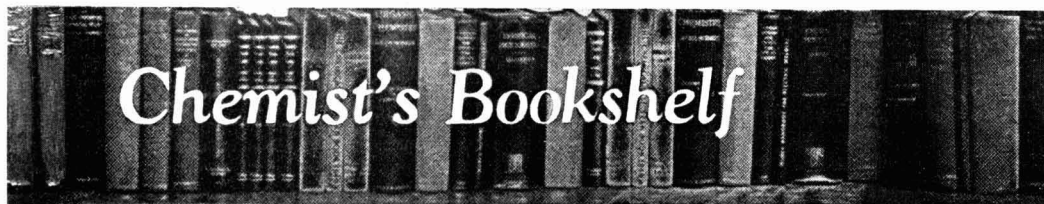
## Fertiliser Plant Recommended

INDUSTRIAL CONSULTANTS asked by the Federal Government of the Rhodesias and Nyasaland to consider the possibility of setting up a nitrogen fertiliser plant in the Federation have given a favourable report. Production of ammonium sulphate as the main nitrogen fertiliser is recommended. Consumption of nitrogenous fertiliser has risen from 4,000 tons a year in 1951 to 9,000 tons a year and it is estimated that the demand may rise to 20,000 tons by 1960 and 40,000 tons by 1970. Last year nitrogenous fertiliser was imported into the Federation from Britain and the Continent at an average landed cost of £24 4s per short ton. Estimates suggested for cost of production of ammonium sulphate in the Federation are between £10 16s (approx.) and £15 5s per long ton, depending on process and site. Likely sites appear to be Livingstone, Norton and Gatooma and cost of the plant is estimated at about £5 to £6 million.

## Change of Name

NAME of the headquarters of the Gas Council at 1 Grosvenor Place, London SW1, will in future be Murdoch House instead of Gas Industry House.





**THE MANUFACTURE OF GLYCEROL.** (Vol. III. —*The Modern Soap and Detergent Industry*). By G. MARTIN. 2nd edn. revised and enlarged by H. J. STRAUSS. The Technical Press Ltd., London. 1956. Pp. 219. 84s.

The appearance of a new edition of this standard work will be welcomed. Much of the information contained in the 1926 edition has been retained, and new material has been added. Details are now included of numerous synthetic production methods available, including a reference to the latest (1955) Shell development involving the reaction between hydrogen peroxide and acrolein. Many aspects of the manufacture of glycerol from soap lye are discussed in great detail. Polymerised glycerol and glycerol substitutes also receive close attention. In addition there is a veritable mine of information on the physical properties and use of glycerol and allied compounds.

With certain exceptions, the claim that this book is a thoroughly revised, up to date version of the 30-year-old first edition is justified. Unfortunately, the general layout does not qualify for the term 'up to date.' Many of the diagrams are just plain old-fashioned. To anyone with less than perfect eyesight, a large number of the flow-sheets and drawings are almost indecipherable. It is appreciated that sentiment sometimes does not allow too drastic a change to be made to an old faithful, but this attitude can be carried too far.

Again, one hardly expects to see in a 1956 revised edition a statement such as 'Within the past few years the film type of evaporator has made considerable progress,' especially when the description that follows concerns equipment introduced some 30 or 40 years ago. The book is divided into six sections, the largest having 10 chapters and the smallest having two, and each section has its own group of page numbers. This is bad. It makes the use of the index a wearisome and sometimes exasperating task.

Nevertheless, anyone with even the remotest interest in glycerol should find this volume a constant and faithful companion. It is a pity; it could also have been an elegant one.

J. W. MULLIN

**CHEMISTRY OF CARBON COMPOUNDS.** Vol. III. Part B. Edited by E. H. RODD. Elsevier Publishing Co., Amsterdam. Distributed by Cleaver-Hume Press Ltd., London. 1956. Pp. xx + 1670.

More than half of the volumes in this valuable series have now been published. So far, the chemistry of aliphatic, alicyclic and aromatic compounds has been presented and discussions of heterocyclic and miscellaneous compounds are awaited in future volumes. It will be recalled that, although Part A of this volume was devoted entirely to benzene derivatives containing a single aromatic ring, certain groups falling within this

broad class had to be omitted. Five of the chapters in Part B complete the description of these groups; the first, concerned with quinones, is contributed by Z. E. Jolles, while W. J. Hickinbottom, in association with R. F. Garwood and M. F. Ansell, has written the other four.

