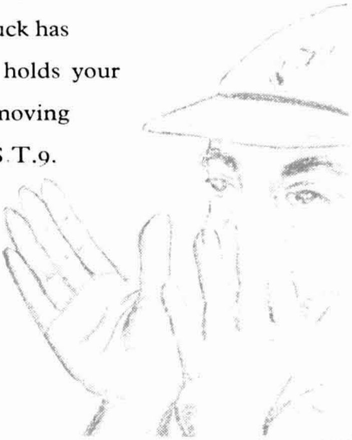
# The Chemical Age

VOL LXVIII 16 MAY 1953 No 1766



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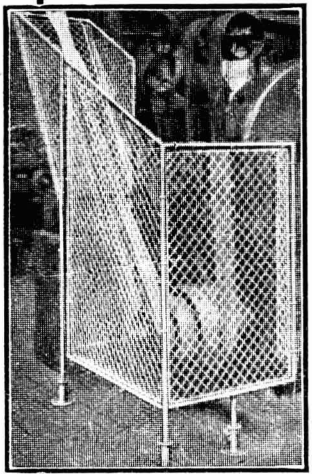

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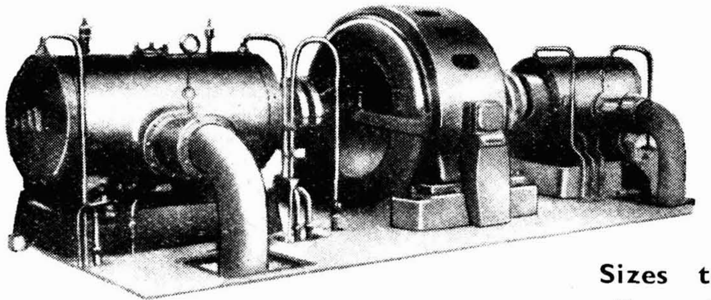

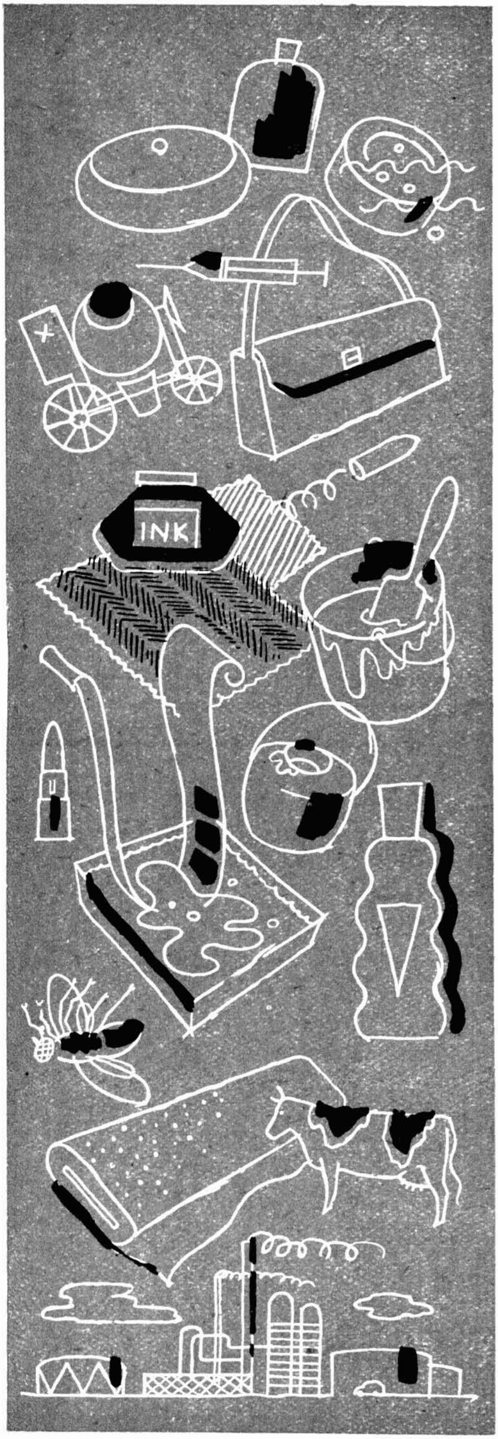
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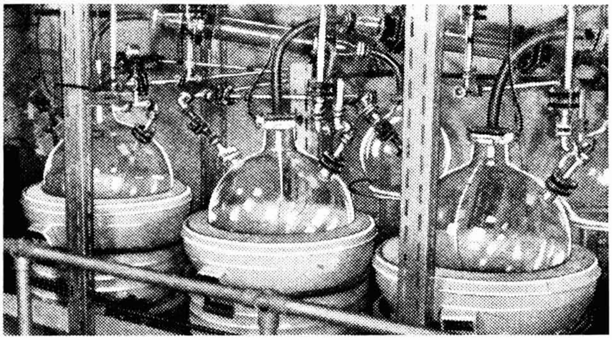

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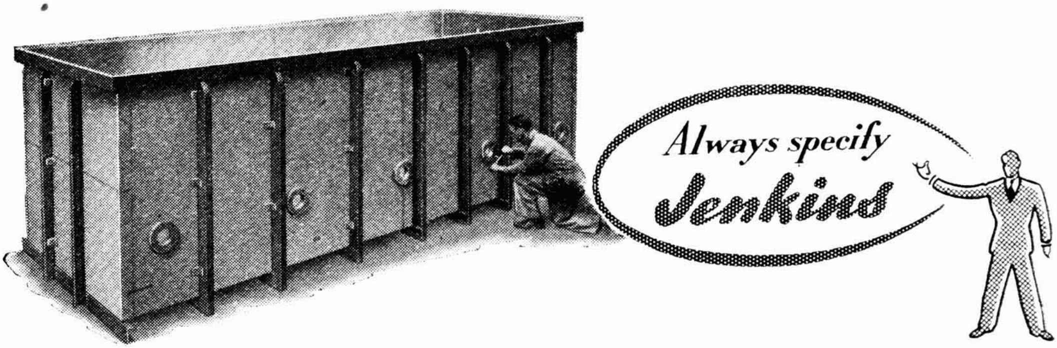
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Volume LXVIII 16 May 1953 Number 1766

# Ammonia as a Fertiliser

IN the United States liquid anhydrous ammonia and concentrated aqueous ammonia are now considerably used as nitrogenous fertilisers. Direct application to soils and crops is much practised, but the ammoniation of superphosphate seems even more popular. Superphosphate has, of course, a natural capacity to combine with ammonia. Further reaction—with increasing quantities of ammonia—leads to the production of tri-calcium phosphate and sulphate of ammonia. The ammoniation of superphosphate must, therefore, be checked at an early stage so that hydrogen ions remain in the calcium and ammonium phosphates. Complete neutralisation degrades or reverts the phosphate, thus nullifying the original purpose of making superphosphate. If ammonia is used at the rate of from 1 to 2.5 per cent of the weight of superphosphate, the desirable end-products predominate.

Unfortunately this valuable reaction fits the fertiliser legislation of the United States much more comfortably than it fits British legislation. Most of the phosphate in superphosphate is present as the di-hydrogen calcium salt—$Ca(H_2PO_4)_2$. The partial stage of ammoniation converts this water-soluble form of phosphate into the mono-hydrogen calcium salt, which is not water-soluble, and into the di-hydrogen ammonium salt, which is water-soluble. According to the amount of ammonia added—within the range of 1 to 2.5 per cent—water-solubility of phosphate is partially lost. However, the mono-hydrogen calcium phosphate is soluble in dilute citric acid or in ammonium citrate solution, accepted criteria for phosphate availability in a number of countries including the USA. But in Britain the single criterion for superphosphate is water-solubility. The aged Fertilisers and Feeding-Stuffs Act stands in the way of new technical developments.

Do we lose by this disability? The principal supplier of nitrogen in compound fertilisers is sulphate of ammonia. This, of course, can be mixed with superphosphate without reduction of phosphate water-solubility. At current prices, a unit (1 per cent) of nitrogen as sulphate of ammonia costs 15.3 shillings. A unit of nitrogen as 30 per cent aqueous ammonia costs 10.3 shillings. There is an appreciable tonnage of ammoniacal liquor lost every year in Britain, inevitably produced in coal carbonisation processes but not recovered in some 700 small works because the scale of operations does not justify the installation of plant to work the liquor up into sulphate of ammonia. Probably the total loss per year is equivalent to 19,000 tons of ammonia. This is a theoretical estimate based upon the tonnage of coal carbonised in Britain and the difference between the calculable and actual by-production of ammonia. Such liquor, if merely recovered in a form that could be used in superphosphate ammoniation, should provide nitrogen at a unit cost of 4s. or 5s.

