The Chemical Age

VOL. LXXVI No. 1949

17 November 1956

TESTS ON L P POLYTHENE

(See page 286)

INDEX TO ADVERTISERS

The first figures refer to advertisement in **The Chemical Age Year Book**, *the second to the current issue*

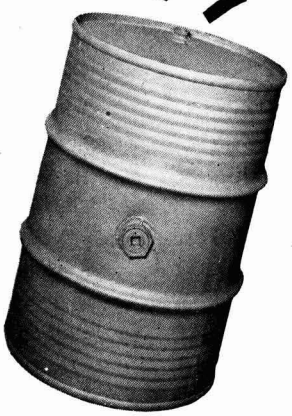
[*continued on page 264*

INDEX TO ADVERTISERS

The first figures refer to advertisement in **The Chemical Age Year Book**, *the second to the current issue*

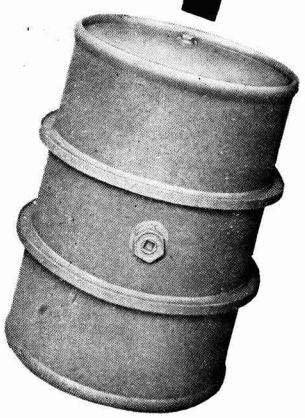
C

BRABY (regd.) STEEL DRUMS



expendable
(single journey)

These drums are available in a wide range of types in Returnable and Non-Returnable forms. All types can be supplied with painted exteriors whilst some may be decorated in colour suitable for the application of Users' names, trade marks, etc. Other finishes include galvanized, tin or lacquer lined.



returnable

ONE OF THE WIDE RANGE OF
BRABY
PRODUCTS

FREDERICK BRABY & COMPANY LIMITED
HAVELOCK WORKS. AINTREE, LIVERPOOL, 10. TELEPHONE: AINTREE 1721
OTHER FACTORIES AT: London Works, Thames Road, **Crayford**, Kent. TELEPHONE: Bexleyheath **7777**
Eclipse Works, Petershill Road, **Glasgow**, N. TELEPHONE: Springburn 5151
Ashton Gate Works, **Bristol**, 3. TELEPHONE: 64041. And **Falkirk**
OTHER OFFICES: 352-364 Euston Road, **London**, N.W.1 (Head Office). TELEPHONE: EUSton 3456
110 Cannon Street, **London**, E.C.4 (Export). TELEPHONE: MANsion House 6034
Queen's Buildings, 10 Royal Avenue, **Belfast**. TELEPHONE: 26509

VOL. LXXVI No. 1949

17 NOVEMBER 1956

The international weekly chemical journal covering every aspect of industrial chemistry and chemical engineering

THE CHEMICAL AGE

NEWS of the WEEK

BOUVERIE HOUSE · FLEET STREET · LONDON · EC4

Editor
GEOFFREY F. D. PRATT

Telephone : **FLEet Street 3212** (*26 lines*)
Telegrams : **Allangas · Fleet · London**

Director
N. B. LIVINGSTONE WALLACE

Manager
H. A. WILLMOTT

Midlands Office,
Daimler House,
Paradise Street,
Birmingham
(*Midland* 0784/5)

Scottish Office,
116 Hope Street,
Glasgow C2
(*Central* 3954/5)

Leeds Office,
Martins Bank Chambers,
Park Row,
Leeds
(*Leeds* 22601)

The annual subscription is 52s 6d ($7.40), single copies 1s 3d (by post 1s 6d). Overseas subscribers may send their subscriptions direct to London, or remit through any of our agents.

VIEWPOINT

Export Progress

FOR manufactured goods, the remarkable expansion of West German output, the modest recovery in Japan and continued growth elsewhere have added rapidly to world supplies. Industrial areas' demands have expanded similarly also. The race for export sales has been keen, in spite of the increase of nearly 60 per cent between 1948 and 1955 in the total volume of the non-Communist world's exports of manufactured goods.

In this period, West Germany has increased her share of the total from 2 per cent to nearly 11½ per cent, while Japan's share has advanced from under one per cent to about four per cent. These gains have not restored the pre-war position of these countries but they have exerted marked pressure upon exports from other industrial areas. The smaller countries of Europe have stood up to this pressure remarkably well, but the growth rate of exports from the US and the UK has been less and the British share in particular has fallen somewhat lower than before the war.

In a recent *Board of Trade Journal* progress in new exports during 1955 and the first half of this year is reviewed and a comparison is made of UK export performance in certain fields with that of our main competitors. It would seem that in 1955 this country exported 'new' goods valued at nearly £73 million, representing two and a half per cent of total UK exports. In 1953, new exports were just under two per cent and were valued at £51 million.

New goods exported can be divided into three broad categories: Chemicals, engineering products and 'other exports.' Last year the value of the chemicals group exceeded that of the other groups, although in the first half of this year the engineering products group had a slight lead over chemicals. The noticeable increase in new chemicals in 1955 was due to the demand for synthetic detergents and tetra-ethyl lead anti-knock compound. Five and a half million gallons (five times that exported in 1953) of the latter were shipped to 40 different countries.

Exports of synthetic detergents in 1955 were valued at £6-7 million. This year's figures also show a further expansion of exports of synthetic detergents. Two of the largest markets, Belgium and Italy, are setting up their own detergent manufacturing plants and demand for UK detergents will diminish. Thus new and larger markets will have to be sought.

Most of the other new exports in the chemical group are pharmaceutical products. Last year exports of antibiotic drugs alone reached nearly £8 million but due to falling prices, the value is not so high for the first half of this year.

Trade in radioactive isotopes has expanded rapidly, rising from £60,000 in 1953 to £200,000 last year. Exports of electronic instruments for use in detecting radiation from radioactive isotopes have also expanded. Research reactors have been exported to several countries.

A prominent item of 'other exports' is refined petroleum, which earned about £78 million in 1954, There was a slight decline in 1955 to £72 million but a further expansion has been noted this year and so far exports are running at an annual rate of some £90 million. Plastics have also made a valuable contribution to UK exports and have continued to expand in the first half of this year, particularly to Western Europe. There is, however, growing competition from European producers.

Nylon textiles have declined from £7.9 million in 1951 to £2.8 million last year and just over £1 million this year. Again, many countries who were importers are now manufacturing nylon goods; also production has caught up with demand. Exports of nylon yarns and fibres have, however, increased.

By comparison the US gained an early lead in exporting new goods. As far back as 1938 the US had started to export synthetic detergents and by 1948 had a substantial export trade in nearly all 'new exports' listed above. The only field where Germany was ahead before the war years was in electronic equipment.

In the pharmaceutical field, the US still remains the world's largest supplier, but in the other main items of the chemicals group—synthetic detergents and tetra-ethyl lead anti-knock compound—UK export last year approached those of the US and in the case of the anti-knock compound, had exceeded US exports. It is of interest to note that US exports of nylon stockings also show a decline.

One of the most striking German advances has been in plastics materials. In 1951, Germany exported about half the value of United Kingdom exports, i.e. £8.6 million, but in 1955, at £25 million they slightly exceeded UK imports. In the synthetic detergent field, Germany exported £180,000 worth in January to September 1951; in 1955, exports were valued at £2.7 million.

It is apparent from this survey that while exports of many items and, in particular, those of the chemical and allied industries have expanded rapidly since 1951, in many instances, UK exports are far behind those of the US. In certain fields, too, Germany has gained considerable ground in a short space of time. What is also disturbing is that some of the export items are in fact made in the UK by subsidiaries of US companies.

PLANT INTEGRATION

Important Factor in Petroleum Chemical Manufacture

STYRENE MONOMER is a liquid which less than 20 years ago was a laboratory curiosity. Now it is a major raw material for industry. Thus spoke Sir Miles Thomas, chairman of Forth Chemicals Ltd. and of Monsanto Chemicals Ltd. at the inauguration of extensions to the former company's plant at Grangemouth, Scotland, last week (THE CHEMICAL AGE, 10 November). Sir Miles declared that the plant's output of more than 30,000 tons a year would make it possible for British industry to satisfy all its present needs for styrene monomer.

Mr. J. M. Pattinson, a director of Forth Chemicals, said at the inauguration ceremony that the manufacture of styrene depends on a continuous supply of ethylene, and ethylene being a vapour can only conveniently be supplied in the large quantities required through a pipe. It is therefore almost a necessity that a plant to manufacture styrene should be located within close distance of the plant manufacturing ethylene. The styrene itself when manufactured is a stable liquid and can be carried away in road and rail tankers or by sea.

Similar considerations apply to the manufacture of other petroleum chemicals of which ethylene, or any other similar substance, forms an important or principal constituent.

Ethylene, while not actually being present in crude oil as such, is readily made from the wide range of petroleum products normally produced in an oil refinery. However, in the process of making ethylene, in which about seven tons of petroleum feedstock are required to produce one ton of ethylene, other valuable products are also made, some of which can be used in further chemical manufacture, some are used as fuel, and some remain as oil products.

These latter are returned to the oil refinery for blending in motor spirit manufacture. For this reason, and in order to take advantage of the type of petroleum feedstock which is most readily available and most suitable for conversion, it is necessary to locate in its turn the ethylene manufacturing plant adjacent to the oil refinery.

This results in a fully integrated succession of plants, the output of which ranges from the relatively simple oil products made in the oil refinery to the wide variety of complex chemicals which are either required by the chemical industry as feedstocks or, in some cases, may be finished products for the market.

Mr. Pattinson added that the integrated development of the Forth Chemicals plant had led to economies in overheads. Large quantities of steam, power and cooling water were needed in the manufacture of styrene etc., all of which were available economically by integration with British Hydrocarbon Chemicals and the BP refinery next door.

Consumption of oil products is estimated to rise very substantially in the next few years, necessitating yet further increases in refining capacity.

SUPERPHOSPHATE FACTORY

NEARLY £3 million worth of contracts have already been signed by African Explosives and Chemical Industries (Rhodesia) Ltd. for the establishment of their giant factory near Salisbury which is to produce enough superphosphates to satisfy the needs of the Federation (see THE CHEMICAL AGE, 29 September, p. 574). The factory is scheduled for completion in January 1958. £100,000 has so far been spent on the site, it was announced recently.

Supplies of phosphate rock will be obtained for the first few years from Morocco, but ultimately it is hoped to switch to the important phosphate claims at Dorowa which the company has bought. At present the Federation spends over £1 million a year on these imports. The managing director of African Explosives, Mr. Spilhaus, stated recently that the Dorowa claims are 'better than the Transvaal ones' and it is estimated that at present rates of consumption there must be about 40 years' supply there. As the whole area has not been explored, there may be more. A problem associated with the Dorowa phosphate, however, is that no economical method of concentrating this particular type of phosphate has yet been discovered. The company believe they will find a suitable method.

Denmark's US Reactor

THE DANISH Government has ordered a 500kW research reactor from the Foster Wheeler Corporation of America. Delivery is expected by the end of 1957. The fuel will be natural uranium enriched to contain 20 per cent of U-235. The reactor will be installed near Copenhagen.

New Oil Cracker

ICI's Unit to be in Full Production by the New Year

ICI's SECOND oil cracker at Wilton is now in operation and is expected to be in full production by the New Year. It has been built for the Billingham Division at a cost of £6m. Plans for this unit were announced in 1954, three years after the start-up of the first unit. Plans for a third unit have already been announced as the major part of a £16m extension at Wilton and this third unit is scheduled to be in production at the end of 1959.

The new plant occupies a site of about 15 acres and when in full production will double the output of products resulting from cracking oil obtained from the Middle East. It is estimated that when the third cracker comes on line the annual consumption of oil as the raw material will be 500,000 tons a year.

Improvements in Processes

The processes operated by the new plant are basically the same as those employed on the first plant, but experience has resulted in improvements in the processes and economies in the structural steelwork of the plant itself.

Like its predecessor, the new plant is broadly divided into three sections: The pyrolysis, or cracking, section which converts the oils into a mixture of gases and crude motor spirit; the gas separation section; and a small section which refines the crude motor spirit which is piped to the Billingham factory for blending.

The processes operate over a wide range of temperatures. In the cracking process the steam used is heated to 1,700°F while in the system to liquefy and separate the gases the temperature is as low as minus 200°F.

A feature of the new plant is the flare stack—a safety device for consuming the highly inflammable gases should faults arise in the system. This has been built to the latest US design and incorporates a special burner.

The plant was constructed by Kellogg International Corporation and the design, engineering and construction of No. 3 olefine plant is also being done by Kellogg.

ABCM Director

IT IS understood that Mr. George Brearley, the consulting chemical engineer, is to succeed Mr. J. Davidson Pratt as director of the ABCM. On Wednesday the Association would make no statement to THE CHEMICAL AGE about the reported appointment.

NOTE & COMMENT

PHOSPHINE FOR FARMERS ?

A BRIEF but remarkable contribution to *Nature* (F. Hunter & I. Thornton, 1956, **178**, 867) makes the suggestion that phosphine, PH_3, might be developed as an agricultural fertiliser. Moreover, small glasshouse tests with radishes and wheat have been carried out. The use of ammonia as a gaseous fertiliser is given as an argument by analogy, but this surely dismisses too readily some of the practical problems that would accompany farm use of phosphine. Ammonia is very soluble in water; phosphine is only slightly soluble. A phosphine solution decomposes in light, and red phosphorus is deposited; red phosphorus would no doubt oxidise in the soil but it can hardly be thought of as a desirable temporary addition. Phosphine, unless pure, ignites spontaneously in contact with the air, due (according to older textbooks) to the presence of P_2H_4. This implies that a high standard of purity would have to be achieved and in general, of course, farm fertiliser economics do not allow for this certain degree of refinement.

It is true that phosphine would represent a highly concentrated form of fertiliser, with over 91 per cent of phosphorus content. Indeed, expressed in terms of equivalent P_2O_5 content—as by present fertiliser measurement customs it would have to be—it would perplex all farmers by being able to declare a content of 208.8 per cent of P_2O_5! And undoubtedly much of the phosphine that in fact got into a soil would be converted by oxidation into phosphate of this type.