Attention is then turned to the various classes incorporating two or more benzene rings; non-fused systems are considered in three chapters devoted severally to diphenyl and its homologues (W. J. Hickinbottom), phenyl-substituted methanes (W. J. Hickinbottom and S. H. Harper) and di- and poly-phenyl paraffins (S. H. Harper). The guides to aromatic compounds with condensed nuclei are J. van Alphen, G. M. Badger, S. Coffey, J. W. Cook and E. H. Rodd. Until recently one was accustomed to thinking of carbocyclic aromatic compounds as being the benzene family but one is reminded of the modern extended conception of aromaticity in the chapter on quasi-aromatic compounds (G. L. Buchanan and R. A. Raphael), in which tropolones and biscyclopentadienyl derivatives are discussed. So rapidly are these fields expanding that there is little doubt that it will be necessary to extend the chapter considerably in future editions.

This is an essential reference book for every chemical laboratory. Compiled by a renowned team of experts, it contains a wealth of useful information and stimulating ideas. Once more one is indebted to Dr. Rodd for his overall guidance and to Dr. Hickinbottom for the monumental task which he has again undertaken so efficiently. The vast majority of chemists are already well aware of the outstanding contribution which this series is making in their subject; to those who have not had the opportunity of studying earlier volumes, this book is strongly recommended.

E.J.B.

## Economic Production of Magnesium

BECAUSE of the high cost of electricity and materials, the electrolytic production of magnesium has been abandoned by Magnesium Elektron, Clifton Junction, Manchester. In the new process, briquettes composed of calcined dolomite and ferro-silicon are reduced at high temperature under vacuum. Magnesium metal is liberated as a vapour and condensed in the form of crystal metal on the cool end of retorts. The advantages are that the system can be heated by low-grade oil, while the dolomite is found extensively in the Pennine range. As the ferro-silicon is imported from Norway, the short sea-passage also helps to reduce costs.

The company already has a pilot plant in operation and it states that the price of the magnesium produced by this process will be competitive.

## CHEMICAL STOCKS & SHARES

### Increased Demand for British Funds

FIRMER conditions ruled in stock markets and values, both in the industrial and gilt-edged sections, have moved in favour of holders. Sentiment has been helped by a number of factors, particularly by the belief that the credit squeeze and other measures taken against inflation are proving effective. There is no early prospect of the credit squeeze being relaxed but, on the other hand, there are growing hopes that, before the next Budget, it may be possible to reduce the bank rate from its current 5½ per cent. It is this hope which has helped to bring increased demand for British Funds. Elsewhere, the initial shock of the sharp decline in half-yearly earnings shown by many leading industrial companies, including ICI, has been replaced by wider recognition that in most cases the lower profits arise from the policy of keeping prices of goods down in order to increase turnover. Moreover, it is pointed out that the majority of companies should have no difficulty in maintaining their dividends despite somewhat lower profits. On this basis many shares would give quite attractive yields and it can be expected that they will respond in price when there is a general rally in stock markets.

#### ICI Shares

ICI shares declined to close on 40s at one time following the interim statement, but later rallied to 41s, which, however, compares with 42s 9d a month ago. The half-yearly figures, showing a further increase in turnover, but lower net profits because of the policy of freezing prices which has now been extended to more than 10,000 products, have had the effect of dispelling earlier hopes that the dividend might be raised above the previous year's 10 per cent. It cannot, however, necessarily be assumed that the dividend will not be raised, even if, as seems likely, profits for the whole year are lower. In any case ICI shares are, of course, a sound long-term investment with scope for higher dividends. Moreover, there is talk in the market that sooner or later more capital may have to be raised. It is assumed that, when this proves necessary, ICI shareholders will be offered preferential terms of allotment whether the capital is to be raised in shares or a prior charge of some kind.