The ammoniation of superphosphate can reduce fertiliser costs. If nitrogen from ammonia enters the composition of a compound fertiliser, more room is left for the inclusion of other materials than is the case when nitrogen from sulphate of ammonia is used. Ammoniation makes the production of more concentrated compounds possible. This further reduces costs by enabling more plant-food to be bagged, transported, and handled on the farm at the basic costs of these ancillary operations.

Until recently we have merely watched this American development from afar, reluctantly accepting the fact that a single British condition, the law and its effect upon the market, prevents similar development here. With commendable courage, Scottish Agricultural Industries Ltd. have manufactured several hundred tons of ammoniated superphosphate and ammoniated NPK compounds, and pot tests and full-scale field trials have been carried out. Broadly speaking, a necessary alteration in our fertiliser legislation has been anticipated. A paper reviewing the history of ammoniation in America and very fully reporting these Scottish explorations was recently read by J. Angus at a meeting of the Fertiliser Society. Here surely is a development in fertiliser technology that should be fully and speedily utilised. It does not call for great installations of new plant; existing granulating plant in the industry can be effectively used. Indigenous nitrogen material now going to waste can be saved for the soil, and even if ammoniation of superphosphate eventually called for more nitrogen than this, aqueous ammonia produced by synthesis would be lower in cost than ammonium sulphate. Mr. Angus's paper, when it is available in the series of *Fertiliser Society Proceedings*, deserves careful study.

## On Other Pages

The annual subscription to THE CHEMICAL AGE is 42s. Single copies, 1s.; post paid, 1s. 3d. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784/5). LEEDS OFFICE: Martins Bank Chambers, Park Row, Leeds, 1 (Leeds 22601). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

# Notes & Comments

## Dearer Sulphur

RELEASED from price control, American sulphur producers have raised prices swiftly. The increases will take effect as from 1 June. One company has announced a rise from $22 to $25.5 per ton at mine and from $23.5 to $27.5 per ton at port. $4 has similarly been added to the export price of $26.5, making the new export price $30.5. On the other hand, another prominent sulphur-mining company, Texas Gulf, is reported to be charging $28.0 per ton f.o.b. for both home and export trade, which is regarded as a deviation from past policy; the export price for US sulphur has generally been about $4 higher than the home trade figure. Broadly, new prices quoted for recovered sulphur, e.g., refinery sulphur, etc., seem to be running at the same level as those for the mined element though there is a drop of 50 cents a ton for discoloured grades. American sulphur seems likely, therefore, to be from 15 to 20 per cent dearer after 1 June. It may seem somewhat anomalous that this vital raw material should advance in cost when the world trend for so many other raw materials is downward. However, the sulphur shortage was one of the first crises of Korea, stock-piling, and rearmament, and control by freezing prices at existent levels was rapidly imposed by the US Government. Sulphur producers have not shared in the 1950-52 upward price movement as fortunately as producers of many other materials. The end of control—virtually to be regarded as defreezing—finds most producers anxious to make up for lost opportunity, particularly as their efforts to mine or recover greater annual tonnage have increased working costs per ton. It remains to be seen whether the new prices can be maintained. The recent shortage has forced many countries to develop alternative sources of sulphur for acid manufacture. America's home demand is still very high, but any recession in trade—perhaps signalled last week by the cuts announced in defence expenditure—is bound to have its effect upon trade in sulphur. The producers' chance to raise prices may have come a little too late.

## Radio-reactions

A RECENT paper read to the American Institute of Chemical Engineers (*Chemical and Engineering News*, **31**, 13, 1310) by Dr. L. E. Brownell describes new rôles for radio-isotopes in industry. Gamma-rays from cobalt-60 have proved much more effective than ultra-violet light for promoting the chlorination of benzene to produce the insecticide, BHC. The gamma-radiation from the cobalt source is more penetrating, so that the effect upon the reaction is at once displayed throughout the vessel. Ultra-violet radiation has been absorbed at surface levels only, so that mixing and recycling has been necessary to obtain an optimum yield. With thick-walled vessels the radiation from cobalt-60 can penetrate into the reaction mixture easily whereas light radiation cannot do so at all effectively. An even more significant example cited by Dr. Brownell was the oxidation of sulphurous to sulphuric acid. Gamma-radiation from cobalt-60 stimulates this reaction so that an 'appreciable yield of sulphuric acid is obtained' when oxygen is passed through sulphurous acid. It was suggested that this could develop into a new process for making the acid. An important new branch of radio-chemistry would seem to be stirring from its little-known laboratory infancy. The by-products from atomic energy development may revolutionise chemical industry far more than the eventual arrival of atomic energy itself.

## Reliable Sources

IT is often said that the good journalist is one who, if he has not the requisite knowledge of a subject himself, knows where to obtain dependable information. In technical matters, however, this is not always easy, and this has been appreciated by the Association of British

Chemical Manufacturers which conceived the excellent idea of a 'Press Guide to British Chemicals and their Manufacturers,' now being distributed by the association. The book is based on an alphabetical list of chemical products or fields of work considered likely to be the subject of inquiry. A simple numerical code identifies the companies likely to be able to provide authoritative information, and the name and telephone number of the official authorised to answer inquiries is given to provide a positive contact and obviate delay. As many chemicals are better known by their trade names one section is devoted to a list of those most likely to be required. The ABCM is to be congratulated on this publication which should not only prove a boon to the writer, journalist, broadcaster and lecturer, but by supplying means of contact with informed authorities should help to raise the standard of articles and talks and aid in the dissemination of technical knowledge.

## *Foam—Continued*

OUR recent leader on the troublesome by-product foam caused by detergents (THE CHEMICAL AGE, **68**, 545-6) now has a sequel, the Naval Research Laboratory in the United States having recently reported on progress in fire-fighting foam studies. Unfortunately these two kinds of foam, the unwanted and the useful, seem connected by nature and name alone, for although small amounts of waste detergent can pile up mountainous clouds of foam in rivers and at sewage works, detergent-produced foams have not been found particularly effective in putting out oil fires. The foaming agent for fire fighting is natural in origin, a protein-type extract from materials such as hoof and horn meal, fish scales, cereals or soya bean meal. The extraction is made by calcium hydroxide digestion; subsequently the lime is neutralised with acid. The final product, after filtration, is a liquid with 30 per cent or so of solids, heavily composed of hydrolysed proteins with some proportion of free amino-acids. It has been proved that the first stage of foam action is simply that of cooling—the water held in the foam puts out hydrocarbon fires by its temperature-lowering effect; and it is only after this stage that a vapour-free foam is capable of preventing re-ignition with a petrol or oil fire. It is now clear, therefore, that high water retention must be a principal quality of any foam with good fire-preventing properties. Mere stability and the power to blanket inflammable vapours are not enough by themselves. Whether a synthetic foaming agent can be developed to replace and improve upon hydrolysed extracts of animal or vegetable protein is open to conjecture. Fuller accounts will be found in *Industrial and Engineering Chemistry* (**45**, 4, 11-13A) and in *Chemical Week* (**72**, 15, 38).

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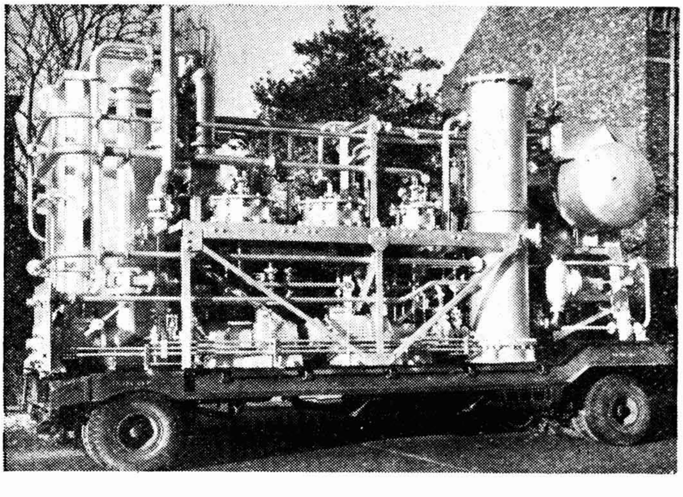

***One of a number of 'Package Units' for the production of carbon dioxide built by the Power-Gas Corporation in association with The Girdler Corporation of USA. The process used involves the combustion of oil fuel followed by treatment of the products of combustion with an absorbing agent which is regenerated by the heat of combustion***

## *Chemical Engineering*

### European Conference

A EUROPEAN Conference of Chemical Engineering, sponsored by the Dechema Deutsche Gesellschaft für chemisches Apparatewesen and the Société de Chimie Industrielle, will be held in Paris in connection with II$^{e}$ Salon de la Chimie and the XXVI$^{e}$ Congrès International de Chimie Industrielle.