GLASSHOUSE EXPERIMENTS

THE glasshouse experiments, which are not yet described in any detail, have shown that phosphine was not toxic to germination at normal phosphatic application rates. Soil retention of phosphine was not, however, nearly as efficient as with ammonia. On the other hand, at equivalent rates of phosphate supply, yields were similar for phosphine and superphosphate. At higher application rates it was indicated that soil fixation was considerably less for phosphine than for superphosphate.

It is not irrelevant that the use of gaseous ammonia or of liquid ammonia and ammonia solutions as farm fertilisers has not developed in this country with the widespread vigour of US development. The view that in our climate losses by volatilisation might be serious has been expressed quite often. This would surely be an even greater hazard in large-scale field dressings of phosphine. Apart from its much smaller solubility in water, phosphine liquefies at -85° C. compared with -33.5° C. for ammonia.

Certainly this highly interesting idea should be pursued by all possible experimental means, but it seems to be facing many obvious difficulties for translation from a small-scale curiosity venture into one of large-scale practicality.

PYRETHRUM INSECTICIDES

PYRETHRUM seems to have survived the post-war threat from synthetic insecticides, and to have done so with ample margin to spare. Not even allethrin, synthetic and closely related to the pyrethrins of natural pyrethrum, has seriously damaged the demand; indeed, most allethrin used is blended with natural pyrethrins. The successful pyrethrum farming of Kenya, which began in 1926, broke the Japanese monopoly that had started earlier in the century. It is not so well known, however, that pyrethrums are also a major crop in the Belgian Congo.

Exports from the Congo followed several years after exports from Kenya had begun, and today the annual output is some $4\frac{1}{2}$ million pounds compared with about $7\frac{1}{2}$ million pounds in Kenya. About two-thirds of the output from both areas is bought by the US. Non-agriculturists may wonder why a crop of such evident cash-value is grown in so few places. The answer is that for good development the plant requires a warm latitude and a height of 5,000 to 10,000 feet.

Pyrethrum has advanced in technical status in recent years because no signs of insect-resistance to its toxicity have been observed.

Most of the pyrethrum exported from Africa to the US is sold as baled flowers, and the extraction of the pyrethrins is carried out in America. But the shipment of a concentrated extract instead of baled flowers would bring considerable economy—about seven pounds of extract would take the place of a 4-cwt. bale. This is the next development in the African pyrethrum industry. A privately owned extraction plant at Nairobi has already been in operation for some years, but a new plant is to be built at Nakuru by the Pyrethrum Board of Kenya. Together, the two plants will be able to extract pyrethrins from about 14 million to 20 million pounds of flowers a year. Although this is well above Kenya's present total output, it is not looked upon as over-optimistic; by 1960 the US market is expected to double its demand. The situation is very similar in the Belgian Congo. A private plant which can extract some of the annual crop has been set up, and there are plans for a second plant—co-operatively funded—that will be able to handle the rest. In a few years time the export of pyrethrum flowers as such should cease, and instead an extract of about $1\frac{1}{2}$ per cent of the weight of flowers will be shipped.

People in the NEWS

● MR. R. W. H. BELL, MR. M. W. HIGGS, MISS H. A. SUMNER, of Dunlop's chemical research department, MR. T. B. CLEWLEY, of the company's polymer development section, and MR. B. J. HINTON, of the tyre compounds division, are among eight employees who have each been awarded £25 under the company's part-time education scheme upon receiving the B.Sc. degree. The total awards amount to £1,190 and others sharing them are 23 who have gained national and other certificates in chemistry.

● Owing to ill-health, MR. J. R. ARUNDALE has retired from the office of secretary to Simon-Carves Ltd. from 31 October 1956. MR. R. S. HELLIWELL, M.A., A.C.A., the company's accountant, has been appointed in his place.

● MR. RICHARD M. COLLINS has been appointed a director of The Anglo-French Phosphate Co. Ltd.

● DR. GEORGE E. HOLBROOK, assistant general manager of the organic chemicals department, E.I. Du Pont de Nemours & Co., has been appointed general manager of the company's elastomer chemicals department, which will commence operations on 1 January. MR. SAMUEL G. BAKER, who was recently appointed general manager of the organic chemicals department, will continue as head of that department.

● The Department of Scientific and Industrial Research Act 1956 came into force on 7 November. The composition of the new council is: SIR HARRY JEPHCOTT, chairman, Glaxo Laboratories Ltd.; SIR ERIC ASHBY, president and vice-chancellor, The Queen's University of Belfast; PROFESSOR C. E. H. BAWN, Grant-Brunner Professor of Inorganic and Physical Chemistry, University of Liverpool; SIR HUGH BEAVER, managing director, Arthur Guinness, Son & Co. Ltd.; PROFESSOR. P. M. S. BLACKETT, Professor of Physics, Imperial College of Science and Technology, University of London; H. DOUGLAS, general secretary, Iron & Steel Trades Confederation; SIR WALTER DRUMMOND, a director of George Angus & Co. Ltd., and also Smith's Dock Co. Ltd.; W. L. HEYWOOD, general secretary, National Union of Dyers, Bleachers and Textile Workers; DR. WILLIS JACKSON, director of research and education, Metropolitan-Vickers Electrical Co. Ltd.; SIR PHILIP JOHNSON, deputy chairman, R. & W. Hawthorn, Leslie & Co. Ltd.; PROFESSOR E. A. G. ROBINSON, Professor of Economics, University of Cambridge. DR. H. W. MELVILLE, the secretary of the present advisory council, will be secretary of the new council.

● As the result of a recent serious illness MR. W. T. AGER has had to relinquish his appointment as manager of the home orders department of A. Gallenkamp & Co. Ltd. He has been with the company for 50 years.

● MR. W. E. CONE, technical adviser to the British Road Tar Association, due to retire on 14 March 1956, has at the Council's request agreed to remain in office until March 1958.

● HM the Queen has approved recommendations made by the Royal Society for the award of Royal Medals to DR. DOROTHY M. C. HODGKIN, Reader in X-ray Crystallography, Oxford University, and DR. O. T. JONES, lately Woodwardian Professor of Geology, University of Cambridge.

OBITUARY

The death occurred on 31 October of SIR FRANCIS SIMON, Dr. Lee's Professor of Experimental Philosophy at Oxford University. He was 63. A native of Berlin, Sir Francis received his early training in Germany, becoming director of the laboratory of physical chemistry at Breslau. In 1933, with the coming to power of Hitler, he came to Britain to work at the Clarendon laboratory where he developed the low temperature physics group. He was connected with the atomic energy project since its inception and it was largely due to his efforts that a diffusion process was introduced for preparing uranium-235. After having been reader in the subject for 10 years, he was appointed Professor of Thermodynamics at Oxford in 1945 and became Dr. Lee's Professor a month ago in succession to LORD CHERWELL.

Ion-Exchange Resins

Recent Advances Discussed at Midlands SAC Meeting

'RECENT Advances in Ion-Exchange Resins' were discussed by Mr. D. K. Hale (CRL, Teddington), at a meeting of the Midlands section, Society for Analytical Chemistry, on 25 October.

The author outlined the properties and methods of application of conventional ion-exchange resins. He described some new ion-exchange materials, including chelating resins, ion-exchange membranes and ion-exchange papers; also the recent developments of electron-exchange resins. Mr. Hale concluded with descriptions of new ion-exchange techniques.

New Federation

THE THREE textile groups known as The Flat Dyed Rayon Association, The Spun Rayon Fabrics Dyers Group and the Rayon Crepe Dyers Association will be known in future as Dyers of Man-made Fibre Fabrics Federation Ltd. This was incorporated on 29 October 1956. The new Federation provides for a free interchange of technical information and the establishment of uniform costing systems to ensure efficiency in production. Head office is at Midland Bank Chambers, Spring Gardens, Manchester 2.

CIBA Lecture

THE EIGHTH Ciba Foundation lecture will be given by Professor R. B. Woodward, professor of chemistry, Harvard University, on 'Recent Advances in the Chemistry of Natural Products,' at 5 p.m. on 5 December in the Meeting Room of the Zoological Society of London, Regent's Park, London NW1.

Sipon Products

A RANGE of fatty alcohols, sulphated fatty alcohols, alkyl aryl sulphonates, emulsifiers and quaternary ammonium compounds are listed in a brochure published by Sipon Products Ltd., 23 Dryden Chambers, 119 Oxford Street, London W1.

Engine Test Laboratory

A NEW motor fuels engine test laboratory was opened on 2 November at the British Petroleum Co.'s Sunbury-on-Thames research station. The new laboratory is claimed to incorporate in one building all the equipment necessary for research into motor fuels.

Nearly 140 delegates attended the one-day conference in London on 12 November. Five papers were presented

Occupational Hygiene Society Meeting

FIRES IN INDUSTRY DISCUSSED

SIR GEORGE BARNETT, HM Chief Inspector of Factories, who opened the conference, pointed out that material losses caused by fires in this country amounted to £25 million a year—a large proportion of which was due to fires in industry.

Fire in industry could, said Sir George, be divided into two parts: Initial outbreak, and subsequent spread. The first was a matter of individual responsibility and therefore the most difficult to control. The second part was a question of good housekeeping—constructional details, correct stacking etc.—which could be controlled by legislation.

Survey of Fires

Mr. N. C. Strother Smith, director, Fire Prevention Association, spoke on 'A Technical Survey of Fires in Industry,' and dealth with causes of outbreak, spread of fire, and the conditions in which fires are allowed to start and develop.

Chief Fire Officer E. R. Ashill (Croydon) took as his subject 'Industrial Fires from the Point of View of the Fire Brigades.' He said that 10,000 fires were attended by brigades at industrial premises in 1955—an appreciable increase over pre-war years. Despite the increase in fires, there had been a decrease in fatal and non-fatal accidents.

Mr. Ashill went on to say that fire prevention had become a major part of fire brigades' work during the past few years. Industrial organisations could obtain advice on fire prevention from any local authority fire brigade.

'First aid treatment of burns is simple. So simple, in fact, that it is often overlooked,' declared Dr. D. McG. Jackson, surgeon-in-charge, MRC Burns Unit, Birmingham, whose subject was 'First-aid for Casualties from Fire.' The most important first aid treatment was to cover the burn with a clean cloth or sterile dressing and get the casualty to hospital as soon as possible. 'Time is the most important consideration in treatment of burns,' said Dr. Jackson, 'with urgent transfer to hospital the primary aim.'

It was necessary to give patients assurance as a means of countering shock; shock and sepsis caused more deaths among burns casualties than anything else.

Explaining various treatments, Dr. Jackson pointed out that cold tap water was soothing for small burns and particularly valuable in cases of burns due to caustic. A solution was available for treating burns caused by acids or alkalis. Oinments should not be used. It was vitally important to prevent burns becoming contaminated.

He favoured the carrying out of plasma transfusion at hospitals rather than at the scene of an accident. Generally it was possible to arrange this in Britain today. And burns casualties travelled quite well up to distances of 20 miles immediately after accident; they did not travel so well the next day.

'People won't take the problem of fire seriously,' complained Mr. H. Mason Bibby, president, Industrial Fire Protection Association, who spoke on 'Managerial Responsibilities and Fire Prevention.' Every fire began in a small way and if workers were trained to deal with incipient fires immediately, the number of major incidents could be reduced.

Mr. Bibby defined 'management' as including everyone from charge-hands to managing directors. He thought that every factory employing more than 200 people should have a fire prevention officer though not necessarily a works fire brigade. And managements should be prepared to back their FPOs.

Good housekeeping could prevent most fires other than 'special' fires such as those which might occur in the chemical and allied industries.

Automation

On automation Mr. Bibby said it resulted in large interconnected machines with big undivided floor spaces which made for an easier spread of fire. In short, automation usually meant fewer fire breaks. He added that in modern continuous plant the fire risk was very great during shut-down periods and when maintenance work was in progress. At these times managements had to adopt special fire precautions.

Mr. Bibby considered that the wider use of plastics material had increased industrial fire risks arising from static electricity and he thought a high humidity was one of the best safeguards against static build-up.

About buildings, he said that although the various regulations might be irksome to managements they were, nevertheless, quite reasonable and it was important that they should be observed.

He did not think open smoking was the cause of many fires, but illicit smoking was. 'Smoking areas' might be the answer to the illicit smoking problem.

Fire Alarms

'Modern Methods of Fire Alarm and Extinction' was the title of the lecture by Mr. P. Nash, of the Fire Research Station, Boreham Wood. He explained how various alarm and sprinkler systems worked and how tests were carried out at the Station on these devices.

As a result of work at the Fire Research Station interesting information had been obtained on the effect of corrosion on detectors, said Mr. Nash.

Dealing with fire fighting materials, he pointed out that tests had shown that a little water could be used to put out large fires—about eight gallons per 1,000 cu. ft.

Base injection of foam could be used to control fires in oil tanks of up to nine feet in diameter, and the installation was not liable to be damaged by explosion. For base injection a foam having low expansion (not more than a factor of 3½) was most satisfactory.

In drypowder extinguishers common salt had been found as efficient as bicarbonate of soda for putting out petrol fires, said Mr. Nash. Some powders had an adverse effect on foam causing breakdown; new powders were being developed for fighting fires involving the rare metals.

Mr. Nash told of a floating spray head which could be put inside petroleum storage tanks to discharge chlorobromomethane automatically when fire or explosion occurred.

Manipulation of Low Pressure Polythene

IN AN ARTICLE in *Chemie-Industrie Technik* (October). Dr. Franz Broich of Chemische Werke Hüls, AG, Marl, Kreis Recklinghausen, reports various tests on low-pressure polythene and in particular on Vestolen (a polymer made by the Ziegler process), which is manufactured jointly by the firms Bergwerksgesellschalf Hibernia and Chemische Werke Hüls, AG, Marl, Kreis Recklinghausen.

As there are now 20 years of practical experience with amorphous polyvinyl chloride, this material serves as a standard of comparison when testing new products. It has been used as a standard in the development of technical applications of Vestolen although the author points out that direct comparison with polyvinyl chloride is hardly valid as Vestolen contains up to 85 per cent of crystalline material.