Buyers have been about for the shares of Borax Holdings, which, however, have tended to move rather closely with the trend of Wall Street

markets now that US investors are interested in them. Nevertheless, compared with a month ago, the price has advanced from £13 11/16 to £14½. There are general expectations of a higher dividend and perhaps of a free scrip issue which would reduce the market price by giving shareholders more shares. At present the price is so high that it is out of the reach of the small investor. Hickson & Welch 10s shares have been well maintained at 28s 6d, while Hardman & Holden 5s shares remained at 10s 6d. Glaxo were good, having advanced on the month from 33s 6d to 34s 6d helped by the rise in net profits from £1,456,000 to £1,665,000, the increase in the dividend from 12½ per cent to 14 per cent and the proposed free issue of one share for every two held.

#### Morgan Crucible

Elsewhere, Morgan Crucible 'A' shares have been firm at 43s 6d and Greeff-Chemicals Holdings 5s shares were well maintained at 16s 9d while Negretti & Zambra 5s shares strengthened to 16s 3d. Triplex Glass 10s shares at 33s 4½d have been steady, helped by the view that, bearing in mind that the business of the group is more widely spread than is often supposed, there are grounds for assuming the dividend for the current year may be maintained.

F. W. Berk 5s shares have strengthened from 7s to 7s 6d and the 6s 8d units of the Distillers Co. at 20s 9d were within 3d of the level ruling a month ago. In other directions the good yield brought in buyers for Yorkshire Dyewares & Chemical 5s shares which moved up from 8s 6d a month ago to 9s.

#### Monsanto Chemicals

Monsanto 5s shares were 23s 3d compared with 24s 3d a month ago, and Laporte 5s shares receded on the month from 17s 3d to 16s while Albright & Wilson 5s shares moved down on balance from 19s 3d to 18s 6d. After the decline in the previous month, Brotherton 10s shares have held steady at 25s. Sentiment in regard to chemical shares has remained under the influence of the ICI half-yearly figures showing lower profits, due to the price-freeze policy. It cannot of course be deduced from this that profits of all chemical companies have moved lower. The individual circumstances vary a good deal. There seems a strong case for chemical companies

## Tetraethyl Orthosilicate

### Service Bulletin is Published Describing Applications

A TECHNICAL service bulletin, No. 4S/2, has been issued by Monsanto Chemicals Ltd., Monsanto House, Victoria Street, London SW1, on tetraethyl orthosilicate (tetraethoxysilane), a distilled product consisting essentially of monomeric ethyl silicon ester Si (C<sub>2</sub>H<sub>5</sub>O)<sub>4</sub>. Principal application of the compound is the internal coating of lamp bulbs with finely divided particles of almost pure silica, which are deposited by the fume produced by the combustion of tetraethyl orthosilicate with the aid of oxygen.

The coating is stated to have a negligible effect on the light output and confers the following advantages on treated bulbs: Improved diffusion, lower apparent brightness of filament, softer white light, decreased internal arc cover and diminished blackening with age. Treatment cost per bulb is very small. Also, in contrast to methyl silicate, ethyl silicate does not appear to give rise to eye damage, and provided normal ventilation precautions are taken, no danger should arise from inhalation of the vapour. The liquid has no corrosive action on the skin.

### Q & Q Exports Progress

THE basis for a sound export of Quickfit & Quartz laboratory apparatus has been made firmer during the past year, stated Sir Graham Cunningham, chairman and managing director, at the annual general meeting of the Triplex group of companies.

which have so far not done so to adopt the growing practice of issuing a half-yearly profit statement or progress report.

Reichhold Chemical 5s shares have remained at 15s 9d and Anchor Chemical 5s shares at 11s 6d. William Blythe 3s shares at 11s were within 9d of the level ruling a month ago. British Chrome Chemicals 5s shares at 9s 9d lost a few pence. Lawes Chemical 5s shares strengthened from 15s to 15s 9d, and shares of plastics companies were better with British Xylonite 25s 9d compared with 24s 9d a month ago, though British Industrial Plastics 2s shares eased from 4s 10½ to 4s 6d. Elsewhere, British Drug Houses 5s shares eased from 13s 3d to 13s and Boots Drug 5s shares from 14s 6d to 14s. In response to the good financial results, T. W. Ward have risen from 60s 9d to 64s 9d.

by  
Peter Pain M.A.