This conference will also form the programme of lectures of the annual general meeting of the Dechema for 1953. The conference will open on 22 June, with the following series of lectures:—G. Hulot (Paris), 'Heavy Liquids and their Application to Industrial Uses'; A. Guyer (Zürich), 'Adsorption and its Place in Chemical Engineering Research'; G. Bozza (Milan), 'Pollution of the Atmosphere by Chemical Plant'; W. Jost (Darmstadt), 'Research on Rectification under Extreme Conditions'.

These will be followed by plenary lectures on chemical apparatus and equipment of the XXVI$^{e}$ Congrès International de Chemie Industrielle:—G. M. Schwab (Munich), 'The Present Position of Scientific Research Work on Industrial Catalysts'; A. H. M. Andreasen (Copenhagen), 'The Determination of Grades of Fineness of Industrial Powders by the Pipette Method'; E. Ott (Wilmington), 'From Test Tube to Chemical Works'; A. Nasini (Turin), 'Absorption and Catalysts'. The Dechema Deutsche Gesellschaft für chemisches Apparatewesen, Frankfurt am Main-W 13, Postfach and the Société de Chimie Industrielle, Paris VII, will be pleased to furnish further details concerning these events.

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## *Oil Drum Reconditioning*

REGARDED as one of the most up-to-date works in the country for the reconditioning of oil drums—that of Drum Reconditioners, Ltd., Colnbrook, Bucks.—has recently added to its equipment a GEC infra-red plant to stove the drums after repainting.

While the drums are passing through the plant on powered conveyors they are thoroughly cleaned and restored to their original shape. After external residue of rust and paint has been removed in a shot blaster, the drums are hand sprayed in a two-man booth and finally carried through an infra-red oven by overhead cable conveyor.

The oven, 36 ft. long, has a maximum loading of 288 kW. and consists of sheathed wire element troughs mounted in 6 ft. panels. The drums are suspended at 4 ft. intervals and after being sprayed are given a flash-off period of five minutes, stoved for three minutes at full heat and finally left to cool for ten minutes, after which they may be handled. About 200 drums an hour are stoved in this manner.

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## *Italian Methane Production*

THE production of methane in Italy is assuming similar importance to that in the USA during the development period, according to the recently issued annual report of the Italian State petroleum interests, the AGIP.

From 98,000,000 cu. metres produced in 1952, double this figure has been attained during only three months of 1953. Nearly 1,300 miles of pipelines have been laid to bring methane supplies to the Fiat concern in Turin, to Verona and Bologna, from which further extensions are being rapidly constructed. At Tavazzano, near Milan, is the first power station using methane only as fuel; while elsewhere the saving of coal to Italy must by now represent 50 per cent of total requirements. Gas cylinder filling-plants have been installed at four key-points for supplying domestic demands.

Italian oil interests also include both British and American companies working under licence to find petroleum deposits, particularly after the Gulf Oil Corporation and the Macmillan petroleum interests had reported that Sicilian subsoil is identical with that of Texas. In Rome and Palermo there are Italian subsidiaries of such companies, while at Rimini both British and American interests are working a promising oilfield.

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### Annual Works Holiday

The factories of George Kent Ltd., at Luton, Resolven and London, will be closed for the annual works holiday from Friday evening 17 July, to Tuesday morning, 4 August. Offices at all factories will remain open and staffed during the holiday.

# *Further Expansion*

## Mathieson Acquire John Powell & Co.

NEGOTIATIONS have been completed which will lead to the acquisition of John Powell & Co., Inc., its subsidiaries and associated companies, by Mathieson Chemical Corporation.

John Powell & Co., Inc., founded in 1923, has been a leader in the development and formulation of insecticides, herbicides and rodenticides. Four basic grinding and mixing plants to serve pesticide formulators are operated at Brooklyn, New York; Atlanta, Georgia; East Omaha, Nebraska; and Elkton, Maryland. Sales offices are located throughout the United States and a technical service laboratory is maintained at Port Jefferson, Long Island, New York.

### Widened Distribution

Mathieson has for the past several years been manufacturing basic chemicals for insecticide and herbicide use. The integration of Powell's broad distribution system into Mathieson's agricultural chemicals business will make it possible to further expand Mathieson's operations throughout the United States and foreign countries. The management of Powell will continue as a part of the Mathieson organisation.

Mathieson Chemical Corporation, with headquarters in Baltimore, Maryland, is one of America's major producers of industrial and agricultural chemicals, organic and inorganic. Products include alkalis, chlorine and chlorinated products, nitrogen products, sulphur and sulphuric acid, fertilisers and insecticides, hydrocarbon products, Squibb drug and pharmaceutical products, dry ice, carbonic gas, and hydrazine.

Mathieson has total assets of more than $320,000,000, production of millions of tons of basic chemicals annually, 20 US manufacturing plants and 17 foreign plants and licensees distributing throughout the free world. Since 1948 Mathieson has increased its sales 497 per cent; net income, after taxes, has risen by 362 per cent; and gross assets have risen 388 per cent.

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### Mr. C. H. Lumley

It is with great regret that we have to announce that MR. CHARLES HOPE LUMLEY, O.B.E., director of Sigmund Pumps, died on 29 April, 1953.

# *New Anodising Process*

A NEW anodising process, known as EC. Electrodising, which is claimed to give a superior corrosion and abrasion resistant film to the surface of aluminium and its alloys has been announced by the Philton Company, New York. Philton is licensing agent for Colonial Alloys Company of Philadelphia, who developed the process. Electrodising, which can be controlled to meet required specifications, is said to provide a protective surface at a fraction of the cost of conventional sulphuric acid and chromic acid processes.

Using properly balanced electrolytes, the EC process first generates a relatively porous film and through this film a relatively non-porous film is induced directly on to the surface of the metal being treated.

In addition to power savings, said to average about 75 to 90 per cent as compared with other processes, other economic advantages of electrodising are said to include decreased cost of electrolyte; completion of four to five times as much work with the same equipment; about 50 per cent reduction in cooling cost; and negligible cost of heat sealing.

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# *Titanium Corrosion Tests*

FURTHER proof that the new metal, titanium, is one of the world's most effective resistants against corrosion has been provided through experiments conducted by the US Bureau of Mines. A report describes tests in which titanium, made by the Bureau in its own laboratories, was joined to other metals in acid and salt solutions. The experiments showed that titanium did not corrode when coupled with magnesium, zinc, aluminium, iron, copper, or stainless steel in a three per cent sodium chloride solution—approximately the amount found in seawater. All the other metals except stainless steel did corrode, however.

Titanium corroded when joined to copper in sealed bottle containing various concentrations of hydrochloric acid aerated by helium. When air was substituted for the helium, however, the copper corroded and titanium was not affected. Adding amounts of dissolved copper to the solution made titanium even more corrosion-resistant, according to the report.

# The Gas Industry in the USA

## British Productivity Team's Report

DESPITE the difference in character of the British and US gas industries a number of ways in which American practice could, with advantage, be applied directly or in modified form in Britain are indicated in the conclusions and recommendations of the productivity team on gas which visited the USA last year.

The report of the 16-man team led by Mr. J. H. Dyde, deputy chairman, Eastern Gas Board, is in effect a handbook of modern practice comprising 200 pages of text, 45 plates, a large number of charts and diagrams, and a series of appendices. The tour was organised under the auspices of the Anglo-American Council on Productivity and the Mutual Security Agency and the report, entitled 'Gas,' is published by the British Productivity Council, 21 Tothill Street, Westminster, London, S.W.1 (8s. 6d., post paid, excluding air mail).

Although there are no appreciable known reserves of natural gas in Great Britain, a discovery of any magnitude would be of immense value to national economy, and the team suggests that vigorous support should continue to be given to prospecting wherever there is any possible hope of success. Recovery of methane from coal mines is being investigated in Britain, and the methods devised in America for the utilisation of natural gas and for its re-forming could generally be applied to methane so recovered.

Use of liquefied petroleum gases by the gas industry in Britain, based on American experience, presents considerable potentialities, subject to satisfactory terms of purchase and to long-term security of supplies. Improvement in the availability of liquid petroleum gases should result from the rapid extension of the oil refinery industry now taking place in Britain. A useful contribution to British coal economy could be made by developments in the use of liquefied petroleum gases by the gas industry.