Accelerated Ageing

Dr. Broich reports on the problem of ageing in Vestolen. This is stated to be accelerated by exposure of the material to prolonged heat (up to 100°C) in an oven with air circulation. Brittleness develops which can, however, be considerably retarded by the use of suitable stabilisers. New stabilisers have recently been developed and it has been found possible to produce pale coloured mouldings with good ageing properties even when using processing temperatures of the order of 300°C. Further exhaustive tests are now in progress to determine the physiological properties of the product.

Coloration of this polymer has been carefully studied as some dyestuffs appear to have an adverse effect on ageing and others cause blooming or inferior fastness to ultra-violet light. As the dyestuffs commonly used are unstable above 230°C and elasticity of the polymer is only produced at high processing temperatures the optimum degree of elasticity was not achieved. It was only found possible to achieve the desired elasticity at processing temperatures of 180 to 200°C when a lubricated type of Vestolen granule had been developed.

The type of black used is also important as carbon black affects both stabilisation and colour. The degree of dispersion of the black in polythene is stated to have a considerable effect on the mechanical properties of the finished product as the presence of agglomerates may lead to a reduction in tear strength. Microscopical examination is deemed a satisfactory method of controlling dispersion in the compounded material.

If manufactured articles made of polythene are subjected to mechanical stresses after being melted with polar liquids, cracks or surface fractures may be produced without distortion. Such effects are known as 'stress corrosion.' They were first observed in high-pressure polythene strips which had been bent at an angle of 180° and the surface lightly scratched. Small cracks developed after immersion in an aggressive chemical. Because of the higher crystalline content of low-pressure polythene, brittle fractures appear in stressed manufactured articles melted by polar liquids, even without prior scratching.

Experiments have been conducted on samples of tubes cut along the major axis and bent outwards or inwards. Some were exposed at once to various polar liquids and others were first immersed in boiling water for 30 minutes. Tubing from plastic granulated at 290°C was compared with that prepared from lubricated material and with polythene containing no additive. The control sample was granules and tubing processed at 190°C.

Interesting Results

Results obtained show that up to now the more homogenous types are less brittle than the control sample. Cracks, however, appeared on portions of the surface exposed to higher stresses before they developed on areas subjected to lower stresses. No cracks appear to have developed in the samples treated with boiling water. Broich states that while no final conclusion can be drawn from these experimental results, any internal stresses in low-pressure polythene mouldings should be avoided or relieved in order to avoid stress corrosion.

These results are considered by Broich in connection with the manufacture of tubing. He records that a process of fabrication must be employed which enables a tube of homogeneous structure free from stress to be produced. If some random stress is imposed (as in the above-mentioned experiments) then, even after relatively short exposure to polar liquids, cracks may develop without any manipulation. It is possible that smaller and unnoticed interval stresses in tubing may subsequently be released after several months and give rise to brittleness and cracking, especially if the material is used at elevated pressures of about 10 atmospheres. This tendency, Dr. Broich states, would be considerably increased if the wall thickness chosen for the pressure tubing was inadequate. Even rolling up tubing in a warm state may ultimately lead to defects as described above.

Creep Resistance

On resistance to creep, the author recommends that due allowance should be made when calculating the dimensions of tubing. In fitting pipework of Vestolen it has been noted that little axial expansion occurs. As the material is not as stiff as polyvinyl chloride the tubing tends to bend sideways. The use of expansion double bends is not advised, as such assemblies (and pipe leads) are not easily fabricated and their dimensional stability has not been found satisfactory. Injection-moulding of such pieces is suggested.

To obtain mouldings free from internal stress the material should be plasticised in an extruder and thoroughly homogenised before being heated above the softening point in a cylinder and injected into a mould heated to the same temperature. It is stated that Vestolen can be injection-moulded into articles with a large surface area if high temperatures are employed.

Other points made by Dr. Broich are in regard to pipe connections. If these have to withstand peak stresses exceeding the rated pressure, he sug-

[*turn to page 289*

DIARY DATES

MONDAY 19 NOVEMBER

CS (Nottingham & Leicester)
Leicester: University College, 4.30 p.m. 'The Structure of Vitamin B_{12}' by Dr. Dorothy M. C. Hodgkin.

Institute of Metals (Sheffield)
Sheffield: Engineering Lecture Theatre, The University, St. George's Square, 7.30 p.m. 'Automation' by Dr. H. D. Turner.

North East Metallurgical Society
Middlesbrough: Cleveland Scientific & Technical Institution, 7.15 p.m. 'Analytical Control by the Quantometer' by W. S. Sykes.

Institute of Metal Finishing
London: Borough Polytechnic, Stanley Hall, Borough Road SE1, 6.15 p.m. 'Some Aspects of Production of Sheet Metal Components in Relation to Their Finishing Techniques' by D. H. Lloyd.

TUESDAY 20 NOVEMBER

Royal Institute of Chemistry
Chatham: Medway College of Technology, Maidstone Road, 7.30 p.m. 'The History of Forensic Science in England' by Professor J. M. Webster.

SCI (Microbiology Group)
London: Royal Society of Health, 90 Buckingham Palace Road SW1, 5.30 p.m. Discussion of third edition 'Bacteriological Examination of Water Supplies,' HMSO, 1956.

Society of Instrument Technology
Manchester: College of Technology, 7.30 p.m. 'Control of Distillation Columns' by J. W. Broadhurst.

Hull Chemical & Engineering Society
Hull Church Institute, 7.30 p.m. 'Chemical Crop Protection' by A. L. Abel.

WEDNESDAY 21 NOVEMBER

I.Chem.E. (NW Branch)
Leeds: The University, 7 p.m. 'Non-Newtonian Fluids' by E. G. Richardson.

I.Chem.E. (Graduates & Students)
Treforest: Glamorgan Technical College, 7 p.m. 'Silicones' illustrated by the film 'Rubber from Rock' by D. W. R. Price.

British Association of Chemists
London: The Medical Society of London, 11 Chandos Street, Cavendish Square W1, 7 p.m. 'Detergency' by R. C. Tarring.

Society for Analytical Chemistry
London: 'The Feathers', Tudor Street EC4, 6.30 p.m. Discussion meeting of Microchemistry Group.

Manchester Metallurgical Society
Manchester: Manchester Room, The Central Library, 6.30 p.m. 'The Role of Grain Boundaries in Creep' by Dr. D. McLean.

THURSDAY 22 NOVEMBER

CS (Bristol Section)
Bristol: Chemistry Department, The University, 5.15 p.m. 'Acetylene-Allene Chemistry' by Professor E. R. H. Jones.

CS (Bristol Section)
Gloucester: Technical College, Brunswick Road, 7 p.m. 'Plastics from Petroleum' by R. W. King.

CS (Edinburgh Section)
Edinburgh: North British Station Hotel, 7.30 p.m. 'Polymerisation in Heterogeneous Systems' by Professor C. E. H. Bawn.

Fertiliser Society
London: The Geological Society, Burlington House, Piccadilly W1, 2.30 p.m. 'Use of Fertilisers in the Far East' by Dr. H. L. Richardson.

FRIDAY 23 NOVEMBER

Royal Institute of Chemistry
Cambridge: University Chemical Laboratory, 8.30 p.m. 'An Industrial Pilgrimage' by Dr. M. A. T. Rogers.

Royal Institution
London: The Royal Institution, 21 Albemarle Street W1, 9 p.m. 'Plant Growth and Man-made Molecules' by Professor R. L. Wain.

CS (Aberdeen Section)
Aberdeen: Chemistry Department, The University, Old Aberdeen, 7 p.m. 'Physical Properties of High Polymers in Relation to their Chemical Structures' by Professor G. Gee.

CS (Southampton Section)
Southampton: Chemistry Department, The University, 5 p.m. 'Some Aspects of the Organic Chemistry of Phosphorus' by Professor H. N. Rydon.

CS (S Wales Section)
Swansea: Chemistry Department, University College, 6 p.m. 'Factors Involved in the Production of Carbonium Ions' by Professor A. G. Evans.

Lead Find in Greenland

ALMOST PURE LEAD ore is reported to have been found by the Danish geological expedition in North East Greenland, by the Lummen Lake about 50 kilometres from Mestervig.

Dryers

North-West Engineers Hear About Through-Circulation

AT A MEETING of the North-Western branch of the Institution of Chemical Engineers in Manchester on 16 October a paper, *A Method of Design of Continuous Through-Circulation Dryers*, was presented by H. C. Glover and A. A. H. Moss.

Essential feature of through-circulation dryers is the passage of hot air at a low velocity through a thin permeable bed of material supported on a perforated band. This moves through two or more independent drying zones that direct the air movement countercurrent to the material. Hot air is continuously re-cycled through the material by a fan; part of the air is discharged to the atmosphere and is replaced by fresh air.

Every material has its own drying characteristics and experiments were described on a stable organic material in the form of 11/64 in diameter rods that contained about 50 per cent water. This was dried in a laboratory batch through-circulation dryer which had a $7\frac{1}{2}$ in. diameter basket situated in a vertical duct and was linked to one arm of a scale that weighed the material in it at fixed intervals. The material was dried by a measured quantity of hot air, and the humidity of this air was measured continuously upstream and downstream of the basket.

A graph of the rate of drying against moisture content showed constant and falling rate periods. The variations of rate of drying with variations of diameter of extruded rods, depth of bed, mass velocity of drying air and of approach air humidity were measured and plotted on graphs. The constants evaluated in drying rate equations and the data were used for the design of a full-scale dryer.

It was assumed that the critical moisture content and the shape of the falling rate curve were unaffected by changes in drying conditions. Loading, air velocity, size of material and drying temperature are frequently decided by economic considerations; laboratory experiments can be done under these fixed conditions, then the design becomes a matter of calculating the effect of different humidities which will be used with air recirculation. A worked example of design was given.

Commemoration Dinner

OVER 100 guests were present at a dinner and dance held at Bradford on 2 November organised by the West Riding branch of the Society of Dyers and Colourists to celebrate the discovery 100 years ago of mauveine.

Output and Sales of West German Chemical Products

PROVISIONAL ESTIMATES put total sales of West German chemical industry in January-September 1956 at DM 11,300 million, an increase of 8.7 per cent over the corresponding figure of 1955 which in turn showed a rise by 14.4 per cent compared with the first three quarters of 1954. While output and sales of chemical products in the Federal Republic are thus still expanding, the rate of advance is clearly slowing down.

This is especially true of inorganic basic chemicals, the production of which showed a rise of 4 per cent only in the first half of this year. Sulphuric acid showed an output increase of 10 per cent, caustic soda of 8 per cent, chlorine of 13 per cent, while the production of calcium carbide fell by 7 per cent and the soda output was almost unchanged.

New Plants

At the same time a number of new and modernised plants have been brought into operation, with the result that the supply position has distinctly eased. This in turn has enabled chemical employers to meet the trade union demand for a shorter working week. Agreement has been reached in principle on the introduction of a 45 hour week from 1 May next. Workers are to be compensated for loss of earnings through reduced working hours by a 6 per cent increase in wage rates, in addition to a 3 per cent rise which is to become effective on 1 January; this will continue when the shorter working time has started. Both sides are satisfied with this compromise, the employers no doubt hoping that increased wage costs will be offset by the effect of modernisation and automation.

Chemical exports from the German Federal Republic in the first half of 1956 amounted to DM 1,821 million, an increase by 11.9 per cent compared with the first half of 1955. The expansion rate of the previous year has thus been almost maintained, but German chemical manufacturers are not satisfied with the result.

Not only has the chemical industry's share in West German export trade declined slightly, but there has been a significant change in the direction of German chemical exports. There has been a slight falling-off in trade with Asia and Africa, largely due to reduced shipments of nitrogen fertilisers to Egypt and a substantial contraction of sales to China and Hong Kong which were not completely offset by larger exports to India and, to a lesser extent, Indonesia and Iran. German chemical manufacturers, however, increased their shipments to Canada, Mexico, Argentina and Columbia.

Even more satisfactory was the chemical trade with OEEC countries. The UK, Holland, France, Italy and Belgium all absorbed very substantial supplies. Switzerland reduced her purchases of German chemicals, notably dyestuffs which are the only major group to show an overall decline in exports from the Federal Republic this year. Shipments of pharmaceuticals, paints, glue, washing agents and plastics and fibres, all show more or less substantial export gains.

Growing importance of the European market is shown by the fact that in the first half of 1956 it absorbed no less than 62.6 per cent of all chemical exports from the Federal Republic. German chemical manufacturers are therefore watching with particular interest the moves towards a common market with British participation.

Official Comment

The official comment, however, is not enthusiastic. President Menne, of the West German Federation of Chemical Industry, warned against underrating the difficulties in the way of a common market. Currency distortions, price differentials, and differences in tax and social policies would for some considerable time impose higher barriers than did customs duties, he argued. He criticised supranational bodies concerned with specific fields as a likely cause of Government interference in privately-owned industries and suggested that they should be given up if they prevented Britain from participating in an integration movement.

Higher coal prices are causing some difficulty in certain sections of the chemical industry. The West German fertiliser producers are reported to be considering the advisability of raising their prices. Production and sales are on the whole satisfactory. Exports rose from 190,000 tons (N) in 1953-4 to 256,000 tons in 1954-5 and 293,000 tons in 1955-6. Fertiliser sales in the home market are greatly helped by the Government subsidy of 20 per cent, but the industry's plant capacity has been raised so much that a further expansion of exports is urgently desired. Shipments to the Far East appear to have increased of late, but in other markets US competition has become more severe.

Testing Rubber

THE British Standards Institution announces the publication of the following parts to the revision of BS 903 : Part C1, for the determination of *surface resistivity*, and part C2, for the determination of *volume resistivity* of insulating soft vulcanised rubber and ebonite. The group of parts in which the prefix letter 'C' is used deals with methods of testing the electrical properties of rubber and ebonite. Parts C1 and C2 replace sections 33.2. and 33.3 respectively of the 1950 edition.

The methods differ from those in part 33 of BS 903 : 1950 in that they include an electrometer method and provide for an alternative test voltage. Both parts give details of electrodes and the various types of apparatus and procedure. A method for the calculation of results is also given.

Copies are obtainable from the British Standards Institution, British Standards House, Sales Branch, 2 Park Street, W1, price 3s 6d each.