# Restrictive Trade Practices

## RESALE PRICE MAINTENANCE LAW CHANGES

A GREAT deal has been said on the subject of resale price maintenance. It was the subject of Government report in 1949 and since then its advantages and its evils have been extensively canvassed. The new Act provides a radical change.

Common law has usually been the handmaid of *laissez faire* economics. It adjusts itself with difficulty to a system of controlled competition. In 1915 the House of Lords decided that a manufacturer could not enforce resale conditions against a retailer, on the ground that the retailer was not party to any contract with the manufacturer. (*Dunlop v Selfridge*, 1915. *Appeal Cases*, 847.) To meet this gap in the law manufacturers banded together to cut off supplies from wholesalers who would not see to it that retailers observed these conditions.

The form of organisation for this purpose varied considerably; sometimes the manufacturers formed a trade association of their own, sometimes the wholesalers were included in the association and in a number retail traders could be members too. The sanctions varied also, but were always based on the threat to cut off supplies. In certain industries, and notably in the motor trade, a system of courts was evolved which imposed various penalties, such as fines, as an alternative to being placed on the stop list. These courts disposed of such power that they were in a position to summon persons to appear who were not members of the association concerned.

### Criticism of Private Courts

Methods of price maintenance and systems of private courts in particular met with a great deal of criticism. The problem which Parliament tried to solve was to meet these complaints without creating economic chaos. It did this by filling in the gap in the law. It provided that conditions might be attached to the goods which could be enforced by the manufacturer against the retailer and made private agreements setting up resale price maintenance machinery illegal.

*Enforcement of Resale Price Conditions.* The new law applies from 2 November (Friday). The supplier may impose a condition that goods are to be resold only at a certain price, either generally or to a particular class of persons. This term will appear in the contract between him and the wholesaler. A retailer who obtains the goods after the date of the original contract and who had notice of these conditions will be bound by them; if resale is limited to a particular class, the conditions will bind him only if he falls within that class.

The Act does not define notice; there may be a good deal of legal argument in the future as to whether

this includes only matters brought to the attention of the retailer, for example, by a notice attached to the goods; or whether it includes matters well known in the trade.

A manufacturer who alters his price list will not be able to enforce the new price conditions in respect of goods already on the market. The conditions will apply only in the case of resale in the course of business. Where a price alteration has been declared to be contrary to the public interest by the Restrictive Practices Court it will of course not be enforced. The new law applies to prices in a wide sense and includes conditions as to discount, part exchange and hire purchase.

### Damage and Injunction Claims

Conditions will be enforced at the suit of the manufacturer. He may claim damages and an injunction against the retailer as if he had made a contract with the retailer embodying the condition. But the Court may go further; it is not limited to an injunction relating to the consignment of goods in question. It may restrain the retailer from reselling any of the manufacturer's goods in breach of any such condition, whether the goods be of the same description or not. This is a serious matter for the retailer. If he disobeys such an injunction he may be imprisoned during the pleasure of the court.

*Prohibition of Private Enforcement.* Two or more persons carrying on business in the UK as suppliers may not make or carry out any arrangement by which they undertake:

- (i) To withhold supplies of goods for delivery in the UK from dealers (whether party to the agreement or arrangement, or not) who resell or have resold goods in breach of any condition as to resale price;
- (ii) To refuse to supply goods for delivery in the UK to such dealers, except on terms which are less favourable than those applicable in the case of other dealers carrying on business in similar circumstances; or
- (iii) To supply goods only to persons who undertake, or have undertaken, to withhold supplies of goods, or to refuse to supply goods.

It is also unlawful to make any agreement providing for the recovery of penalties from infringers, or authorising the conduct of domestic proceedings in connection with infringements.

Similarly it is unlawful for dealers to make agreements under which they will withhold orders from.

[turn to page 223

## BS for Draughtsmen

### Standard Drawing for Glass Apparatus

DRAWING CONVENTIONS for representing laboratory apparatus made principally of glass in textbooks and technical journals and reports are recommended in British Standard 2774: 1956 (Drawing conventions for laboratory glass apparatus). They are intended for use both with full-size drawings and with reduced-scale drawings down to about one-tenth full size; the standard is illustrated by 10 pages of examples. Established draughtsman's conventions listed in BS 308, 'Engineering drawing practice,' were followed insofar as they appeared appropriate to glass apparatus. The aim throughout has been to combine clarity and un-ambiguity for the reader with convenience for the draughtsman. Comments on the standard and suggestions for improvement will be particularly welcome. Copies of this British Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W1, price 3s 6d.