Possible developments deserving consideration include:—

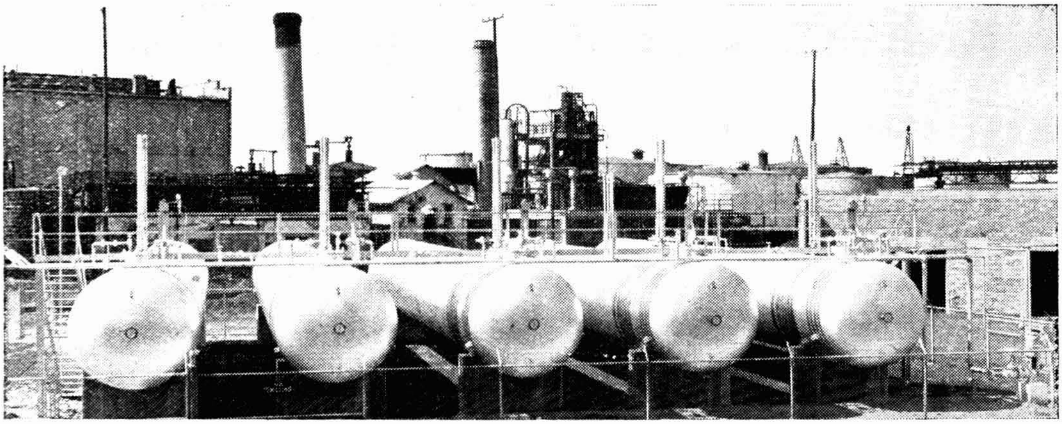
(a) The substitution of butane/air or propane/air mixtures in place of gas made by orthodox methods at existing small undertakings where the provision of bulk gas supplies would not be economic.

(b) Provision of piped supplies of neat propane to small towns or communities where no gas supply at present exists.

(c) Arrangement of butane- or propane/producer gas auxiliary supplies at medium-sized (and possibly at large) gasworks for peak load purposes.

(d) Use of butane or propane to increase the output of carburetted water gas plants at peak periods.

It is desirable that suitable plants, equipment and transport for liquefied petroleum gases should be made available by manufacturers in Britain. A standard code of practice should be prepared covering design,



*Propane/air peak-shaving plant at Providence Gas Works, Providence, R.I., showing the five 30,000-gallon propane storage tanks* installation and operation of all such equipment, and especial regard should be paid to fire and explosion hazards with transport and storage plant. Some particular precautionary measures are given in Appendix XI of the report in which fire-extinguishers using a dry chemical that has a sodium-carbonate base treated to make it water repellent, and propelled by a carbon-dioxide cartridge were recommended, as well as some other types of dry chemical extinguishers.

Approximately 750,000,000 US gallons of liquefied petroleum gas were sold for chemical manufacturing purposes in the USA in 1951, which did not include some 344,000,000 US gallons used by the synthetic rubber industry. Chemicals derived from liquefied petroleum gases include alcohols, organic acids, acetates, anti-oxidants, detergents, plastics, resins, glycols and special solvents; also ethylene and propylene after cracking or de-hydrogenation.

### Production of Gas

Dealing with production the report emphasises that for over 30 years the aspect of gas manufacture in the USA has been affected to an increasing degree by the availability and use by gas utilities of the cheaper natural gas. The first effect on gas manufacture was the rapid displacement of retort installations. The second has been the reduction in production of water gas and carburetted water gas, particularly in the last five years. The result has been that no new plants for carburetted water gas are being installed, while a large proportion of existing plants are being used for the treatment of natural gas or converted for the gasification of oil only.

Finally, and perhaps the most important effect is the displacement of coke oven installations. Until recent years the effect was not severe, but by the end of 1951 the gas industry was operating only 12 coke oven plants, and it was expected that by the end of 1952 this number would have been reduced to five.

Care and attention given to the choice and preparation of coals are outstanding features of modern coke oven practice in the USA. The report suggests that despite the limitations in supplies and geographical difficulties, greater effort might well be made in Britain to obtain more selective allocation of coal within the industry and to individual plants.

There was evidence that the average life of coke oven installations in America was longer than in Britain. US technicians emphasise that if the coal fed to the ovens is uniform in quality and bulk density, and the oven heating and other operational features are maintained constant, maximum efficiency of operation and constant quality of coke are assured, and the life of the ovens is extended. In this connection much research work on movable wall test ovens has been undertaken by the Koppers Co. and a number of undertakings have installed them.

The carbonisation of pitch in coke ovens to produce carbon for electrodes has been practised in the USA and could be a sound economic proposition, dependent on the markets for pitch and pitch carbon. There are, however, considerable operational difficulties associated with the carbonisation of pitch. Labour conditions are arduous and the wear and tear on ovens is very severe, the life of an oven under these conditions being about five years.

Some work has been done in America on the carbonisation of coal-pitch mixtures but there is little interest in the process at present owing to the damage to the ovens resulting from the use of this mixture.

At all works operating coke ovens it was stated that no difficulty was experienced in obtaining by ordinary separation methods a final tar of low water content. On most of the installations the tar and liquid flowed into some system of decantation tanks, followed by final separating tanks. Most of the decantation tanks were at ground level and, for the removal of pitchy deposits, were fitted with a drag bar conveyor operating continuously at a speed of 5 ft. per hour.

### Encouragement Given

Encouragement has been given to the development in the USA of a gas manufacturing process, using as the raw material oil (preferably heavy fuel oil having potentially high capacity) capable of being brought into operation quickly, economical of labour and producing gas interchangeable in quantity with natural gas. Processes evolved during the last few years have been designed mainly for operation in existing carburetted water gas plant equipment modified to meet the special requirements, but new installations of special design are also being erected.

Requirements of the oil gas process, which is designed to use either light oils or heavy fuel oils, are steam and air. No solid fuels are used. Among the several new designs and types of plant for the production of high B.Th.U. oil gas evolved after considerable research is the Hall process conceived by Mr. Edwin L. Hall, director of the A.G.A. laboratories, Cleveland, Ohio, and developed at a works of the Consolidated Gas Electric Light and Power Company, of Baltimore. The most successful form of plant is a four-shell regenerative set. If necessary a three-shell carburetted water gas set can be adapted by adding a fourth shell unit.

In the physical processes, condensing as applied to coal gas did not appear to have received more detailed attention in America than in Britain. The two chief methods in use were that of 'direct' coolers in which the gas and the cooling water were in direct contact, and the conventional type of water-tube condenser.

Apart from the usual washing processes in connection with benzole recovery and the removal of 'gum-forming' compounds, several instances were observed where naphthalene was removed from the gas by direct shock-cooling with water. The naphthalene was skimmed from the surface of the water, melted and sold in the crude state. In one large coke oven plant the gas leaving the ammonia saturators passed to a cooler system and the naphthalene was absorbed in tar and passed to the tar storage.

No gum problems of any considerable magnitude were encountered, and the direct recovery of benzole from gas by solid absorbents was not met with in the USA.

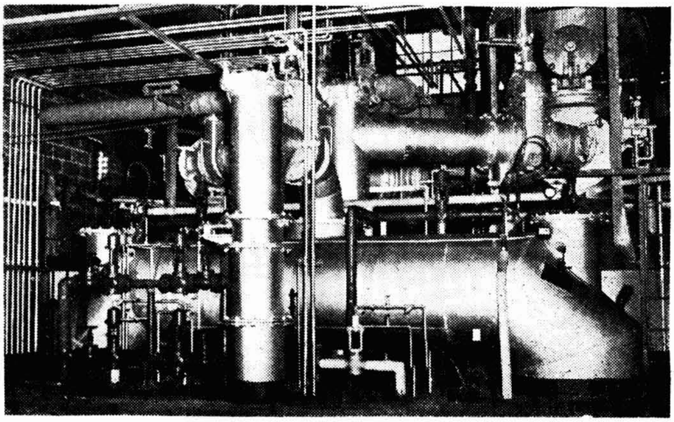
Among the chemical processes in all the coke oven plants visited the recovery of ammonia was by the semi-direct process, while in a number it was associated with dephenolation and the partial recovery of crude tar bases, so that the whole process was closely connected with the problem of effluent disposal.

The general concensus of opinion appeared to be that by-product ammonia recovery was not in itself a paying proposition although requirements in connection with effluent purity introduced a new factor in its favour.

Similar observations applied to dephenolation and pyridine recovery. Probably one reason why the economics of sulphate of ammonia production varied so much was that a number of the plants had been written off, while in others new and costly equipment added considerably to the charges. Five large plants manufacturing sulphate were inspected.

Of these installations the Seaboard had new type Koppers saturators. These saturators were constructed of stainless steel, except the dome, which was of mild steel and lead lined. The stainless steel parts had shown no wear during the eight years they had been in use, and the lead work had not needed repair. There were two acid spray separators, lead lined, and also circulating and slurry pumps dealing with 5,000 gallons a minute of acid liquor. They were all constructed of stainless steel.