ICI Films

FILMS added to ICI film library recently include: 'More About Alkathene' (5 min.), a black and white 16 mm short about some of the lesser-known uses of Alkathene; and 'Terylene on Parade' (5 min.), also a black and white 16 mm showing a fashion parade in which garments made from the fibre are displayed.

Fisons Ltd.

Fertiliser Price Situation to be Discussed in Chairman's Review

A DISCUSSION of the present fertiliser price situation is contained in the chairman's review, to be presented at the 63rd annual general meeting of Fisons Ltd. on 30 November.

Raw material accounts for over 60 per cent of the cost of compound fertilisers, says the chairman, Mr. F. G. C. Fison, and in consequence substantial rises in raw material costs must inevitably affect to some extent fertiliser prices.

A price index of Fisons' raw materials has been compiled. The following are the figures for the fertiliser year 1955-56 compared with a figure of 100 for the year 1953-54:

1st quarter	112.1
2nd quarter	118.1
3rd quarter	120.9
4th quarter	121.9
year	119.0

Fisons, says the chairman, have followed a very moderate price policy. 'We have been conscious of the difficulties of the farmer and of the fact that there has been some decline in farm incomes in recent years, and also that agriculture is subsidised by the Government. Our policy, therefore, broadly speaking, has been to fix prices at a level which provided a reasonable return to shareholders and which allowed us to retain part only of the capital required for expansion.

'When there have been exceptional circumstances to the farmer's disadvantage. . . . we have felt it appropriate to carry part of the burden ourselves.'

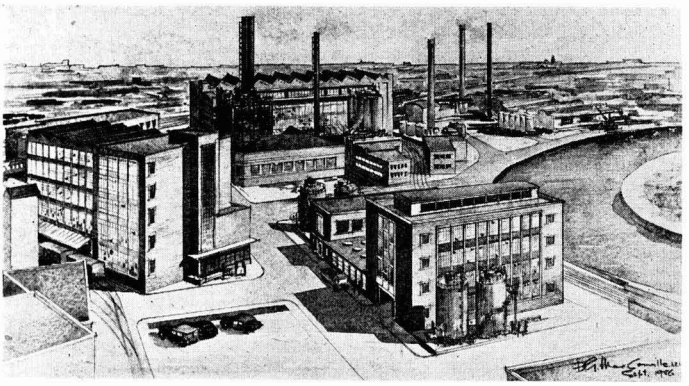
The company's profit for the year was reported in THE CHEMICAL AGE, 3 November, p. 224.

Low Pressure Polythene

from page 286]

gests that they should be made of Vestolit (Chemische Werke Hüls, AG trade name for p.v.c.) or of glass fibre reinforced Vestopal.

Although it is possible to weld low-pressure polythene, there is as yet insufficient practical experience to be certain that this method of connection will give a sufficient degree of homogeneity. Dr. Broich therefore advises cemented joint processes for connecting Vestolen tubing in conjunction with double sleeving made of a special compound of Vestopal. A suitable cement is 100 parts Vestopal, 3 parts of hardener (cyclohexanone peroxide), 1.5 parts of accelerator (10 per cent solution of cobalt naphthenate). Because of a short 'pot-life' (20 to 30 minutes) only small batches should be prepared.



CROSFIELD'S NEW FACTORY

Rebuilding Programme Will Cost at Least £5 Million

A REBUILDING programme which will take about eight years to complete and will cost at least £5 million has been announced by Joseph Crosfield & Sons Ltd., of Warrington, manufacturers of silicon compounds and synthetic detergents (see last week's issue, p. 249).

Announcing this programme at a conference attended by the Mayor of Warrington and leading local industrialists, corporation and trade union officials, Dr. J. E. Taylor, chairman of Crosfields, said that the plan would take two years to get under way. As reported last week the company's intention is to concentrate production on the Lancashire side of the Mersey.

Factory Design

A team of company technicians and engineers has been appointed to design a factory where every building is planned for its appropriate function with ample room for increased production, and where, it is claimed, working conditions will be the best obtainable. Road and rail facilities will be reorganised.

New laboratories with pilot plant facilities will be built to give greater scope for the study of new materials and investigation into new products.

Consulting engineers are now to be appointed and it is hoped that building operations will begin in 1957.

Dr. Taylor said that production would not be interrupted during building. He explained that to concentrate the factory on the Lancashire side it would be necessary to build upwards.

After the announcement the chairman answered several questions. A trade union official asked whether the company had in mind automatic processes which would save labour.

Dr. Taylor replied: 'On the whole we shall use automatic processes where they can be applied. We shall also use mechanisation where it applies. One must do that wherever possible to save costs in labour.

'But if you are worried about the labour content of the factory as a whole, I would point out that we would not be spending £5 million if we did not hope to expand our trade, and I think there will be plenty of work.'

Questioned about atmospheric pollution, and Crosfield's plans for the reorganisation of boilers, Dr. Taylor said that plans to raise steam for the new buildings were not yet settled. The company had at the moment three boiler houses, and they were very old. 'It is time we put our house in order,' said Dr. Taylor, 'therefore we plan either to purchase steam from the central electricity authority or to generate it ourselves.'

This, however, was not part of the £5 million plan.

Warrington's Future

A recent survey showed that 33 per cent of all incoming materials came from sources within 12 miles of the Warrington works and 40 per cent were imported raw materials coming through the port of Liverpool. The rebuilding plan is described as an expression of faith in the future of Warrington.

The illustration on this page is reproduced from a water colour by D. G. MacConville, ARIBA, Warrington.

NIAC Chairman

SIR IFOR EVANS, Provost of University College, London, has been appointed chairman of the National Insurance Advisory Committee as from 1 January, in succession to SIR WILL SPENS.

FREE SURFACE OF HEATED LIQUIDS

Result of Recent Investigations

A RECENT NOTE in the *Soviet Journal of the Academy of Sciences* (1) describes some experiments on thin layers of heated fluid and gives interesting results on the form of free surface of the liquid.

Investigations were confined to the fall of distilled water in the form of a fine spray past polished duralumin tubes, mounted horizontally; the tubes could be heated by an electric current passing through a wire coil inside the tube. Depending upon the size of the drops, i.e. the rate of flow of the water, and the diameter of the cylinder, a thin film is formed on the cylindrical surface; at room temperature the film thickness varies considerably with the rate of flow, but there is little variation of thickness around the perimeter of the tube, despite the liquid drops leaving the lowest point of the cylinder (Fig. 1).

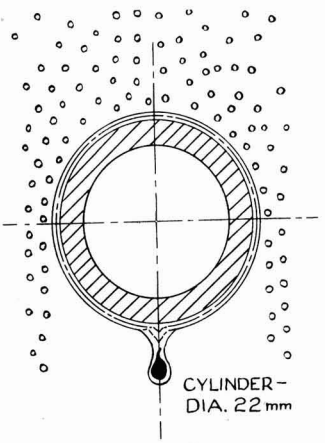


Fig. 1

With increase of temperature of the surface of the cylinder there is, naturally, an increase in the temperature of the film and an increased rate of evaporation of the fluid, but it was found that, provided the temperature of the cylindrical surface did not exceed 80° C, the surface of the liquid film remained smooth. At a temperature above 80° C, however, the liquid surface changes into the form of a series of waves, uniformly distributed along the length of the cylinder (Fig. 2).

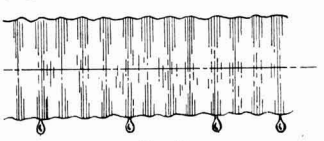


Fig. 2

Alterations to the rate of flow and the temperature (provided this was kept above 80° C) appeared to make little difference to the wavelength. This surface condition was observed for temperatures up to the boiling point of the liquid, but as the boiling point was approached, evaporation from the troughs of the waves was increased and drying out of the film occurred in these regions. This form of the surface appeared to be stable, even close to the boiling point of the liquid and for considerable temperature gradients through the layer.

Suggested Explanation

The author suggests, as an explanation of the wave formation, that, due to a temperature difference between two points of the fluid surface, flow takes place along the surface from the point of higher surface tension to the point of lower surface tension, i.e., from the crest to the trough. This flow along the curved surface causes a pressure gradient in the layer of fluid adjacent to the cylinder, resulting in a movement of fluid along the surface of the cylinder in the opposite direction (Fig. 3). The effect of weight of the liquid appears to be small, since the wave pattern is the same on both the top and bottom surfaces of the cylinder.

It would seem that the phenomenon described above might be important in various heat transfer problems, and, as the author states, there is scope for further theoretical and experimental work.

REFERENCE

(1) Alimov, *Doklady Akademii Nauk SSSR*, 1956, **109**, [3], 559.

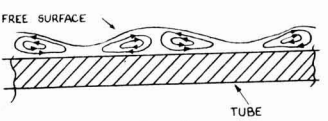


Fig. 3

Iron Ore Reduction

A PROCESS for reducing iron ore by hydrogen instead of coke has been developed on the laboratory scale by Hydrocarbon Research Inc., of the US, in collaboration with the Bethlehem Steel Co. Detailed engineering studies are now proceeding for a full-scale plant, says a report from the Technical Information and Documents Unit of DSIR.

Micro-Chemistry

Course of 12 Lectures at Norwood Technical College

COMMENCING 12 January next a course of 12 lectures and appropriate practical work designed to survey the principal branches of chemistry in which small-scale methods have been successfully applied, will be held on Saturday mornings, from 9.15 to 12 noon, at Norwood Technical College, Knight's Hill, London SE27.

Lectures will deal with the scope, aims and achievements of small-scale techniques, design and construction of simple apparatus, organic and inorganic preparations on a reduced scale; simple chemical microscopy and photomicrography; inorganic qualitative and volumetric analysis; organic qualitative and quantitative analysis and microtechniques for the determination of molecular weights. Further details may be obtained from the secretary of the College.

Biostat Accepted

AFTER an extensive series of assays on its biostatic properties, oxytetracycline (marketed by Pfizer Ltd., Folkestone, Kent) has been accepted by the US Food and Drug Administration as a suitable preservative for poultry carcases. The appropriate oxytetracycline formulation is known as Biostat.

In a trial experiment, an Oslo whaling company treated two whales with Biostat Whale Formulation at the time of kill. The freshness of the whale carcases was considerably prolonged. Independent analysis also established that whale oil extracted from the carcases showed no detectable trace of residual antibotic.

Anglo-US Negotiations

NEGOTIATIONS are under way between Arthur D. Little Inc. a US consulting research organisation of Cambridge, Mass., and several people in the UK for the formation of a non-profit-making organisation to carry out fundamental scientific investigations. The organisation is likely to operate from Inveresk, near Edinburgh.

Details will be announced on completion of negotiations. In THE CHEMICAL AGE on 27 October it was stated that Arthur D. Little Inc. is taking over the Institute of Seaweed Research at Musselburgh, Scotland.

by
Peter Cooper F.P.S.

Toxic Hazards in Industry

Part II—GENERATION OF POISONOUS GASES

TOXIC GASES which have inadvertently been generated in chemical plant as a result of cleaning operations, leakages or fires obviously constitute a particularly insidious danger. Fatal poisoning has followed the inhalation of arsine in a confined space, the gas being generated by the action of a galvanised zinc bucket on an acid arsenical sludge. Any metal which liberates hydrogen will, of course, produce arsine from an acid medium which contains arsenic as a constituent or an impurity. Conversely, any acid which liberates hydrogen from a principal metal will produce arsine from its arsenical impurities. Adequate ventilation, also the replacement of metal utensils by plastic polymers, serve to obviate the danger.

Despite the garlic odour of arsine, its presence may remain unheeded for long enough to cause acute poisoning. The first symptom may be a burning and stinging of the face, and later the skin may acquire a bronze colour. The victim suffers from nausea and vomiting, with consequent thirst. Abdominal pains may become severe, and are accompanied by the sensation of choking, and oppression of the chest.

Effects of Arsine

Arsine rapidly produces a severe anaemia, and the slightest exertion brings about shortage of breath. The peripheral nerves are affected. Severe headache is followed by delirium, hallucinations, tremors and finally convulsions. Where the onset of poisoning is more protracted, the liver becomes enlarged and painful on pressure, and jaundice appears. Kidney function also suffers, respiratory failure and death following. Chronic poisoning from inhalation of smaller quantities of arsine involves severe headache, nausea and vomiting. The breath has the characteristic odour of garlic. Anaemia or toxic jaundice are very liable to appear in the milder cases of poisoning.

Treatment

Fresh air and absolute rest are the essential beginnings of treatment. Later, the development of anaemia may necessitate inhalations of oxygen (never to be given except under medical supervision) and blood-transfusions. The effect of arsine is particularly serious in persons whose liver or kidney function is already impaired for any reason.

Carbon monoxide is generated by the incomplete combustion of a great many organic compounds; particularly fuels in furnaces, slow-combustion stoves and internal-combustion engines. Producer gas, water gas and coal gas are rich in CO, and even minor leaks of these fuels may have serious effects. Since the combining power of carbon monoxide for blood haemoglobin is about 200 times as great as that of oxygen, only about one part in a thousand of atmospheric CO is needed to halve the oxygen-carrying power of the blood. Unfortunately, no definite symptoms warn the victim until he is on the verge of collapse; the loss of brightness perception may be one of the very earliest signs of intoxication.

Cumulative Poisoning

Slow cumulative poisoning produces weakness and aching of the limbs, an accelerated pulse, frontal headache and nausea. Even if the outcome of exposure is not fatal, the cerebral deprivation of oxygen may often be sufficient to damage the brain cells irreversibly, leaving the patient dull and apathetic for life.

After toxic exposures to carbon monoxide, fresh air and prolonged and complete rest are indicated. Warmth is needed to restore the metabolic loss, and artificial respiration becomes imperative if breathing grows difficult. It may be advisable, under medical direction, to administer oxygen and fresh blood.

Hydrogen sulphide may be generated during the fermentation of protein materials, the bacterial reduction of sulphates, or by the leakage of acid into a sulphur-containing effluent. It is the most dangerous constituent of sewer gases. A whiff of the concentrated gas may produce immediate unconsciousness and rapid death.