## Anti-Freeze Plant Plans

PLANS for the construction of a modern \$1.5 million plant for the formulation and packaging of automotive anti-freeze were announced recently by W. Adrian King, manager of the automotive products department of Olin Mathieson Chemical Corp., Baltimore, Maryland.

The plant will be built at Mapleton, Illinois, on a portion of a 250 acre tract of land purchased from the Toledo, Peoria & Western Railroad. Ground will be broken next spring, with completion of the plant scheduled for early 1958 in time for the 1958-59 anti-freeze season, according to Mr. King. It will consist of a one storey steel and concrete block building of about 90,000 sq. ft. floor space, an outdoor tank farm for bulk storage of raw materials, and terminal facilities for rail, truck and water transportation.

Modern jet formulating equipment will enable the plant to turn out 12 million gallons of anti-freeze a year. This will make it the largest of Olin Mathieson's anti-freeze formulating plants and one of the largest of such operations in the U.S.

## Department Transfer

FROM 29 October the buying department of the A. Ibbetson & Co. Ltd. group will be transferred to Jeyes' Sanitary Compounds Co. Ltd., Richmond Street, Plaistow, London E13 (GRAngewood 4057).

# PICKLING PLANT DEVELOPMENT

## New Shop at Dempster's Yorkshire Works

RECENT developments at the Rose Mount iron works of Robert Dempster & Sons Ltd., Elland, Yorkshire, include a new pickling and painting shop which is now in operation.

The new shop has been built on a site within the existing works boundary, and is served by a ring road which facilitates receiving and despatching materials, the scheme being devised and built to meet an expanding demand for the pickling and painting of steel plates and sections used in gas, chemical and oil plants, and general structures.

Corrosion has its primary origin in millscale and rust which are formed in the rolling processes, and unless they are completely removed by a positive method, the acids in the atmosphere combine with moisture, continuing the corrosion at varying rates according to the localities.

In the sulphuric acid/water wash/phosphoric acid process installed by Dempster, millscale and rust are removed from the steel by immersion in a 5/6 per cent sulphuric bath at a temperature of 65° C for 15 to 25 minutes, after which superfluous acid is allowed to drain off prior to washing by two dips in the water bath which is maintained at 65° C. After washing, the steel is then immersed in the phosphoric bath maintained at 85° C and containing two per cent free phosphoric with 0.3 per cent to 0.4 per cent iron. This final immersion produces a rust inhibiting coat of iron phosphate over the whole surface of the steel. When dry, and while still warm, the steel is painted with the priming coat specified, well brushed in.

The three baths are each 35 ft. by 5 ft. by 9 ft. deep, the tops being three ft. three in. above the shop floor level. The shells are of reinforced concrete, lined on the inside with rubber membrane, and clad on the outside and inside with 9 in. thick acid resisting brickwork set in acid resisting cement and with bullnose capping.

Each bath is heated by four steam injectors of special design, and emptied by means of steam ejectors from a sump at the end, the spent pickling liquor flowing to the effluent plant along acid resisting gullies covered by cast iron open mesh grids.

### Disposal of Effluent

Disposal of effluent necessitated the building of a complete neutralising and settling plant in order that the effluent discharged to the sewers would be of pH 7 to pH 9 and with solids not exceeding 40 parts in 100,000.

The plant is capable of dealing with flat plates or sections to a maximum of 34 ft. long by 7 ft. wide, while curved plates of 35 ft. by 7 ft. with a versed sine of up to four ft. six in. can be accommodated at a single dip.

These facilities are available to other firms in the engineering industry.

## Workmen Overcome

FIVE workmen were overcome by fumes at the National Coal Board's carbonisation plant at Wingerworth, near Chesterfield, on 21 October. Three of them were detained in hospital.