At two plants visited dephenolation was practised after the removal of free ammonia from the liquor. The phenolic bodies are removed by a counter-current of steam, and the phenol-laden steam is washed by



***A four-shell regenerative set typical of the Hall process plant evolved for the production of high B.Th.U. oil gas. Tar emulsions or tars of high water content are produced from the oil gas particularly if heavy fuel oils are used, but these emulsions are often difficult to break down***

*(Courtesy, Gas Machinery Company, Cleveland, Ohio)*

five per cent aqueous caustic solution. The resulting sodium phenate solution, after being concentrated to give a tar acid content of 18 per cent, is sold to chemical manufacturers. In one plant it was stated that the cost of labour, caustic soda and steam just about balanced the receipts from the tar acid solution, the plant having been written off, while in another the dephenolating process was worked at a loss the magnitude of which was not disclosed.

Of particular interest were the small compact plants installed for the partial recovery of crude pyridine or tar bases from the mother liquor of the sulphate of ammonia saturators, but the economic position of the process appeared to be doubtful.

### Plants Inspected

Five plants were inspected, some of which were of lead-lined construction and others of stainless steel, and in all the crude bases were sold as such, having a water content of about 20 per cent. The bases were liberated from the sulphate by a stream of vapour obtained from the free section of the ammonia stills. In one plant the operating costs were stated to balance receipts, while others claimed variable profits on the recovery process.

Chief differences between procedure for the removal of hydrogen sulphide in the USA and in Britain were due to three main factors, namely the standard requirements for purity; the relatively small amounts of manufactured gas distributed in America; and the absence of ready supplies of indigenous sulphur in Britain.

For purity gas, the standard in Britain requires a freedom from hydrogen sulphide which is of the order of 1.5 p.p.m. by volume, or about 0.09 grain per 100 cu. ft., while no restriction is placed on organic sulphur compounds. In the USA there are various State regulations which generally specify the permitted amount of total sulphur and so permit a greater freedom with respect to hydrogen sulphide. It should also be noted that in Britain the purification processes have to deal with a hydrogen sulphide content three or four times as great as in the gases dealt with in the USA where they are mainly derived from oil or natural gas which in itself, except in special circumstances, does not present a sulphur problem.

All the plants inspected using liquid purification methods were worked so as to remove about 90 per cent of the hydrogen sulphide from the gas, while conventional oxide purifiers completed the process. Only in two was sulphur actually recovered, so that manufactured gas purification in the USA does not, at the present time, contribute to the solution of the sulphur shortage.

In one plant 25,000,000 cu. ft. a day of oil gas containing 350 grains per 100 cu. ft. of hydrogen sulphide was purified down to a content of 50 grains by the Thylox process. This process employs an arsenic compound, and details have been published in the technical Press, particularly by Koppers. The sulphur produced is washed and filter-pressed, but it was emphasised that when working on oil gas it was not possible to produce sulphur of fine quality because of the difficulty of removing traces of oily matter. The sulphur paste recovered from this plant contains about 96 per cent sulphur on the dry basis, and is sold with a water content of about 50 per cent. It finds a ready market for the manufacture of insecticides. It was noted that the plant required about 24 hours to attain satisfactory operating conditions after a shut-down.

Other plants visited were using either the Koppers ordinary Seaboard process or the hot activation vacuum process. As an example of the first, the gas from the ammonia saturators, free from ammonia but containing hydrogen sulphide, hydrogen cyanide and benzole, passes to the liquid purification plant, where about 90 per cent of the hydrogen sulphide and all the hydrogen cyanide are removed.

### Washing Process

The gas is washed under pressure of about 30 in. W.G. in a 60-ft. mild steel tower packed with three tiers of wooden grids each 10 ft. high. After this operation, the wash liquor is pumped to an activator tower and a stream of air approximately twice the volume of the gas treated is drawn through it by a fan. The resulting foul air is burned under Stirling boilers or gas producers so that the sulphur dioxide reaches the atmosphere *via* various stacks. Considerable trouble was experienced with the boiler house chimney, and an annular lining of specialised glazed tiles had to be inserted at considerable expense to the full height of 307 ft.

Of special interest among the plants

visited was the Koppers vacuum carbonate process for hydrogen sulphide removal. In this process the gas is contacted countercurrently with a solution of sodium carbonate in a packed absorber tower. The foul solution from the base of the absorber is circulated over the actifier, where the hydrogen sulphide is removed by counter-current stripping with water vapour under vacuum. The actified solution is pumped from the base of the actifier through a cooler to the absorber to complete the cycle. The actifier is maintained under a relatively high vacuum to reduce the quantity of heat required to generate the water vapour for actifying the solution.

The volume of stripping vapour required to actify the solution remains about the same under vacuum as at atmospheric pressure, but the weight of vapour and the heat required to generate the vapour are reduced greatly under the vacuum maintained in the actifier. Two of the plants built by Koppers Co. Inc., using the vacuum carbonate process, include equipment for recovering the hydrogen cyanide as a saleable product. One plant is designed to recover either liquid hydrogen cyanide of high purity or sodium cyanide solution, while the other plant is designed to recover sodium cyanide only.

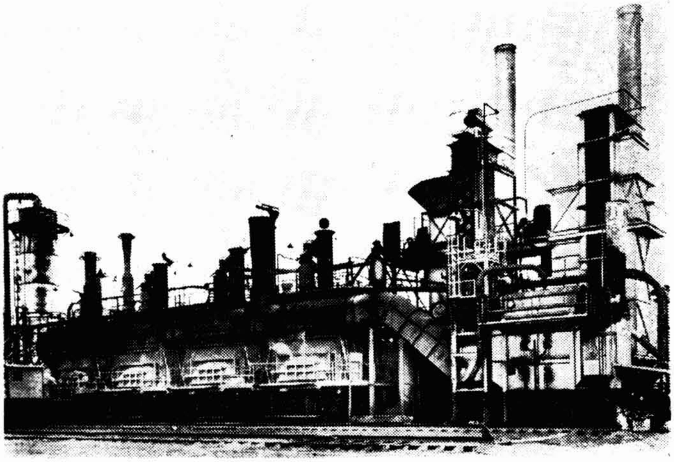
One of the major items of operating cost with the ordinary sulphur recovery processes is the steam required for actifying the solution. By operating under a vacuum, the steam requirements are greatly reduced. A further improvement that has been developed and patented by Koppers permits the operation of this process with no external steam required for actifying the solution. This development provides for the recovery of heat which otherwise would be wasted, and the use of this heat to generate the required stripping vapour from the solution inside the actifier.

It is interesting to note that the hot vacuum carbonate process is to be installed at a works in Britain.

Apart from the Thylox plant previously mentioned, the acid plant working in conjunction with the Koppers vacuum carbonate process was the only example of the recovery of sulphur in a useful form. It is of the contact type using a vanadium catalyst, and has a capacity of 60 tons a day of 100 per cent sulphuric acid. The plant can operate on both elemental sulphur and hydrogen sulphide provided by the vacuum purification plant.

An interesting hydrogen cyanide plant was inspected in detail. Briefly the mixed gases from the vacuum purification plant consist essentially of hydrogen sulphide 65 per cent, hydrogen cyanide 20 per cent and carbon dioxide 15 per cent, all saturated. The hydrogen sulphide and carbon dioxide are driven off and the hydrogen cyanide is absorbed selectively in water in a stainless steel tower packed with unglazed porcelain saddles. The HCN is stripped from the aqueous solution by steam and condensed at −5°C. and atmospheric pressure, being then stored in stainless steel tanks. The liquid HCN, 99.6 per cent pure, is stabilised by 0.01 per cent orthophosphoric acid to prevent polymerisation, and is ultimately converted to sodium or potassium cyanide by releasing the liquid into the appropriate hydroxide.

Most of the plant equipment is of stain-



***Knowles Broad ovens for the production of coke from petroleum oil at the Portland Gas and Coke Co., Oregon. The plant uses 55,000 gallons of oil a day and produces 3,000,000 cu.ft. of 1,030 B.Th.U. gas and 32-35 tons of petroleum coke***

less steel and extreme precautions for safety and training of the operatives are in force. There is auto equipment for warning of polymerisation, and for *p*H control. There are no gas lines at the rear of the instrument panels, all control being remote.

### $H_2S$ Removal

Removal of hydrogen sulphide by oxide of iron in conventional purifiers was examined at nine plants and, with coal gas, was applied either to complete purification or to the completion of the process, after the removal of up to 90 per cent of the hydrogen sulphide by liquid purification processes. With oil gas the oxide purifiers, with one exception, were used for the complete purification. Consideration of these plants revealed the following main points:—

(a) All except one were situated in the open, usually at ground level. Dry lutes and various methods of up, down and split stream flow were used. Many of the boxes were of mild steel welded construction, and were rectangular, although some circular purifiers with side discharge doors were seen;

(b) They were generally emptied manually with the aid of mechanical picks and shovels;

(c) Air for revivification *in situ* was usually added and no particular attempts were made to work the oxide up to a high sulphur content;

(d) There were no specifications for the purifying material, and while much lux mass opened up with softwood shavings was used, other materials included local limonite, or even rusted iron borings;

(e) The spent oxide was always dumped.