Odour of Hydrogen Sulphide

The well-known odour of hydrogen sulphide is not so obvious in high concentration. It irritates the lining of the orbits, pharynx, bronchial tree and lungs. Once it enters the lungs, its absorption into the blood-stream brings about a depression of the central nervous system, leading to violent headache, shortage of breath, muscular weakness, weakening of the pulse, and cooling of the body temperature. Finally, hydrogen sulphide produces convulsions, coma and death through respiratory failure.

Chronic exposure to weaker concentrations of the gas causes nausea and headache, confusion and excitement. Insomnia is characteristic of mild intoxication. Coughing, running of the nose and frequent sneezing also commonly occur. The absorption of moderate quantities of hydrogen sulphide produces anaemia and sometimes a dermatitis.

Fresh air and absolute rest in the horizontal position are the essentials of treatment. Oxygen may be

Toxic Hazards in Industry

advisable. Hot water bottles or electric blankets may be used to counteract the loss of body heat. In severe intoxications, it may be necessary to perform artificial respiration for long periods.

Carbon dioxide, which tends to accumulate in cellars, shafts and silos, is commonly produced by combustion or fermentation processes. Considerable quantities, sufficient to produce a toxic effect in unventilated spaces, may result from the accidental acidification of natural or synthetic carbonates or the discharge of acid-soda fire extinguishers. At 20 per cent concentration, the gas may prove rapidly fatal by simple asphyxia or heart failure. Any concentration above 2 per cent causes discomfort and 8 to 15 per cent produces headache and dizziness, oppression of the chest, and ringing in the ears. Sometimes a state of inebriation results, followed by vomiting and unconsciousness.

Some degree of excitement is normal with carbon dioxide poisoning. Fresh air is the first counter-measure. In severe cases, artificial respiration and oxygen inhalations may be needed. Cautious doses of ammonia or amyl nitrite by inhalation are useful, otherwise the symptoms must be treated as they come to light.

Danger of Phosgene

A number of chlorinated hydrocarbons generate carbonyl chloride, with a small proportion of chlorine, when they come into contact with flames or heated metals. The use of a carbon tetrachloride extinguisher to deal with a fire in an enclosed space is open to this objection. One of the first effects of carbonyl chloride (phosgene) is to depress the sense of smell, so that the gas may be unperceived until poisoning has reached a serious stage.

Phosgene produces irritation of the eyes and a violent cough, followed by shortage of breath and a sense of chest oppression. The pulse and respiration later accelerate, and the circulation becomes embarrassed. Inadequate oxygenation of the blood leads to cyanosis and the failure of the heart-muscle.

Contaminated clothing must first be removed, then the patient given copious fresh air and prolonged absolute rest. Oxygen, under positive pressure, may be administered, and cardiac stimulants are frequently given by injection.

Phosphine has been known to result from the slaking of cement containing natural phosphides. It may also be generated during carbide or ferro-silicon manufacture. Its inhalation gives rise to restlessness and fatigue, followed by nausea, gastric pain, vomiting, diarrhoea, thirst, headache, dizziness and painful oppression of the chest. Coughing may produce a green fluorescent sputum. There is marked shortage of breath, leading progressively to coma and convulsions. Death has been known to occur, even after survival for several days.

Chronic exposure to hydrogen phosphide leads to anaemia, bronchitis, gastric upsets and disturbances of vision, speech and gait. The patient must be kept warm and perfectly quiet, and the removal of half a litre of blood may be necessary to relieve lung congestion.

(to be continued)

BASIS OF INSECT REPELLENCY

Review of Investigations

SINCE the physical basis of insect repellency is still unknown, the search for new repellents has had to be conducted on an essentially hit-or-miss basis. There is some evidence to show that odours of substances may be correlated with the low frequency, fundamental vibrations of their molecules (**1**). R. H. Wright now reports in *Nature* (**2**) his investigations on dimethylphthalate, indalone, 2-ethyl hexanediol-1,3,-benzyl benzoate, n-propyl-N,N-diethyl succinamate and butoxy propylene glycol. Additional substances were chosen from a list of repellent chemicals published by Morton *et al.* (**3**) who graded the substances on the basis of duration of protection they afforded, the most effective substances being placed in group 4 and the least effective in group 1. Fourteen substances showing group 4 repellency were added to the above substances, making a test set of 20 repellents. Twenty non-repellent substances (group 1) were collected as a control group.

Infra-red absorption curves were recorded in the region from 700 to 400 cm.$^{-1}$ using a Perkin-Elmer model 21 infra-red spectrophotometer equipped with a potassium bromide prism and a linear wave-number cam. Liquids were examined as received but solids were usually examined as mulls in Nujol.

The results of absorption curves of the six commercial repellents exhibited a striking correlation in the part of the spectrum near 460 cm.$^{-1}$. Thirteen of the twenty substances in group 4 had peaks between 449 and 471 cm.$^{-1}$, three of the remainder showed strong continuous absorption in the same region and three had nearly broad bands which overlapped this region. Of the non-repellent substances, only one had a peak between 449 and 471 cm.$^{-1}$, the rest showing very little absorption in the neighbourhood of 460 cm.$^{-1}$. The marked exception in the repellent group was dimethylphthalate, which is probably the best repellent available. It showed no absorption peak near 460 cm.$^{-1}$. Wright considers, however, this compound has a sufficiently symmetrical structure for certain vibrational modes to be inactive in the infra-red. The Raman spectrum of dimethylphthalate has a line at 230 cm.$^{-1}$.

Conclusions from Results

Wright concludes from his results that the physical basis of mosquito repellency is a molecular vibrational mode capable of giving rise to infra-red absorption or Raman scattering near 460 cm.$^{-1}$ (or 21.7μ). It is not known whether other insects are repelled by molecules exhibiting this or other characteristic frequencies.

It is obvious that there is considerable practical value in these results in screening new substances for mosquito repellency. The results also lend support to the theory that low-frequency vibrations of molecules provide the physical basis of their odours.

REFERENCES

(1) Wright, R. H., *Nature, Lond.*, 1954, **173**, 831.
,, ,, *J. appl. Chem.*, 1954, **4**, 611 and 615.
(2) ,, ,, *Nature, Lond.*, 1956, **178**, 638.
(3) Morton, F. A., Traniš, B. V., and Linduska, J. P., *US Bur. Ent. and Plant Quarantine*, 1947, E-733 (September).

Sulphuric Acid

UK Production from 1 July to 30 September

PRODUCTION of sulphuric acid and oleum, excluding Government plants, in the UK from 1 July to 30 September 1956 was 515,632 tons of 100 per cent H_2SO_4, representing 73.3 per cent of the production capacity. Of the total production, 116,118 was chamber and tower and 399,514 was contact. The summary of monthly returns issued by the National Sulphuric Acid Association Ltd. is given in the tables on the right.

CONSUMPTION OF SULPHURIC ACID AND OLEUM
1 July-30 September

Trade Uses	Tons 100% H_2SO_4
Accumulators	2,329
Agricultural purposes	5,330
Dichromate & chromic acid	3,579
Bromine	3,016
Clays (Fuller's earth, etc.)	2,448
Copper pickling	766
Dealers	2,798
Drugs & fine chemicals	3,810
Dyestuffs & intermediates	17,538
Explosives	4,131
Export	926
Glue, gelatine & size	108
Hydrochloric acid	14,309
Hydrofluoric acid	3,012
Iron pickling (including tin plate)	27,355
Leather	1,130
Lithopone	3,251
Metal extraction	827
Oil refining & petroleum products	15,306
Oils (vegetable)	1,921
Paper, etc.	1,443
Phosphates (industrial)	82
Plastics, not otherwise classified	8,758
Rayon & transparent paper	63,408
Sewage	2,377
Soap, glycerine & detergents	18,063
Sugar refining	130
Sulphate of ammonia	69,663
Sulphates of copper, nickel, etc.	5,929
Sulphate of magnesium	286
Superphosphates	105,001
Tar & benzole	5,894
Textile uses	4,354
Titanium dioxide	67,331
Unclassified	46,004
Total	512,613

SULPHURIC ACID AND OLEUM
(*Tons of* 100% H_2SO_4)

	Chamber & Tower only	Contact only	Chamber, Tower & Contact
Stock 1 July 1956	25,911	64,963	90,874
Production	116,118	399,514	515,632
Receipts	23,474	33,883	57,357
Oleum feed	—	1,345	1,345
Adjustments	−1,285	+153	−1,132
Use	73,420	211,459	284,879
Despatches	65,070	213,281	278,351
Stock 30 September 1956	25,728	75,118	100,846
Total capacity represented	197,560	506,000	703,560
Percentage production	58.8%	79.0%	73.3%

RAW MATERIALS
(*Tons*)

	Pyrites	Spent Oxide	Imported Sulphur	Recovered, H_2S & Filter Cake	Zinc Concentrates	Anhydrite
Stock 1 July 1956	175,462	126,620	57,916	10,253	47,417	17,101
Receipts	97,247	58,976	76,368	9,619	72,526	172,624
Adjustments	+3,826	+326	−79	+63	+10	−2,934
Use	87,929	56,138	58,204	7,489	44,969	172,046
Despatches*	2,838	3,825	376	180	9	—
Stock 30 Sept. 1956	185,768	125,959	75,625	12,266	74,975	14,745

* Including uses for purposes other than sulphuric acid manufacture.

Census of Production

The Census of Production to be taken in 1957 for the year 1956 will be a simplified census on a sample basis, similar to last year's census. An Order prescribing the matters about which returns may be required has now been made by the Board of Trade. Undertakings producing coal, gas, electricity, oil-shale, crude or refined petroleum or shale oil products are exempted from making Census of Production returns to the extent to which they supply the necessary information to the Minister of Fuel and Power (or in certain cases to the Secretary of State for Scotland).

US GOVERNMENT & GRADUATES

RECENTLY ISSUED by the US National Science Foundation is a study entitled *Federal Support for Science Students in Higher Education* which analyses some of the ways the US Government helped science students in 1954.

More than 20 per cent of all graduate students and 16 per cent of all undergraduates in the US today receive financial help from the Federal Government. Support of science students, who number more than 100,000, is stated to cost the Government $100 million. The study shows that 94 cents out of every dollar spent for undergraduate aid is accounted for under the veterans' educational benefits. The rest was accounted for by the Defence Department civilian employees and Naval Reserve Officers' Training Corps.

In 1954, the NSF study shows that the US spent nearly $23 million to support over 16,000 graduate students studying natural sciences and engineering and $2.5 million to support 500 fellows taking post-doctoral studies. Some 2,156 graduate students in chemistry received financial aid compared with 2,034 in biological sciences and 1,846 in physics.

It seems that in graduate schools the pattern of federal support is different from that in undergraduate schools. Thus the veterans' benefits account for a much smaller proportion of federal aid—only 18 cents out of every dollar spent.

More than 5,900 graduate students were employed as research assistants in 1954 at a cost of over $10 million (66 per cent of funds). Some 20 per cent of the assistantships were in chemistry; more than 50 per cent were in physical sciences. The funds employed were obtained mainly from research contracts of military departments. Other government agents providing support were the Department of Health, Education and Welfare (HEW), the Atomic Energy Commission (AEC), the Department of Agriculture and the National Science Foundation (NSF). Government fellowship awards to 1,500 graduate students in 1954 amounted to nearly $5 million. Some 60 per cent of fellowships in natural sciences were financed by NSF. Reactor engineering and radiological physics fellowships were financed by AEC and the State Department financed graduate study abroad.

Since 1954 US federal aid for graduate students in science has increased. However, under the present law, the veterans' educational benefits cease in 1965. As these are almost the exclusive source of federal aid to undergraduates and a substantial part of aid to graduate science students, termination of these benefits may severely strain other sources of support. American feeling is that lack of funds will adversely affect the supply of trained scientific personnel. In the US, as in this country, a great many graduate students rely on financial assistance to continue their studies. If adequate US government support is not forthcoming there will be, of course, a decrease in highly qualified scientific manpower in the US at a time when there is an evergrowing shortage.

From all Quarters

NZ Resins Plant

SYNTHETIC resins for use in the surface coating and plastics industry will be produced in a plant being erected at Auckland by Polymers (NZ) Pty. Ltd., affiliate of Polymer Corporation Pty. Ltd., of Homebush, Australia. It is expected to begin operations later this year.

Australian Bauxite

ANOTHER large bauxite deposit has been discovered in North Queensland, in the Lynd River area, near Cairns. It was recently reported that a 2,000 square mile tract on Cape York Peninsula was rich in bauxite. A detailed survey is now being made and it is confirmed that the deposits generally are nine feet deep throughout the area.

Soda Ash Plant

AN Indian company is to build a plant in Uttar Pradesh to make soda ash and ammonium chloride by the Benz process, which has never been used in the country. The necessary machinery will arrive next year and the plant is expected to go into production early in 1958. The State Government of Uttar Pradesh is expected to invest Rs14.5 million in the project.

Crude Oil

PRODUCTION of crude oil at Kuwait for the period 1 January to 30 September 1956 was 43,357,842 tons. The Iraqi fields of the Iraq Petroleum Co. Group produced 25,885,334 tons during the same period while at Qatar the Qatar Petrolelum Co. produced 4,454,216 tons. In South Iran the figure is 19,102,000 tons. These figures have been compiled by the British Petroleum Co. which has interests in all these areas.

Italian Industry

ALUMINIUM production during the first half of this year totalled 120,808 tons, which is 30.3 per cent lower than the figure for the corresponding period in 1955.

There was a slight fall in the production of synthetic fibres in June compared with the previous month (13,029 tons against 13,363 tons). Total production for the first six months of the year, however, was 78,271 tons against 65,837 tons in the same period of 1955.

Italian exports of mercury during the first half of this year amounted to 1,088 tons against 481 tons and 1,441 tons for the corresponding periods in 1955 and 1954 respectively. Revival of trade in mercury is attributed to increased demands from the US, Germany, Japan and France.

Nitrate Factory

FURTHER to the report of a nitrate factory for Greece (THE CHEMICAL AGE, 21 July, p. 125), the Greek Government recently announced an international call for tenders for construction of the factory. Capacity of the plant is to be 74,000 tons of nitrogen annually. Lignite from Ptolemais will be used. At present, some $15 million are spent every year on imports of fertilisers.