# BCIRA ANNUAL REPORT

## Maximum Government Grant Obtained

ACCORDING to the 35th *Annual Report*, the income of the British Cast Iron Research Association for the year ended 30 June 1956 was £197,372, £6,011 greater than for the preceding year. Grant-earned income has again exceeded £120,000, enabling the association to earn the maximum Government grant of £56,000. Revenue expenditure has risen from the previous year's figure of £111,012 to £138,194. This increase is attributed to additions made to staff during the year together with increases in the cost of materials and services.

Cathodic protection of ships' propellers is being studied in conjunction with the British Shipbuilding Re-

search Association. A shrouded anode has been developed to fit to the propeller tailshaft to minimise attack. Many vessels have been fitted with magnesium anodes and their progress in service is being studied. Work is also being carried out on the possible influence of anti-freeze solutions on corrosion in the waterways of diesel engines.

Methods of analysis are continually under review, says the report, and normal methods of analysis are being systematically examined for deficiencies, with a view to their incorporation in a handbook for analytical chemists, the first part of which is nearly complete.

★ PUBLICATIONS AND ANNOUNCEMENTS ★

A SELF-CLEANING strainer which is claimed to incorporate a novel principle of working is made by Ashworth & Parker Ltd., Riverside Works, Bury, Lancashire. Known as the Rotoklene, the strainer consists of an internally toothed drum mounted in a suitable casing so that it can be rotated by a pinion which extends the full length of the drum, the pinion being turned by an outside handle, or by power if desired. The outside of the drum has axial ribs, the spaces between communicating with the internal tooth spaces. On the outside of the drum the straining medium is situated. The liquid to be strained enters the outer casing by a suitable branch, passes radially inwards through the straining medium and leaves by a branch communicating with the interior of the drum. The straining wire is of a special vee-shaped cross-section which is claimed to present a low-resistance path to liquid without becoming blocked in a short interval of time.



CHEMICAL ATTACK and abrasion is a major problem common to an extremely wide range of industrial plants. A booklet just published by Silvertown Rubber Co. Ltd., of Herga House, Vincent Square, London SW1, shows how these problems can be overcome by utilising the protective properties of specially compounded Silvertown rubber and ebonite.

Entitled *The Inside Story of Silvertown Linings & Coverings*, the booklet deals with the basic problems arising from the handling of corrosive and abrasive material, and goes on to show how tanks and other vessels, pipes and equipment, are given lasting protection. Some of the precise checks and controls made at each stage of the lining and covering processes are discussed and a number of interesting and unusual installations carried out by the Silvertown company are illustrated. Reference is made to the lining of vessels 'on site' where the conditions are suitable, and a useful tabulation at the end of the booklet gives numerous details of the chemical resistance of rubber and ebonite.



NUMBER 176 of *Science Progress* has now been published by Edward Arnold (Publishers) Ltd., 41, Maddox Street, London W1, price 12s 6d net. This quarterly review of scientific thought, work and affairs contains articles on new applications of low temperatures, regulation of plant growth with chemicals, the physical theory of nature and man's study of lightning. A section is devoted to recent advances in astronomy, physics, general and physical chemistry, biochemistry, pedology and plant physiology. The two essay reviews are Jurassic geology and selected reference material on atomic energy.

SOLVENT RECOVERY COSTS have always to be borne in mind. It is therefore of interest to note that the Sorbonorit process developed by United Norit Sales Corporation Ltd., Amsterdam, Holland, is stated to give solvent recovery costs which amount to 10-15 per cent of the initial solvent expenses.

The Sorbonorit plants are based on the ability of the Sorbonorit carbon to adsorb the solvent vapours at very low concentrations. The solvent adsorbed is driven off the carbon by means of low pressure steam, and the steam/solvent mixture is led to a condenser where, if the solvents are non-soluble in water, separation is effected in a gravity separator. If the solvents are soluble in water, separation is effected by distillation.

Agents for Sorbonorit recovery plant are Farnell Carbons Ltd., 1a Conduit Road, Plumstead, London SE18. The technical department of United Norit Sales Corp. Ltd., Amsterdam, will advise companies with solvent recovery problems and its research laboratory will carry out tests where special recovery problems are involved.