Removal of organic sulphur compounds from gas was not receiving any more than academic consideration in the USA, for the obvious reason that it does not constitute a problem of any magnitude because such coal gas as is distributed is sufficiently diluted by other relatively sulphur-free gases.

Both Britain and America appear to be actively engaged on methods for the improvement of effluent treatment and disposal. The problem may be of greater magnitude to Britain where the preponderance of manufactured gas results in a much greater volume of effluent, while the smaller rivers considerably reduce facilities for dilution and disposal.

Methods met with in America varied considerably, as also did the methods of disposing of the effluent water. At present there are no official specifications for effluent in the USA, but the matter is receiving the close legal attention of the various authorities concerned with river pollution.

It is not known whether any work is in progress in America on the decolorising of effluents, but some work has been done on the use of ozone for reducing the oxygen absorption of effluents, and the Standard Oil Company has made a grant to Ohio State University for an investigation into the use of biological attack to combat stream pollution by certain industrial and municipal wastes.

With regard to industrial relations the team were satisfied that no evidence was produced to show that the American gas worker in general was working harder than his British counterpart. Any increased productivity in the American industry was, on the whole, admitted to be due to improved techniques rather than to increased effort.

In view of the relatively short estimated life of the natural gas reserves in America it is evident that the research for alternative economic methods of ensuring gas supplies must be developed in the comparatively near future, and much research in the USA is being devoted to that end.

A parallel problem exists in Britain inasmuch as the stocks of the best gas-making and coking coals are a diminishing asset and gas must accordingly be produced from other grades of coal or from other sources. It would therefore, in the opinion of the team, be of great advantage if permanent and close liaison could be maintained between the gas industries in both countries.

### Impressions Gained

An impression was gained that research in the USA was the subject of a more liberal and many-sided attack than in Britain. This is no doubt due to economic problems. In Britain with more limited resources the line of approach has to be more selective, particularly with regard to applied research.

The most striking impression received by the team in regard to training and education was probably the emphasis placed, first on the general education of employees as opposed to the specific training, either technical or commercial, necessary for the satisfactory execution of particular duties, and secondly, on training in and for management.

# US Coal-Gas & Coke

## Very Rapid Decline in Output

PRODUCTION of retort coke in the United States in 1952, as reported by producing companies to the US Bureau of Mines, totalled 44,914 net tons. This figure represented a decrease of 65 per cent from the output reported for 1951 and was clearly indicative that this source of coke is no longer an important factor in the supply of solid fuels in the United States. Only seven plants located in four States reported production of coke and tar in 1952. Seven coal-gas installations were retired and dismantled in 1952 and at the close of the year there were only one idle and five active plants in existence. The principal contributing factors in the rapid decline of coal-gas plants in recent years have been: (1) high manufacturing costs of the finished gas, (2) limited flexibility of gas production, (3) lack of a market for the coke, and (4) extension of natural gas pipe lines.

The only chemical raw material recovered by all retort operators was crude coal tar. Production of this material is naturally governed by the quantity of coal carbonised, and therefore the drastic decline in coal charged into retorts in 1952 reduced output of tar by 69 per cent and total production amounted to less than 1,000,000 gal. The limited supply of crude retort tar has caused several tar distilling plants located in New England to close for lack of sufficient raw material. Although considerable quantities of ammonia (in the form of ammonia liquor) and crude light oil were produced during and shortly after World War I, no production of either of these products was reported in 1952 although one plant did recover a small quantity of drip oil.

Copies of a directory of coal-gas plants in existence on 31 December, 1952, may be obtained on request to the Anthracite and Coke Sections, Coal Branch, Bureau of Mines, Washington 25, D.C.

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### New Coalfield in Derbyshire

After two years of investigations National Coal Board officials have confirmed the existence of a new coalfield in South Derbyshire. It is thought possible that the deposits may extend into Leicestershire.

# US By-Product Sulphuric Acid

PRODUCTION of by-product sulphuric acid at American copper and zinc plants in 1952 increased 5 per cent over 1951, and was the largest since 1944, according to the US Bureau of Mines. The acid reported is only produced from the sulphur content of the sulphide ores.

| | Copper Plants (tons) | Zinc Plants (tons) | Total (tons) |
|---|---|---|---|
| 1948 .. .. .. | 111,967 | 529,478 | 641,445 |
| 1949 .. .. .. | 96,344 | 476,932 | 573,276 |
| 1950 .. .. .. | 131,342 | 609,571 | 740,913 |
| 1951 .. .. .. | 189,125 | 635,948 | 825,073 |
| 1952 .. .. .. | 202,364 | 664,714 | 867,078 |

In addition to the by-product sulphuric acid shown in the table, some of the zinc plants covered produced the following quantities of sulphuric acid from native sulphur: 1948, 233,099 tons; 1949, 130,592; 1950, 243,743; 1951, 261,106; 1952, 224,671 tons. Sulphur consumed to make the foregoing quantities was: 1948, 80,365 tons; 1949, 44,525; 1950, 84,249; 1951, 88,091; 1952, 76,557. No sulphur was used at copper plants that produce by-product acid.

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# Nylon Sifting Fabrics

FOR chemical sifting processes nylon has been found to be a first-class fabric, the action of many industrial chemicals, including alkalis, hydrocarbons, soap solutions, oils and petroleum having no effect on nylon yarns.

The smooth cylindrical filaments of nylon yarn minimise friction and increase resistance to abrasion. The limited amount of moisture which nylon is capable of absorbing, allied to its quick drying properties, is a major asset in many industrial applications. The smoothness of the filament permits only the adherence of surface dust, which can be wiped off easily.

A new range of industrial sifting textiles is now being marketed under the brand name, 'St. Martins' nylon. This follows ten years of research and practical experiment jointly conducted by Courtaulds Ltd., who weave the fabrics, and Henry Simon Ltd., exclusive world distributors. The range includes more than 40 fabrics and embraces all grades from 14 to 160 meshes per inch, equivalent to silk bolting cloth grades from 14GG to 72GG, and from 1XX to 14XX. Finer numbers are in preparation.

# *Sulphuric Acid Returns*

A SUMMARY of monthly returns of sulphuric acid and oleum in the UK for the period 1 January-31 March, issued by the Sulphuric Acid Association, Ltd., shows that stocks dropped from 70,170 tons at 1 January to 59,020 tons at 31 March.

The following tables have been abstracted from the summary.

SULPHURIC ACID AND OLEUM
(*Tons of* 100 *per cent* $H_2SO_4$)

| Data referring only to Acid Makers' Returns | Chamber only | Contact only | Chamber and Contact |
|---|---|---|---|
| Stock, 1 Jan., 1953 | 30,844 | 39,326 | 70,170 |
| Production | 172,375 | 277,835 | 450,210 |
| Receipts | 35,629 | 15,309 | 50,938 |
| Oleum feed | — | 1,285 | 1,285 |
| Adjustments | −128 | −114 | −242 |
| Use | 111,317 | 105,431 | 216,748 |
| Despatches | 100,986 | 195,607 | 296,593 |
| Stock 31 Mar., 1953 | 26,417 | 32,603 | 59,020 |
| Total capacity represented | 200,420 | 334,950 | 535,370 |
| Percentage production | 86.0% | 82.9% | 84.1% |

RAW MATERIALS
(*Tons*)

| Data referring only to Acid makers' returns | Pyrites | Spent | Sulphur & $H_2S$ | Zinc Concentrates | Anhydrite |
|---|---|---|---|---|---|
| Stock, 1 Jan. 1953 | 127,958 | 238,049 | 62,185 | 78,670 | 515 |
| Receipts | 71,798 | 65,281 | 55,178 | 48,595 | 50,048 |
| Adjustments | +858 | +584 | +1,584 | — | — |
| Use | 69,570 | 71,893 | 67,347 | 41,019 | 50,013 |
| Despatches* | 282 | 17,424 | 273 | — | — |
| Stock, 31 Mar. 1953 | 130,762 | 214,597 | 51,327 | 86,246 | 550 |

* Including uses for purposes other than sulphuric acid manufacture.