Portuguese Salt

AN ORDER has been issued by Portugal's Ministry of Economy placing all salt produced or to be produced in the country under Government control. This has been necessitated by the inadequacy of production this year, which is due to the effect of wet atmospheric conditions on the salt pans.

Indian Dyestuffs

AN INDIAN DYESTUFFS UNIT is to be started by the Government of India through the National Industrial Development Corporation (see THE CHEMICAL AGE, 27 October, p. 185). At the present time there are 10 dyestuffs plants in India, the largest being connected with ICI Ltd. Expansion is planned for all the units.

Indian imports of dyestuffs have increased over the past few years and demand is expected to increase still further by 1960 to give an estimated consumption of nearly 10,000 tons of dyestuffs. The Government intends that indigenous raw materials should be used in the industry.

Filament Nylon

THE CHEMNYLE filament nylon dyeing process developed by Chemstrand, can also be used with a number of optical bleaches, said Mr. Walter H. Hindle, associate director of textile research for the Chemstrand group.

Speaking before the Midwest section of the American Association of Textile Chemists and Colorists, Mr. Hindle said that applying optical bleaches by the Chemnyle process gave extremely uniform results. He went on to say that more than 100 dyeing and finishing companies both in the US and overseas had already applied for a licence to use the Chemnyle process.

Chemicals-from-Coal

A CHEMICALS-from-Coal industry, to cost between £50 to £70m., is being investigated by the New South Wales State Government. Establishment of the industry would cut imports of chemicals, rubber and plastics by £50m. a year, the Minister without Portfolio, Mr. Simpson, said. The project was recommended in September.

W. German Potash

ACCORDING to the sales agency of West German Potash Mines, West German potash exports for the first five months of the current fertiliser year (from 1 May) increased to 337,747 tons from 269,697 tons over the same period in 1955, an increase of 25 per cent. Domestic sales totalled 451,762 tons in the period under review compared with 413,892 tons in the same period last year, an increase of nearly 10 per cent.

Iraq Sulphur

A WORLD Bank mission a few years ago recommended that natural gas, by-product of Iraq's oilfields, should be harnessed for extraction of sulphur and other products. Output of the proposed plant is estimated at 300 to 350 tons a day. Cost of construction is put at £1.5 million. Tenders are expected to be issued within the next three months.

COSMETIC CHEMISTS & SILICONES

Invitation to Examine Properties

'SILICONES in the Cosmetic Industry' was the title of a lecture given by Mr. T. W. Watson at a meeting of the Society of Cosmetic Chemists of Great Britain on 2 November.

Mr. Watson declared it his aim to present an account of the many special properties of the silicones and to invite cosmetic chemists to examine these properties in the light of their special requirements, so that, by selecting the appropriate type of silicone, advantages might accrue to the cosmetic industry as they had already done in many others. As a general introduction he provided a 30 minute talking colour-film entitled *What's a Silicone*?

After the film Mr. Watson discussed the synthesis of the silicone, and outlined special properties which might suit them for application in the cosmetic industry. The liquids are water-white, oily substances with viscosities ranging from values less than that of water to extremely viscous fluids. They have low volatility and their relatively low surface tension enables them to spread well on the skin to form a thin invisible continuous film which is water-repellent. Thus protection may be afforded against contact with soaps and other detergents, acids, alkalis and organic solvents, and protective properties may be given to emollient creams, ointment bases and so on.

Mr. Dobson, the president, introduced a discussion by suggesting that cost must be an important factor. It would be necessary to examine the efficiency at a low level of concentration and compare it with that of the conventional materials. One promising use would be for the treatment of moulds to prevent sticking of the moulded material. Dr. Matalon expressed anxiety lest the application of silicones to the skin might interfere with metabolism or with the remedial action of antibiotics. Mr. Watson was of the opinion that the many publications which described the silicones as innocuous would clear away this objection.

CAUSTIC SODA-CHLORINE PLANT

Attempt to Overcome Mexican Shortage

DEMAND for caustic soda in Mexico has increased sharply in recent years due mainly to the rapidly expanding rayon industry. To overcome the shortage of caustic soda, Pennsalt International Corporation has formed a subsidiary company, Industrial Quimica Pennsalt. This company will build a caustic soda-chlorine plant near Mexico City with an initial capacity of 18 tons per day caustic and 15 tons per day chlorine.

Part of the chlorine produced will be used for the manufacture of DDT and is expected to make a substantial contribution to meeting the strong local demand for agricultural and domestic insecticides. Chlorine will also be supplied to the pulp and paper industry and will be used for water purification. Later, Industrial Quimica Pennsalt intend to increase their production of caustic and chlorine and so assist in the development of plastics, solvents, detergents and other new industries.

Oronzío de Nora, Milan, whose mercury cells have been installed and operated by the Pennsylvania Salt Manufacturing Company at Calvert City over a number of years, have been commissioned to provide a complete caustic soda-chlorine plant on a turn-key basis. Initially twelve Oronzío de Nora 14 TGL cells will be installed and will be operated at 40,000 amps. Layout, erection, equipment, and start-up will all be handled by Oronzío de Nora. This project of Industrial Quimica Pennsalt is further evidence of the rapid expansion of the Mexican economy and of the fruitful association of foreign capital with the industrial development of Mexico.

Rutile Mining

IT IS reported that an agreement is being negotiated between British Titan Products Ltd. and Columbia-Southern Chemical Corporation of the US to mine rutile near Freetown, Sierra Leone. Rutile is a raw material for titanium.

ICI and Consolidated Zinc are shareholders in British Titan Products.

Columbia-Southern and ICI Ltd. have an agreement to supply the US Government with 5,000 short tons per annum of granular titanium metal (THE CHEMICAL AGE, 13 August 1955).

RIC Graduates

FIFTY candidates are named in the pass list issued by the Royal Institute of Chemistry following the final examination for graduate membership held in September.

Cockade PRM

Phage Resistant Medium is Reported

AT THE 14th International Dairy Congress, the value of Cockade PRM in cheese-making was reported.

Cockade PRM is a 'phage resistant medium'. It is a white spray-dried powder, which is reconstituted as a 10 per cent (approx.) solution in distilled water for use. It is a calcium-free neutral medium, produced from milk.

'Phage' is the name for ultra-microscopic organisms which attack and destroy the acid-producing bacteria in 'cheese starter cultures' with which all manufactured cheese is made. These organisms are permanently present in any creamery. The result of phage is either no cheese or cheese which has to be downgraded—cheese with cracks in, cheese that is not solid enough etc. and even cheese unfit for human consumption.

Cockade PRM, it is claimed, will resist phage, in the following ways:

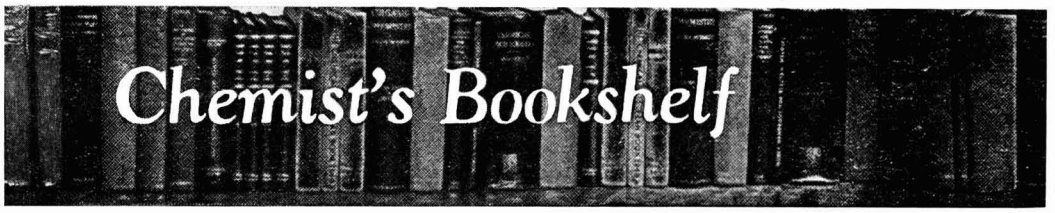
1. Phage will not multiply in PRM solution, and if initially present some of the phage will die out during incubation.
2. Many cheese starter strains (or cultures)—different ones have been developed in different countries for producing different cheeses—will grow in PRM, and some grow better in PRM than in milk.
3. Any starter culture that will grow in PRM will develop normally in spite of even the heaviest phage contamination.
4. A concentration of phage that will cause complete lysis (disruption of cells) in cheese milk will not affect cheese-making if PRM based cheese starter is used.

General adoption of Cockade PRM could mean:

(a) More top quality cheese.
(b) Less expensive production.
(c) With the problem of phage overcome Government subsidies for dairying research could be reduced.

Patents have been taken out (or are pending) in all cheese-producing countries. Production of PRM is at Fisons Milk Products Ltd. factory, Coleraine, N. Ireland, and by the spring commercial production should be of the order of 250 tons per year. Plans are now being drawn up to increase production by 1958.

Cockade PRM was developed as a result of investigations by Bruno Reiter, a bacteriologist, who has studied cheese-manufacture since 1938, and has worked on the phage problem since 1943.



CHEMICAL SAFETY SUPERVISION. *By* J. GUELICH. Reinhold Publishing Corporation, New York; Chapman & Hall Ltd., London. *1956.* Pp. 221. *36s.*

During the past decade the subject of safety in chemical factories, fostered by the more progressive trade journals, has grown almost to the status of a branch of technology. In the US, at least, it has also acquired its own band of specialists, known as safety supervisors, and it is to the men carrying out the task of supervision that this book is addressed. In this country the duties assumed by safety supervisors are frequently shared, particularly in the smaller manufacturing organisations, between the personnel officer, the plant manager, the shift foreman and the shop steward.

All those connected with chemical manufacturing plant, from the chemical engineer who designs it to those in charge of its operations and of its operators, will derive benefit from the author's experience. Some technologists may be put off by the breezy, non-technical language in which the book is written but the style is appropriate to the subject matter, which must be assimilated by employees at widely differing technical levels. Not the least important of the many fruitful suggestions is that of a close liaison between the medical and chemical staff; all too often the medical officer treats his appointment as a lucrative addition to his already overlarge general practice, and victims of accidents are despatched to general hospitals where there is none of the specialised knowledge and attention frequently demanded by chemical burns, poisoning or asphyxia.

The psychology of accident prevention is discussed and also the methods by which personnel may be persuaded to make the most efficient use of protective clothing. The text is well-illustrated by a number of sketches and contains details of actual cases. The book may be most heartily recommended. J. R. MAJER

THE CHEMISTRY OF CEMENT AND CONCRETE. *By* F. M. LEA. Edward Arnold (Publishers) Ltd., London. *1956.* Pp. xvi+637. *70s.*

This is a revised and enlarged edition of the well known book by Lea and Desch, first published in 1935. It is to be welcomed since the past two decades have seen many advances in our knowledge of the chemistry of cements and of the factors affecting the performance of concrete in use. Although the book has been largely rewritten its general purpose, consideration of the chemical and physical properties of cements and concretes in relation to their uses, remains unchanged.

The book deals first with the constitution of cements and their components and with the chemical changes occurring in the course of cement manufacture and use. Many of such changes are physico-chemical in nature and there are numerous clear phase diagrams and explanations of the phase changes involved in cement formation. There is a new chapter on atomic structures of cement compounds and their relation to cementing properties. Setting and hardening and the relationships between physical structure and properties of cements are discussed. Testing of cements is considered generally and the values and significance of tests are considered. An account of recent developments in testing is included.

About one quarter of the book is concerned with special cements and includes detailed consideration of pozzolani cements, cements from blast furnace slag, high alumina cements and cements used for radiation shields. Preparation of these and their resistance to chemical and physical modes of attack are discussed.

Concrete Aggregates

Remainder of the book is concerned with concrete. Various substances used as concrete aggregates are considered and the resistance of concretes to natural destructive agencies and to various organic and inorganic agents. Detailed discussion of concrete mixing is felt to be outside the scope of the book but the subject is discussed generally. A final chapter is concerned with the examination of concrete failures.

The book is extremely well documented with references and an important feature is the provision of much information, particularly with respect to concrete, which is not otherwise readily accessible. There are many clear diagrams or plates and some very useful tables. The author, who has himself made many contributions to knowledge of the chemistry of cements and concretes, has provided an up-to-date and very readable account of the subject. All chemists and others concerned with the science and technology of silicate materials will find the book invaluable. It provides much information for the engineer and others concerned with the construction of plant in which cement and concrete are used. In view of the data and information provided the price is reasonable. W. R. MOORE

Chromium-Nickel Steel

APPLICATIONS of chromium-nickel cast alloy steel of the 25/12 class, Calmet, produced by the Calorizing Corporation of Great Britain Ltd., Tavistock Square, London WC1, are given in the company's latest publication. Calmet is said to combine oxidation resistance with excellent high-temperature load-carrying ability. Tube supports of the material are being widely used in high temperature service for hydro-desulphurisation heaters, oil-cracking units, etc.

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.

P. LEINER & SONS LTD. London EC, manufacturers of gelatine, glue &c. 12 Oct., by order on terms, agreement and two letters all dated 1 June 1955 securing to Industrial and Commercial Finance Corpn. Ltd. aggregate sum of £186,000 due to charges from Glamorgan Alkali & Acid Co. Ltd. and secured by two charges dated 1 October 1952 and 1 June 1955; charged on certain moneys. *Nil. 8 September 1955.

Satisfactions

AMBER CHEMICAL CO. LTD., London W. Satisfactions 18 October, of charge registered 4 October 1951 and debentures registered 11 January 1952 and 20 April 1953.

WATFORD CHEMICAL CO. LTD., London W. Satisfaction 17 October, of charge registered 30 April 1956.

New Registrations

Plastic Dipping Co. Ltd.

Private company. (573,570). Registered 29 October. Capital £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in plastics and similar materials, trade coaters or coverers of metals and other materials in all plastic polymer materials and other chemicals etc. The directors are: James H. Blakely, 2 Queen's Close, Esher, Surrey; Philip S. T. Edmonds, Tower House, Rosslyn Road, Twickenham Park, Middlesex; Victor Scott, 29 Ludlow Road, Guildford. Secretary: J. H. Blakely. Solicitors: E. H. Seager Winn, 50 Maddox Street, London W1. Registered office: 2 Guildhall Chambers, 31-4 Basinghall Street, London EC2.

Burgoyne Burbidges & Company Ltd.

Private company. (573,958.) Registered 8 November. Capital £100 in £1 shares. Objects: To carry on the business of chemical manufacturers, druggists, drysalters, oil and colour men, etc. The subscribers (each with one share) are: G. R. D. Lambert, 20 Harcourt Road, London N22, solicitor's managing clerk; and E. W. Harry, 28 Tremadoc Road, London SW4, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Ashurst Morris Crisp & Co., 17 Throgmorton Avenue, London EC2.