CONICAL ground glass joints for which there is the broadest use and which are readily available are described in a catalogue recently issued by Quickfit & Quartz Ltd. The range of joints has been widened, adding to the conventional types some patterns used by the company in fabricating apparatus. The company claims that these often do a better job more economically. For example, says the catalogue, joints with extra wide shank avoid a weld which would be both unsightly and costly. All joints listed are made in heat and chemical resistant boro-silicate glass with an expansion coefficient of  $3.2 \times 10^{-6}$ .

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### The Restrictive Trade Practices Act

*from page 221*

or discriminate against, suppliers who will not fall in with resale price maintenance machinery.

A recommendation is treated in the same light as an agreement between the recommender and the person whom he recommends.

Such agreements are unlawful when they are made simply for the purpose of price maintenance. But a contract for the sale of goods to which not more than two persons are party is not unlawful because it contains undertakings by the purchaser in relation to the goods sold, and by the vendor in relation to other goods of the same description. Where actual goods change hands a manufacturer may require a wholesaler not to supply the goods to a retailer who does not observe the fixed price, and the wholesaler may require the manufacturer not to sell other goods of the same description to a price-cutting retailer.

*(to be continued)*

## Commercial Intelligence

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

### Mortgages & Charges

The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an \*—followed by the date of the Summary, but such total may have been reduced.

FOX CHEMICAL-ENGINEERING WORKS LTD., London NW. 3 October, charge to Westminster Bank Ltd. securing all moneys due or to become due to the Bank; charged on leasehold reversion of premises at Maybury Gdns., Willesden. \*Nil. 21 August 1956.

HEATHROD, ARDWYN & CO. LTD., Oxford, plastics manufacturers. 3 October, £3,500 deb., to Board of Trade; general charge. \*£1,350. 22 July 1955.

### Satisfaction

UNILEVER LTD., London EC. Satisfaction 8 October, of deb. stock reg. 10 January 1951, to the extent of £115,327.

## New Registrations

### Alfred A. Brown Ltd.

Private company (573,303). Registered 24 October. Capital £5,000 in £1 shares. Objects: To acquire the business of dealers in chemicals and laboratory furnishers carried on by Alfred A. Brown and Mrs. Mary E. Brown, both of 107 Ringstead Crescent, Sheffield; and Edgar England, 6 Kearsley Road, Sheffield. Secretary: E. England. Solicitors: Robert B. Grayson & Son, Sheffield 1. Registered office: 375 Attercliffe Road, Sheffield 9.

### C. J. D. Dyers Ltd.

Private company. (573,157.) Registered 19 October. Capital £100 in £1 shares. Objects: To carry on the business of archill, cudbear and aniline

dye manufacturers, drysalters, chemists, etc. The subscribers (each with one share) are: Ronald W. Woodward, 16 Hillside Avenue, Fartown, Huddersfield; and Harold Holsan, 21 South Cross Road, Birkby, Huddersfield, solicitor's managing clerks. The first directors are to be appointed by the subscribers. Solicitors: Eaton Smith & Downey, Huddersfield. Registered office: Britannia Buildings, Huddersfield.

### KBKK, Japan

Kawakami Boeki Kabishiki Kaisha (F.4568). (Kawakami Trading Company Ltd.). Particulars filed 23 October 1956 pursuant to Section 407 of the Companies Act 1948. Capital: 2,000,000 shares of 50 yen. Registered in Japan; to import, export and sell medicines, agricultural chemicals, chemicals for domestic animals, industrial chemicals, raw material for industrial chemicals and fertilisers, textiles, etc. British address: 31 Budge Row, London EC4. Zentaro Endo of 20 Hallam Street, London W1 is authorised to accept service of process and notices. The directors are: Kikuso Hanada, Kunto Kawakami, Mototaka Kehara, Haruo Yoshikawa and 5 others, all resident in Japan.

## COMPANY NEWS

### Fisons Ltd.

In 1954-55 consumption of fertilisers fell, but turnover of Fisons Ltd. rose by a seventh. Profits, however, fell because rising costs of raw materials reduced margins. Consumption of phosphatic fertilisers rose by 14 per cent and compound fertilisers by 10 per cent during the year ending 30 June.

Fisons Ltd. profit went up from £2.65 million to £3.05 million (15 per cent). The improvement in the fortunes of the Pest Control subsidiary may have contributed to the results.