CONSUMPTION IN THE UNITED KINGDOM
(1 *January*—31 *March*, 1953)

| Trade Uses | Tons 100% $H_2SO_4$ |
|---|---|
| Accumulators | 2,550 |
| Agricultural pruposes | 523 |
| Bichromate and chromic acid | 2,810 |
| Bromine | 3,196 |
| Clays (Fuller's earth, etc.) | 2,032 |
| Copper pickling | 982 |
| Dealers | 2,623 |
| Drugs and fine chemicals | 3,127 |
| Dyestuffs and intermediates | 14,330 |
| Explosives | 7,175 |
| Export | 668 |
| Glue, gelatine and size | 98 |
| Hydrochloric acid | 13,605 |
| Hydrofluoric acid | 2,766 |
| Iron pickling (including tin plate) | 24,629 |
| Leather | 1,024 |
| Lithopone | 1,880 |
| Metal extraction | 981 |
| Oil refining and petroleum products | 16,467 |
| Oils (vegetable) | 2,793 |
| Paper, etc. | 976 |
| Phosphates (industrial) | 310 |
| Plastics, not otherwise classified | 4,304 |
| Rayon and transparent paper | 57,652 |
| Sewage | 2,967 |
| Soap and glycerine | 7,370 |
| Sugar refining | 152 |
| Sulphate of ammonia | 75,075 |
| Sulphates of copper, nickel, etc. | 6,057 |
| Sulphate of magnesium | 1,141 |
| Superphosphates | 133,312 |
| Tar and benzole | 4,818 |
| Textile uses | 5,490 |
| Titanium oxide | 32,166 |
| Unclassified | 31,006 |
| Total | 467,055 |

# *Cambridge Co.'s 'At Home'*

RECENTLY the Cambridge Instrument Company restored a popular pre-war custom by opening their works in Cambridge to members of the university concerned with the teaching and study of scientific subjects. Those invited included professorial and teaching staffs, research and fourth year students, senior technical staff and other senior members of colleges, together with civic personalities.

The 'At Home' was quite informal; all the workshops and research departments were open for inspection and the guests were able to go where they wished and discuss problems and processes of personal interest directly with the workpeople in a free and easy atmosphere. Displays and demonstrations were given of many of the company's products, and prototype apparatus in course of development was shown. Of particular interest to chemists were the direct-writing electronic polarograph; quick acting electronic recorders for various applications; a comprehensive range of *p*H meters, indicators, recorders, and electrode systems; an electro-titration outfit; and a surface tension apparatus.

In the workshops considerable interest was taken in the high frequency automatic soldering and brazing plant and in various special machines devised for specific processes and purposes.

During the two days over 800 visitors were received, including the Mayor and Mayoress of Cambridge, heads of colleges and laboratories and many other prominent scientists.

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## End of Steel Rationing

Replying to Mr. Nabarro in the House of Commons recently, the Minister of Supply, Mr. Duncan Sandys, announced that, as a result of the steady increase in iron and steel output, the statutory control of the distribution of iron and steel, tinplate excepted, should end immediately. When Mr. Brown asked why firms in S.W. Lancashire had been short of steel for the past three months, the Minister replied that even in normal times there were bound to be shortages of specialised types of steel, and the maintenance of a general steel allocation would not assist these specialised difficulties.

# The Analysis of Zirconium

## Part IV—Miscellaneous Methods

*by T. O. PORTCASTLE, Ph.D.*

ANOTHER of what may be termed the 'classical group of organic reagents for inorganic analysis,' which has been used for the precipitation of zirconium is 1-nitroso-2-naphthol, the well-known cobalt and copper reagent. Zirconium reacts with this reagent to form a yellow-green amorphous compound which is insoluble and probably attains to the composition $ZrO(C_{10}H_6.O(NO))_2$. Bellucci and Savoia[69] and also Steidler[70] have used the formation of this characteristic insoluble precipitate for the detection and the determination of zirconium. The 2-nitroso-1-naphthol isomer behaved in a much different manner. Bellucci and Savoia reported the formation of an intensely red precipitate when zirconium solutions were treated with a solution of this reagent. The precipitate formed a blood-red solution in chloroform and this was utilised in a colorimetric method for determining zirconium. Fischer[71] attributed the formula $(C_{10}H_6O_2N)_2ZrO$ to this compound, and reported that no precipitate was formed in hydrochloric acid solution although a deep red colour was observed. The precipitate settled on adding sodium acetate to the red solution.

### Carboxylic Acid Precipitants

*m*-Nitrobenzoic acid has been used in 0.4 per cent aqueous solution by Osborn[72] for the precipitation and determination of thorium, zirconium, quadrivalent cerium, hafnium and mercury. Tin interfered by hydrolysis. Apart from this and the precipitation of mercury, the reagent was specific for the precipitation of all quadrivalent cations except titanium. Modifications to Osborn's methods were reported by Venkataramaniah and Rao.[73] They concluded that while it was true that the reagent was selective in not precipitating numerous di- and tri-valent cations, it could not be assumed that a sharp separation was obtained and indeed they indicated that a re-precipitation was often necessary. This was particularly so in the case of iron and chromium. Venkataramaniah and Rao were unable to separate zirconium from tin (II) by using the *m*-nitrobenzoic reagent, and in contrast to the findings in Osborn's study, attempted separations of zirconium and thorium were not successful.

Jewsbury and Osborn have used ammonium benzoate for the quantitative precipitation of zirconium[74] and several other metals including tin, titanium, thorium, bismuth, cerium, aluminium[75] and beryllium. The insoluble zirconium benzoate was formed at a very low *p*H. Precipitation began at *p*H 0.5 and was complete between *p*H 1.0-1.5 in hydrochloric or nitric acid medium. Thioglycollic acid was used to keep iron, zinc, cerium, etc., in solution giving a separation from all the other metals save aluminium, titanium and thorium. There was observed a slight tendency for iron, cerium and tin to co-precipitate. In the presence of the thioglycollic acid, copper unexpectedly came down with the zirconium, but in the absence of the masking agent a good separation of the two was observed. By control of the *p*H of the precipitation medium, separations of zirconium from aluminium, cerium (III) and uranium (IV) were suggested, but not examined. A good separation from titanium could not be found. In sulphuric acid, the zirconium was completely precipitated only at *p*H 2.0-2.5. Sulphuric acid was rejected as a suitable medium because of the danger of bringing down the basic sulphate.

### Phthalic & Fumaric Acids

Rao and his co-workers have made considerable studies of several carboxylic acids as precipitants for zirconium. This study appears to have been coincident with another on the application of sundry organic acids as precipitants for thorium and appears to have arisen from the latter. Phthalic acid[76] precipitated zirconium quantitatively from solutions 0.35N in free hydrochloric acid. In 0.3N hydrochloric acid, a satisfactory separation from most elements such as Th, Fe, Al, Be, U, Mn, Ni and Ce was obtained, but contamination from Sn, Ti, V and Cr was found. The contamination was readily removed by means of a re-precipitation. The reagent was recommended as being superior to tannin on the grounds that a clean-cut separation from thorium was achieved. The precipitate was of inconstant composition and was therefore ignited and weighed as $ZrO_2$.

Fumaric acid[77] which was first proposed as a reagent for thorium by Metzger has been examined by Rao and his co-workers as a zirconium precipitant. Whereas the precipitation of thorium in aqueous solution was claimed to be incomplete, zirconium came down quantitatively as a gelatinous white precipitate from solutions 0.3-0.4N in hydrochloric acid. Under the same conditions, many other elements, including thorium, were held in solution. As a result of their study of the reagent, Rao and his co-authors concluded that the reagent was particularly valuable for the analysis of minerals. The precipitate had the approximate composition $O = Zr = X$ where X denotes the fumarate radical. Being an unsuitable weighing-form the compound was strongly ignited to $ZrO_2$, and the latter was weighed.

### *m-Cresoxyacetic & Benzilic Acids*

Another of the carboxylic acid reagents for zirconium studied by Rao and Venkataramaniah was *m*-cresoxyacetic acid.[78] The reagent precipitated zirconium completely from hydrochloric acid solutions of normality 0.2-0.25. Numerous other elements including thorium did not precipitate under the same conditions, although Th, Fe (III), Ti and Sn as well as zirconium came down in neutral solution. The zirconium precipitate which was bulky, settled quickly and was easily filtered. It was subsequently ignited to the oxide as inconstancy of composition rendered it undesirable as a direct weighing-form. Titanium and tin, although unprecipitated by the reagent when alone or together, came down by induced precipitation when zirconium was present. Vanadium and chromium persistently contaminated the zirconium precipitate even in 0.2N acid. In all four instances, a reasonably satisfactory separation was claimed on reprecipitating. Sulphuric acid interfered with the determination, but moderate amounts of Be, Al, Ni, Cu, Ba, U and Ce were tolerated.

Benzilic acid also precipitated zirconium from solutions which were 0.2N or less in hydrochloric acid. The precipitate was weighed as $O{=}Zr(OH)B.4H_2O$ (where $B{=}(C_6H_5)_2.C(OH)CO_2$) after drying at 110°C., or it was ignited to the oxide and then weighed. Bivalent cations, Al, Ce and U did not precipitate; although they did not precipitate when alone, Cr and V were co-precipitated with the zirconium, but could be removed in re-precipitating the zirconium. Contamination from Fe (II) and Th was also observed, but the interference from the former was easily eliminated by addition of $SCN^-$ ions to the solution for analysis. No separation from tin and titanium was possible with benzilic acid reagent.