Tudor Court Liquid Gas & General Products Ltd.

Private company. (573,715). Registered 1 November. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in burners, heaters, cookers, stoves, ranges; gas, electrical and chemical appliances, etc. The subscribers (each with 1 share) are: Albert G. Dawe, 27 Leadenhall Street, London EC3, solicitor's clerk; and E. Webber, 83 Kyverdale Road, London N16, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Thomas Cooper & Co., 27 Leadenhall Street, London EC3.

R. & A. Johnson Ltd.

Private company. (16,248). Registered in Dublin, 26 September. Capital £10,000 in £1 shares. Objects: To carry on the business of manufacturing and distributing chemists and druggists etc. The subscribers (each with one share) are: Harold C. Johnson, The Barn, Orwell Road, Rathgar, Dublin; and George H. Hunter, 4 Simmonscourt, Ballsbridge, Dublin, manufacturers' agents. The first directors are not named..

W. E. Davy Ltd.

Private company (573,718). Registered 1 November. Capital £4.000 in £1 shares. Objects: To acquire the business of a pharmaceutical chemist carried on by Wm. E. Davy at 8 Barnsley Road, Stairfoot, Barnsley, as 'W. E. Davy' etc. The directors are: William E. Davy and Nellie Davy (both permanent), of 86 Hunningley Lane, Stairfoot, Barnsley; and Lewis Phillips, 512 Doncaster Road, Stairfoot, Barnsley. Secretary: Nellie Davy. Solicitor: W. Winter, Barnsley. Registered office: 512 Doncaster Road, Stairfoot, Barnsley.

Gay-Addis Ltd.

Private company. (573,456). Registered 26 October. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers and merchants of and dealers in any goods including food products, medicines, medicaments, patent foods and medicines etc. The subscribers (each with one share) are: Percy O. Ansell and Andrew Matthews, both commercial managers of 116 Chancery Lane, London WC2. The first directors are to be appointed by the subscribers.

Solo Match & Chemical Works Ltd.

Private company (573,828). Registered 5 November. Capital £100 in £1 shares. The subscribers (each with one share) are: Dr. Ing. F. Siegmann, 72 Unionstrasse, Lintz-Donau (director of Solo Match & Chemical Works Ltd., Vienna) and Heinz Schilhan, 6 Nedbalgasse, Vienna (export manager of Solo Match & Chemical Works Ltd., Vienna). Secretary: John H. Weeks. Registered office: 6 Stratton Street, Piccadilly, London W1.

COMPANY NEWS

British Alkaloids

The directors of British Alkaloids have declared an interim dividend of 1.2d per 1s share, or 10 per cent, in respect of the year ending 31 March 1957, payable to all shareholders registered on 31 October. This interim compares with 1.8d per share, or 15 per cent, paid on £91,002 prior to a 50 per cent scrip issue. A final of 16⅔ per cent was paid for 1955-56 on the present £136,503 capital.

Tube Investments Ltd.

A final dividend on the ordinary stock of 7½ per cent actual, which, with the interim dividend paid of 6¼ per cent, makes 13¾ per cent actual in respect of the year ended 31 July 1956 is recommended by the directors of Tube Investments Ltd. Allowing for the period during which the new capital raised during the year was partly paid up, this is equivalent to a rate of 15 per cent per annum.

[turn to page 300

Company News

from page 298]

Net profit of the group for the year amounted to £5,271,209, compared with £4,428,523 for the previous year.

Dividends at the authorised rates for the half year ended 30 November 1956 will be paid on the seven per cent cumulative first preference stock and the 4½ per cent redeemable cumulative preference stock. All dividends less income tax at 8s 6d in the £ will be paid to members on the registers at 25 October 1956. The annual general meeting will be held on 10 December.

McKechnie Brothers Ltd.

A final dividend of 10 per cent, making 15 per cent, less tax, for the year ended 31 July 1956, against a forecast of the 12½ per cent equivalent paid for the previous year on smaller capital is recommended by McKechnie Brothers, manufacturers of non-ferrous metals and chemicals. A special distribution of 2½ per cent from non-taxable profits was made last September. Group profits, before tax, amount to £1,052,162, compared with £1,632,482 for 1954-55.

Thos. W. Ward Ltd.

Group profit of Thos. W. Ward Ltd. for the year ended 30 June 1956 amounted, after taxation, to £1,242,697, compared with £1,136,972 for the previous year. A full year's dividend has been paid on the preference and employee's shares, together with an interim dividend of five per cent less tax on the ordinary share capital. A final dividend on the ordinary shares of 10 per cent less tax is recommended. The payment of a final dividend of £12 5s per cent on employee's shares, making £17 5s per cent for the year, tax free, is also recommended. The annual general meeting takes place in Sheffield on 30 November.

Kern Oil Co.

Group net profits of the Kern Oil Co. for the year ended 31 May 1956 increased from £371,625 to £430,044. An unchanged distribution of 25 per cent is announced. The parent company's net profit rose from £312,679 to £342,217 after depreciation of £191,798 (£171,263) and tax of £361,263 (£304,066).

Simon-Carves Ltd.

The directors of Simon-Carves Ltd. have declared an interim dividend of 7½ per cent payable 31 December 1956. The directors state that this must not necessarily be taken as an indication that the total distribution for 1956 will be greater than for 1955 when the rate was equivalent to 16⅔ per cent on the present capital. From the present indications the results for 1956 should be approximately the same as for the previous year.

The Texas Co.

Estimated net income of The Texas Co. and its subsidiaries for the first nine months of 1956 amounted to $207,429,255 or $3.78 a share, compared with $189,767,006 or $3.46 a share for the like 1955 period, it was announced last week by Mr. Augustus C. Long, chairman of the board of directors. Excluding a non-recurring net profit of $8,184,530 realised on the sale of a capital asset in the second quarter of 1955, this was an increase in earnings of 14.23 per cent.

For the three months ended 30 September 1956, estimated net income was $69,340,546 or $1.26 a share, compared with $64,932,963 or $1.18 a share for the similar quarter of 1955.

The company's gross income from sales and services during the first nine months was $1,462,694,392, an increase of 14.22 per cent over the same period last year.

On 18 October 1956, the board of directors declared the regular quarterly dividend of 50c a share and, in addition, an extra dividend of 45c a share, both payable 10 December 1956 to stockholders of record on 9 November 1956.

Larger Premises

MATTHEWS & YATES LTD, manufacturers of Cyclone fans and fan equipment announce that they have transferred their Birmingham office to larger premises at County Chambers, Corporation Street, Birmingham 2. Telephone No. Central 1089 (2 lines).

Label for Safety

MOST likely cause of unforeseeable fire risk in ships lies in a wrong or insufficient description of contents, especially with any package containing chemicals. This was stated by Lieut.-Col. A. G. Bates, a director of Cunard Steam-Ship Co. Ltd., at a meeting in London last month. Colonel Bates spoke on the Principles of Fire Organisation in Ships at Sea and in Port, and pointed out that the precise chemical constituents of packages containing hazardous substances must be available for reference in cases of doubt.

MARKET REPORTS

LONDON Steady conditions have been maintained in most sections of the industrial chemicals market—the situation in the Middle East has had no noticeable influence on the trend of business. Home call against contracts continues to cover good quantities and there is a little more buying interest for forward delivery. The potash chemicals are reported to be in active request while hydrogen peroxide and formaldehyde have met with a fair enquiry. Prices show little change. Sulphate of copper reacted from the higher price as given last week and at the time of this report is quoted at £94 10s per ton less 2 per cent f.o.b. Liverpool The current basis price for dry white lead is £151 10s per ton, and for red lead £147 per ton. The coal-tar products continue in steady request with prices unchanged.

MANCHESTER Prices have continued steady on the Manchester market during the past week, the principal fluctuations being in the non-ferrous metal products in sympathy with the movements of the metals. Textile and other heavy chemicals are being taken up in satisfactory quantities under contracts, and a fair number of fresh enquiries from home users as well as from shippers have been reported. Fertilisers are being called for in about average quantities for the time of the year, with basic slag still one of the most active sections. A steady demand for the leading tar products continues.

GLASGOW Reasonable trading is reported from the Scottish heavy chemical market for the past week, particularly towards the end. Demands have covered most sections of the industry, and those against contracts are being well maintained. Little or no change in prices has taken place and in general these remain firm. The export position is quite satisfactory and a varied range of enquiries have been received.

US Sulphur Output

ACCORDING to the US Bureau of Mines the US sulphur industry produced 621,130 long tons of native sulphur in July, compared with 565,002 tons in June and 487,633 tons in July 1955. Figures for recovered sulphur were: July 1956, 43,400 tons; June 1956, 38,200 tons; and July 1955, 33,900 tons.

"Fluor acid air is procured by dissolving the earthy substance called fluor in vitriolic acid. This kind of air extinguishes a candle and, like vitriolic air, one measure of it saturates two of alkaline air. It is peculiar to this kind of air to dissolve glass when it is hot.

It seems to consist of a peculiar acid vapour, united to the strong substance of the fluor; for water being admitted to it absorbs the acid vapour, and the stony substance is deposited. By this means it exhibits an amusing appearance, whether water be admitted to a glass jar previously filled with that air, or the bubbles of air be admitted, as they are formed, to a quantity of water resting on mercury."

. . . an amusing appearance

So, in 1797, Joseph Priestley described his early observations on hydrofluoric acid to students at the New College in Hackney, and recorded them under the title of *Heads of Lectures on a Course of Experimental Philosophy*. Today, using fluor acid air dissolved in aqua destillata, and costly vessels of silver and platinum, B.D.H. chemists make vast quantities of a great variety of fluorides of high purity, free from all stony substances, for which the B.D.H. sales departments will happily quote for deliveries by the pound, the cwt. or the ton.

Such fluorides are used industrially for all sorts of purposes from increasing the light transmitting properties of lenses to aiding the production of atomic energy.

B.D.H. LABORATORY CHEMICALS

THE BRITISH DRUG HOUSES LTD. B.D.H. LABORATORY CHEMICALS GROUP POOLE DORSET

LC/P/15vt

Classified Advertisements

CLASSIFIED RATES: All sections 5d. per word. Minimum 8/-. Three or more insertions 4d. per word. Box Number 2/- extra. Up to mid-day Tuesday for insertion same week.

SEMI-DISPLAY: 30/- per inch. Three or more insertions 25/- per inch.

SUBSCRIPTION: Annual Subscription of 52/6 brings 52 weekly copies of THE CHEMICAL AGE direct to your address from the printer (postage paid by the publishers), and a copy of THE CHEMICAL AGE YEAR BOOK.

COMPANY MEETINGS AND REPORTS: £12.12.0 per column. Three column measure (approximately 360 words).

OFFICIAL APPOINTMENTS

GOVERNMENT OF CYPRUS

Scientific Officer, Forensic Science Laboratory of the Criminal Investigation Division, Cyprus Police Force.

QUALIFICATIONS: At least a 2nd Class Honours degree in chemistry and extensive practice in chemical analysis.

DUTIES: Responsibility for chemical analysis under the Director of the Laboratory, a Senior Superintendent of Police.

TERMS OF APPOINTMENT: On contract for one tour (2 years) with salary in the scale £900-£1,548 p.a. plus a 20 per cent overseas allowance. Cost of living allowance. Outfit allowance. Gratuity. Free passages. Quarters provided at rental. Free medical attention. Generous leave. Income tax at local rates.

Apply to Director of Recruitment, Colonial Office, London, S.W.I. State age, qualifications and experience. Quote BCD 55/17/066.

EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS in various Government Departments. The Civil Service Commissioners invite applications for pensionable posts.

The posts are divided between following main groups and subjects (a) Mathematical and Physical Sciences, (b) Chemistry and Metallurgy, (c) Biological Sciences, (d) Engineering subjects and (e) Miscellaneous (including e.g. Geology, Library and Technical Information Services).

The Nature Conservancy employs Assistant Experimental Officers and is concerned with ecological research.

AGE LIMITS: For Experimental Officers, at least 26 and under 31 on 31st December, 1956; for Assistant Experimental Officers at least 18 and under 28 on 31st December, 1956. Extension for regular service in H.M. Forces. Candidates aged 31 or over with specialised experience for Experimental Officer posts may be admitted.

Candidates must have at least one of a number of specified qualifications. Examples are Higher School Certificate, General Certificate of Education, Scottish Leaving Certificate, Scottish Universities Preliminary Examination, Northern Ireland Senior Certificate (all in appropriate subjects and at appropriate levels), Higher National Certificate, University degree. Candidates taking their examinations in 1956 may be admitted. Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. In general a higher standard of qualification will be looked for in the older candidates than in the younger ones.

SALARY (London):—

Experimental Officer £925-£1,135 (men); £836-£1,015 (women).

Assistant Experimental Officer £365 (at age 18) to £805 (men), £715 (women). Starting pay up to £655 (men) or £627 (women) at 26 or over. Somewhat lower outside London. Promotion prospects. Women's scales being improved under equal pay scheme.

Opportunities for further education.

Further particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S94-95/56.

Early application advised and in any case not later than 31st December, 1956.

OFFICIAL APPOINTMENTS: continued

CHEMIST (Basic Grade) required by the **ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS,** for the control of chemical process and gas purification production plants in the Chemical Engineering Branch. Some of these plants are operated on a continuous basis and, therefore, shift work may be necessary. Candidates should be corporate members of the Institution of Chemical Engineers or of the Royal Institute of Chemistry, or have exempting qualifications, or hold an Honours degree in Chemistry or chemical engineering. Some previous experience of plant control work is desirable but not essential.

SALARY £775 (at age 25)—£1,060 (at age 34 or over)—£1,210 p.a. (male).

Contributory Superannuation Scheme. A house or assistance towards legal expenses on house purchase will be available for married officers living beyond daily travelling distance.

Requests for application forms by **POSTCARD** to the Senior Recruitment Officer at A.W.R.E., Aldermaston, Berks. Please quote ref. B 1159/38.