Profits after tax (£173,000) are £1.49 million and the dividend of 15 per cent remains unchanged. The group is building a 4½ million fertiliser plant and dividends are, therefore, conservative.

### Research Centre

THE Texas Company's research centre at Beacon, NY, celebrated its 25th anniversary last month. The centre houses Texaco's principal research facilities.

## MARKET REPORTS

**LONDON** The general position is unchanged and most sections of the industrial chemicals market report a steady turnover. The price of sulphate of copper was lowered by £2 per ton as from 29 October, the current quotation being £92 10s per ton less 2 per cent f.o.b. Liverpool. Revised price schedule for bromides, iodides and theobromine have been notified. Potassium iodide BP is now being quoted at 12s per lb. and sodium iodide BP at 15s, both for quantities of a cwt. Activity in the potash compounds and soda products remains steady with satisfactory deliveries being made against contracts. Formaldehyde is in fair demand. There has been a continued good call for hydrogen peroxide, aluminium sulphate, borax and boric acid. A moderate but steady trade characterises the coal-tar products market with spot supplies adequate to meet current needs. Pitch is in good request on home account.

**MANCHESTER** Trading conditions on the Manchester market for heavy chemical products during the past week have been fairly steady. Traders are handling a fair number of enquiries from home users, who are mostly taking good deliveries against contracts. Additional export enquiries have also been in the market and shipping business in caustic soda and most other leading heavy products is on a satisfactory scale. Prices generally are on a firm basis. There is a fair movement of fertiliser materials, with a steady demand reported for most of the tar products.

**GLASGOW** Continued briskness is reported from the Scottish heavy chemical market during the past week, and this has been maintained at a reasonably good level. The demand has covered a range of chemicals and a varied cross section of industry. Levels of prices have remained steady, although towards the end of the week some of the metal derivatives have shown an increase. The export market is still fairly active.

### Acid Capacity Doubled

THE CAPACITY of Norando Mines' sulphuric acid plant in Northern Ontario is to be doubled and alterations are starting immediately. When in full production the plant will manufacture 350,000 tons of sulphuric acid annually and will make the company the largest Canadian manufacturer of sulphuric acid and iron sinter.

# 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.

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**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.

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**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.

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**PERMAPLEX C-10** A highly selective cation exchange resin membrane containing SO<sub>3</sub>H groups.

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

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## SITUATIONS VACANT

**TECHNICAL SERVICE.** A chemist with industrial experience, age 25-32 is required for interesting development work with rapidly growing London company manufacturing wide range of products based on oils, bitumens, natural and synthetic rubbers, vinyl resins etc. The successful applicant will be responsible to the Chief Chemist but will work in close contact with important customers and will be based on the Research Laboratory. Emphasis on experimental ability. Attractive salary. Apply will full details of qualifications and experience to **BOX NO. C.A. 3508 THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

## OFFICIAL APPOINTMENTS

**ANALYST** required Research Unit working Water Pollution Research Laboratory, Stevenage. Minimum qualification, G.C.E., English Language (O) and four subjects including Chemistry at (A) level: degree or analytical experience preferred. Salary and conditions equivalent to Assistant Experimental Officer (man—£350 to £755) or Experimental Officer (man—£875 to £1,075) in Scientific Civil Service, according to age (women's salaries slightly less). Write particulars age, education, addresses two referees, **DIRECTOR, FRESHWATER BIOLOGICAL ASSOCIATION, THE FERRY HOUSE, AMBLESIDE, WESTMORLAND,** by 10 December 1946.

## GOVERNMENT OF TANGANYIKA

Geochemist, Geological Survey Department.

**QUALIFICATIONS:** Good Honours degree in Chemistry or its equivalent. Some experience in inorganic analysis essential with special reference to rock and mineral analysis. Candidates with post-graduate experience preferred.

**AGE LIMITS** 25-40

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Apply to Director of Recruitment, Colonial Office, London, S.W.1. State age, qualifications and experience. Quote BCD 105/8/09.

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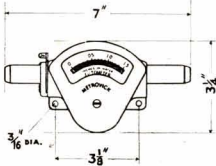
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