SENIOR SCIENTIFIC OFFICERS: SCIENTIFIC OFFICERS.

The Civil Service Commissioners invite applications for pensionable appointments covering a wide range of scientific research and development in most of the major fields of fundamental and applied science. In biological subjects the number of vacancies is small: individual vacancies exist in the Natural History Museum for candidates who have special knowledge of, or who are interested in, malacology, helminthology, acarology, mammalian taxonomy, taxonomic botany (monocotyledons), X-ray crystallography.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

AGE LIMITS: Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted; for Scientific Officers, between 21 and 28 during 1956 (up to 31 for permanent members of the Experimental Officer class). Salary (London) Senior Scientific Officers: (men) £1,135-£1,345; (women) £1,026-£1,240. Scientific Officers: (men £605-£1,055; (women) £605-£962. Women's scales being improved under equal pay scheme. Somewhat lower rates in the provinces.

Further particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S.53/56 for Senior Scientific Officers and S.52/56 for Scientific Officers.

Interview Board sits at intervals, as required.

Early application advised and in any case not later than 31st December, 1956.

OFFICIAL APPOINTMENTS: continued

THE UNIVERSITY OF LEEDS

Applications are invited for a
POST-DOCTORAL FELLOWSHIP IN THE DEPARTMENT OF PHYSICAL CHEMISTRY,
of tenure up to three years, starting salary not less than £600 p.a. and annual increments of £50 p.a.

Applicants should hold a Ph.D. Degree in Physical Chemistry and have experience either of high polymer chemistry or in reaction kinetics. The date of taking up the appointment could be arranged to suit the convenience of the Fellow appointed, but will not be later than 1 October, 1957.

Applications, together with the names of two referees, should be sent to
PROFESSOR F. S. DAINTON,
SCHOOL OF CHEMISTRY,
THE UNIVERSITY, LEEDS, 2,
not later than 1 January, 1957.

SITUATIONS VACANT

THE DISTILLERS COMPANY LIMITED
CHEMISTS

The Company has several vacancies at its Research and Development Department, Epsom, Surrey, for male organic and physical chemists with good honours degrees or equivalent qualifications. Age not over 35 years. Some previous industrial experience, preferably in the field of polymerisation, would be desirable, but is not essential, and recent graduates will be considered. The work concerns fundamental and applied research on high polymers at laboratory and semi-technical levels. Salary according to qualifications and experience. Non-contributory pension scheme. Write: Staff Manager, The Distillers Co. Ltd., 21, St. James's Square, London, S.W.1. Quote Ref: 64/56.

THE DISTILLERS COMPANY LIMITED
CHEMISTS

THE RESEARCH DEPARTMENT OF THE COMPANY has vacancies at its Research and Development Department, Epsom, Surrey, for male Graduates with good honours degrees in Chemistry, Biochemistry, or Botany, or equivalent qualifications. These appointments offer opportunities to the right men leading eventually to posts of managerial or executive responsibility. Age up to 35 years.

In the first instance, the work will be concerned with the application of biochemical methods to the study of metabolism, but will subsequently move towards the production of antibiotics and vitamins by microbial fermentation and investigation of their varied uses. Previous experience in these or related fields, which include Microbiological or Analytical Chemistry, would be desirable but is not essential; recent graduates are invited to apply. Salary according to qualifications and experience.

Non-contributory Pension Scheme.
Write:
STAFF MANAGER,
THE DISTILLERS COMPANY LIMITED,
21, St. James's Square,
London, S.W.1.
Ref. No. 65/56.

FOR SALE

MOISTURE TEST—THREE MINUTES—Already in use in many industries where rapid determination of water content of chemicals, colours, glazes and other raw materials is essential. **"SPEEDY" MOISTURE TESTER** has proved accurate and invaluable. Portable, needs no electricity, no skill. Complete £27 10 0. Order direct or send for illustrated leaflet to (Dept. C.A. 4) **THOS. ASHWORTH & CO. LTD.**, Vulcan Works, Burnley, Lancs.

FOR SALE: continued

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

FOR FREE DISPOSAL:
CHROMIC ACID—2% Approx. 1,000 gallons per month.
MIXED PHOSPHORIC/CHROMIC ACID—
(50% Phos. 7% Chromic) Approx. 1,400 gallons per month.
(3.5% Phos. 0.5% Chromic) Approx. 3,000 gallons per month.
Apply-:
HIGH DUTY ALLOYS LTD.,
WINDSOR ROAD,
REDDITCH,
WORCS.

GARDNER H SIFTER-MIXER, 560 lb. batch. Horizontal 'U' Trough 66 in. long by 24 in. by 28 in. deep with Revolving Brush Sifter. Bottom Outlet. Two available.
WINKWORTH MACHINERY LTD.,
65, High Street, Staines. Telephone 1010.

MIXERS—1 Baker Hand-tilted Trough, 16 in. by 24 in. by 20 in Fast and loose pulleys and clutch. "Z" blades.
1 Ditto Power-tilted Trough, 30 in. by 20 in. by 24 in. Pulley drive and clutch. Four "L" blades.
THOMPSON & SON (MILLWALL), LTD.,
LONDON, E.14.
TEL.: EAST 1844

MORTON, SON AND WARD, LIMITED, STAINLESS STEEL VESSELS

VESSELS of all shapes and sizes, jacketed or unjacketed—with stainless steel mixing gear to requirements; also stainless steel storage tanks and vauum vessels.
" MORWOOD " "U"-shaped TROUGH MIXERS—up to 2 tons, in stainless steel, with agitators, scroll or paddle type, jacketed or unjacketed.
Stainless Steel **TROUGHS, TANKS** and **CYLINDERS** made to requirements.
These items can also be fabricated in mild steel.

JACKETED PANS

100g., 150g., and 200g., new, in mild steel, for 100 lb. p.s.i. w.p.—with or without mixing gear.
3 **cwt. TROUGH MIXERS** by **CHALMERS** and **GARDNER**—stainless steel-lined troughs.
50g., 75g. and 100g. heavy duty **MIXERS** by **FALLOWS** and **BATES.** Agitators driven through bevel gears from fast and loose pully.
200g. cast-iron **JACKETED MIXING VESSEL** with nickel-chrome impellor type agitator driven through bevel gears from fast and loose pulley.

BROADBENT HYDRO EXTRACTORS

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

AIR COMPRESSORS

THREE 30 c.f.m. at 100 lb. pressure, water cooled, automatic overloads, with or without motors.
AIR RECEIVERS MADE TO REQUIREMENTS PUMPS
Selection of new MONO and second-hand Pumps in stock—2 in. to 5 in.

Inquiries Invited.
MORTON, SON AND WARD, LIMITED,
WALK MILL,
DOBCROSS, NEAR OLDHAM,
Lancs.
Phone Saddleworth 437

PRESSURE VESSELS
FOUR AVAILABLE
Each 14 ft. by 8 ft. diameter.
All welded dish-ended type.
Thickness ½ in.
Fitted manhole & cover, etc.
Working pressure 65 lb.
MADEN & McKEE LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.
Phone: Stoneycroft 2727/8.

FOR SALE: continued

PHONE 98 STAINES

ELECTRIC SELF-CONTAINED CRUSHER / ELEVATOR / SCREEN. 415/3/50.
JACKETED RECTANGULAR OPEN TANKS—15 ft. by 4 ft. by 4 ft. & 5 ft. by 3 ft. by 3 ft.
(Two) **COOLING/DRYING ROLLS**—36 in. by 30 in. diam.
12 ft. **JACKETED "U" TROUGH WORM CONVEYOR/DRYER.**
"MANESTY" PELLETING MACHINE—A.C.
"DOUGLAS" GUNMETAL ELECTRIC 1½ IN. PUMP.
(3) **COPPER JACKETED PANS**—30 in. by 26 in. 30 w.p.
STAINLESS STEEL AUTOCLAVES—6 ft. by 3 ft. 100 w.p.
STAINLESS STEEL GARDNER MIXER—40 in. by 17 in. by 17 in.
STAINLESS STEEL SINK UNITS—3 ft. by 2 ft. by 1 ft. 3 in.
STAINLESS STEEL 100-gal. JACKETED MIXERS & PAN.
STAINLESS STEEL PANS—70- & 40-gallon.
STAINLESS STEEL & CHROME ELECTRIC MIXING ARMS/EMULSIFIERS.
HARRY H. GARDAM & CO., LTD.

REDLER 9 in. Elevator, 120 ft. centres, capacity 25 tons per hour, 10 ft. casings, complete with drive.
REDLER 9 in. Runaround Conveyor, 42 ft. 6 in. long, capacity 25 tons per hour, complete with drive.
Ex-Cond.—Low Prices.
G. E. SIMM (MACHINERY) LIMITED,
27, BROOMGROVE ROAD,
SHEFFIELD, 10.
Tel.: Sheffield 64436 (3 lines).

SIMPLITE PUMPS are the World's Simplest, Lightest, Safest and Cheapest diaphragm type. 2 in. Suction completely self priming. Water, mud or chemicals. Petrol, Electric or Hand models from £20. Illustrated leaflet from the makers: **WM. R. SELWOOD LTD., 3 CHANDLER'S FORD, HANTS.** Phone 2275.

Two 30 ft. by 9 ft. **LANCASHIRE BOILERS** for 200 lbs. pressure. Hopkinson Mountings and "Oldbury" Chain Grate Stokers. **JAMES DIXON LIMITED, CENTRAL WORKS, BURNLEY.**

WE OFFER 33 tons Marine Rope, USA origin; 3 million sheets Abrasive Papers and Cloths; Chevrolet Fire Trucks; 3 International Mobile Cranes, excellent condition, 5-ton fixed jib, USA origin; Ethylene Oxide Derivatives, powerful detergent Neutronix; 22 tons Waterproofing Tar; 230 tons "Passivant" with a phosphoric acid base. 20 tons Product for developing colour photographs, 2 tons.
SOCOMO, 10 RUE D'HAUTEVILLE, PARIS 10, FRANCE. TEL.: PRO. 40-23.

WANTED

INDUSTRIAL BY-PRODUCTS, LTD., 16, Philpot Lane, London, E.C.3. will be pleased to receive particulars of any by-products, waste materials and residues for disposal.

CALDER VALE GLASSWORKS LTD

Calder Vale Rd. • Wakefield • Yorks

TEL. WAKEFIELD 3857

● *SPECIALISTS IN* ●

Carboys · Demijohns Winchesters

PATENTS

The Proprietor of British Patent No. 679912, entitled **"IMPROVEMENTS IN OR RELATING TO PHENOLALDEHYDE CONDENSATION PRODUCTS,"** offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern & Carlberg, 14 E. Jackson Boulevard, Chicago 4, Illinois, U.S.A.

AUCTIONEERS, VALUERS, Etc.

EDWARD RUSHTON, SON AND KENYON (Established 1855).

Auctioneers, Valuers and Fire Loss Assessors of
CHEMICAL WORKS PLANT AND MACHINERY
York House, 12 York Street, Manchester.

Telephone 1937 (2 lines) Central Manchester.

WORK WANTED & OFFERED

CRUSHING, GRINDING, MIXING and DRYING for the trade.
THE CRACK PULVERISING MILLS LTD.
Plantation House
Mincing Lane,
London, E.C.2.

GRINDING, CRUSHING AND GRADING
FINE GRINDING LTD.,
BLACKHOLE MINE, EYAM
TELEPHONE: EYAM 227

PULVERISING of every description of chemical and other materials. Collections, storage, deliveries. **THOMAS HILL JONES, LIMITED, INVICTA WORKS, BOW COMMON LANE, LONDON E.3. (TELEPHONE: EAST 3285).**

Have you Reserved Your Space

in

1957 ANNUAL REVIEW NUMBER

January 12

The special issue that will be read and preserved for future reference by buyers of 50 Countries drawn from 40 different industries.

If not please write to:

The Publisher

THE CHEMICAL AGE

154 FLEET STREET, LONDON, E.C.4

or telephone FLEet Street 3212

BORON TRIFLUORIDE-ACETIC ACID COMPLEX

Used as a catalyst in polymerisation, alkylation, condensation and other organic reactions.

PHYSICAL PROPERTIES

Specific gravity 1·4

The commercial product containing 40 per cent. boron trifluoride is a pale yellow or brown, rather viscous liquid. It fumes slightly in moist air and is decomposed by water.

On heating, boron trifluoride is evolved until the strength is reduced to 36 per cent. BF_3 corresponding to the compound $BF_3 \cdot 2CH_3COOH$. This then distils unchanged at 140°C.

On cooling, the 40 per cent. BF_3 complex becomes very viscous below 0°C., but does not freeze even on prolonged standing at −10°C.

BORON TRIFLUORIDE GAS

Used as a catalyst in polymerisation, alkylation, condensation, and other organic reactions.

As a gaseous flux in metal brazing.

CHEMICAL PROPERTIES

The dry gas does not react with metals at room temperatures.

It forms a hydrate $BF_3 \cdot 2H_2O$ with water, and readily forms complexes with oxygen-containing organic compounds, e.g. ethers, phenols, alcohols, acids and aldehydes.

PHYSICAL PROPERTIES

The following published data refer to the pure product:

Boiling point	−101°C.
Freezing point	−128°C.
Critical temperature	−12·25°C.
Critical pressure	49·2 atmos.
Density of gas	3·06 gms./litre at S.T.P.

Commercial gas contains not less than 98·5% BF_3

High Purity gas contains not less than 99·8% BF_3

CONTAINERS

Steel cylinders 5-6 lbs. or 40-45 lbs. net capacity at 1,800 lb./sq. in. pressure.

Advice on materials of construction and on handling may be obtained from

IMPERIAL SMELTING

U.K. MEMBER OF THE CONSOLIDATED ZINC CORPORATION LIMITED

IMPERIAL SMELTING CORPORATION (SALES) LTD • 37 DOVER STREET • LONDON • W.1

PIONEERS IN FLUORINE DEVELOPMENT

Printed in Great Britain by THE PRESS AT COOMBELANDS LTD., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154 Fleet Street, E.C.4, 17 November, 1956. Registered at the General Post Office. Entered as Second Class Matter at the New York U.S.A., Post Office