### *Other Carboxylic Acids*

Three other carboxylic acids were proposed by Rao *et al.* for precipitating zirconium. These were cinnamic acid,[80] salicylic acid[81] and phenoxyacetic acid.[81] The first mentioned was used to precipitate zirconium from boiling solution 0.1N in acid and containing 15 per cent of ammonium chloride. The operation served to separate zirconium from Th, Mn, U, Ce, Be, Ni and Fe, but a separation from Ti, V, Cr and Sn was not obtained. The precipitate was ignited to the oxide. Salicylic acid and phenoxyacetic acid in 0.18N and 0.24N hydrochloric acid were found to be excellent precipitants for zirconium. Bivalent cations remained unprecipitated and also some trivalent cations and cerite earths. A second precipitation was required when thorium was present with the zirconium. This was carried out after solution of the first precipitate in 6N hydrochloric acid. The yellow titanium compound clung tenaciously to the precipitate, and could not be washed free. Digestion of the precipitate with 20 per cent ammonium salicylate improved the precipitation. As usual the compounds were ignited to $ZrO_2$ before weighing.

### *Mandelic Acid & Derivatives*

In 1947, Kumins[82] introduced a new carboxylic acid precipitant for zirconium. Mandelic acid precipitated an insoluble zirconium salt $Zr(C_6H_5.CHOH.CO_2)_4$ from hot dilute solutions of hydrochloric acid containing zirconium. The precipitate was soluble in alkali hydroxide, but in the presence of even considerable amounts of hydrochloric acid, precipitation was complete. Sulphate ion in excess of 5 per cent caused low recoveries. The presence of titanium and thorium did not interfere with the method, nor did many other metal ions such as Fe, V, Al, Cr, Ce, Sn, Ca, Ba, Cu, Bi, Sb and Cd. For the determination of zirconium in minerals, Kumins fused the sample with boric acid, dissolved the cold melt in 2N hydrochloric acid and precipitated the zirconium by adding an excess of 16 per cent mandelic acid. The precipitate was washed with a hot solution containing 5 per cent of mandelic acid and 2 per cent of hydrochloric acid. The precipitate was ignited to $ZrO_2$ and then weighed. Hahn[83] examined Kumins' reagent and found it to be as trustworthy as the usual phosphate method. From 1-15 mg. of zirconium were determined in the presence of Co, Mg, Mn, Hg, Ni, U and Zn. Gavioldi and Traldi[84] applied mandelic acid to the analysis of zirconium in alloy steels, containing 0.36-3.6 per cent of the metal. According to Kumins' method they precipitated the mandelate at 50°C. with a 16 per cent solution of the reagent. The precipitate was aged for four hours at 85°C., filtered and washed 10-12 times with Kumins' wash-solution. The precipitate was ignited at 1,100°C.

Jonckers[85] found that the reactivity of mandelic acid towards zirconium was due to the —CHOH.COOH grouping, and demonstrated that nine other acids showed the same zirconium precipitating property. This study appears to have received scant attention. The attention of Astanina and Ostroumov[86] working at the Institute of Mineral and Raw Materials in Moscow, was focused on Kumins' method. A critical examination satisfied these authors that the method was accurate and effective in separating zirconium from other metals including the rare earths and molybdenum. Astanina and Ostroumov reported that ignition was superfluous since satisfactory results could be obtained by weighing the mandelate directly after washing the excess reagent free with 2-3 lots of alcohol. Zirconium in quantities less than 0.001 g. was slow to come down particularly in the presence of other elements. In such cases, they extended the precipitation time to 24 hours or even more.

The mandelic acid procedure is singularly free from interference from other metals and is generally regarded as being superior to most of the previous methods for determining zirconium. Adverse comments on the method are noticeable by their absence in papers by the various authors who have used it.

### *Halogenated Acids*

Oesper and Klingenberg[87] reported that other glycollic acid derivatives, namely *p*-chloromandelic acid and *p*-bromomandelic acid could be used similarly for the determination of zirconium. They applied them to the analysis of an Fe-Zr-Al alloy. By using these derivatives, it was claimed that a larger volume of precipitate per unit weight of zirconium was obtained. Other advantages accruing were the use of distilled water as wash liquid, and a shorter precipitation time. Direct weighing of the precipitate after washing several times with distilled water with alcohol and drying for 15 minutes at 100°C. was also reported.[88] Although Klingenberg and Papucci examined this direct weighing of the precipitate, they still recommended the ignition in applying the *p*-bromomandelic acid reagent to steel analysis. In dealing with high silicon steels, most of the silica was removed by dehydration before the precipitation. The precipitate was tinted brown when selenium was present in the steel, but the determination was unimpaired.

### *Chloranilic Acid & Picric Acid*

In the concluding paragraphs of this survey, attention must be drawn to a recent colorimetric method, which is based on the use of chloranilic acid as reagent. The reagent (2,5-dichloro-3,6-dihydroxy-1,4-benzoquinone) is a bright red crystalline powder which is sparingly soluble in water, forming an intensely red solution. Chloranilic acid has found its most frequent use in the indirect colorimetric determination of calcium which forms a precipitate on addition of the reagent in aqueous solution. Measurement of the diminution in absorption of the solution is used as the basis of the method. Frost-Jones and Yardley[89] reported that in contrast to the behaviour of the reagent in the calcium determination, where many ions interfered, a relatively selective reaction for zirconium was obtained in perchloric acid solution. The magenta colour produced was first studied by Thamer and Voigt[90] who outlined a colorimetric method for zirconium in $2 \times 10^{-6}M - 5 \times 10^{-5}M$ solutions. The colour reaction proceeded rapidly yielding a true solution which was indefinitely stable. The absorption was measured at 3,400 A and interference from U, Th, Sn, Ti and Fe (III) was measured. No visible reaction with Fe (II), Cr. Al, Co, Cu, Mn. Ba or K was reported. In re-examining the method, Frost-Jones and Yardley measured the absorption at 5,250 A in the visible region, confirming the good selectivity and moderate sensitivity of the method under these conditions. In the final procedure recommended by these authors, a slightly acid aliquot of the test solution containing not more than 1.5 mg. of Zr was transferred to a 50 ml. graduated flask and was treated with 20 ml. of 4M perchloric acid. The contents of the flask were diluted to 45 ml. and 4 ml. of 0.1 per cent aqueous chloranilic acid were added. The flask was maintained at 20°C. for a minimum of 20 minutes and was then diluted to 50 ml. The absorption of this solution was measured on the Spekker absorptiometer using a 4 cm. cuvette and Ilford No. 604 green filters with a water/water setting of 1.

The experiments of Speter[91] showed that the precipitation of zirconium as its insoluble picrate was quantitative. A basic picrate $ZrO.(C_6H_2O_7N_3)_2$ was initially formed, but later hydrolysed to $Zr(OH)_4$ and picric acid. The precipitate was moistened with sulphuric acid to prevent loss of material by explosion when it was ignited to the oxide. The solubility of the precipitate in mineral acids made a separation of zirconium from iron and aluminium impossible. The separation from thorium was also poor and it may be concluded in agreement with the author that the picrate method is of little value.

### Basic Chloride Method

A basic chloride method was proposed by Fischer and Zumbusch[92,93] who claimed that the conventional methods for the separation of zirconium from aluminium by precipitation with phosphate, arsenic acid and its organic derivatives were subject to disadvantages not met with by their procedure. This involved concentrating a solution of the aluminium and zirconium salts in strong hydrochloric acid to incipient crystallisation. An equal amount of hydrochloric acid was added, and the evaporation was continued till the solution was complete in the presence of 25 per cent hydrochloric acid. The solution was chilled at 0°C. for 30 minutes and the precipitate was filtered off and washed with dilute hydrochloric acid at 0°C. The separation from Al, Fe and Ti was indeed complete, but small amounts of zirconium passed through with the filtrate.

An alkalimetric method based on determination of the acid liberated in the reaction of zirconium with sodium tartrate was proposed by Zolotukhin.[94] The procedure involved several titrations and the use of standard solutions of zirconium and fluoride and it may be considered to be cumbersome and not very promising.

Chernikhov and Uspenskaya[95] reported an iodate method for the determination of zirconium. This method appears to be of considerable value, but may be subject to considerable interference from the large number of other ions which also form insoluble iodates, e.g., Ce, Th, Ta, etc. Briefly, the procedure consisted in precipitating the iodate from cold 5N nitric acid by addition of 10 per cent potassium iodate to at least 10-15 times the theoretical quantity. The precipitate was filtered off and washed with 0.8 per cent potassium iodate in 0.75N nitric acid and with alcohol and ether. The precipitate was dried at 40-45°C. for 10-15 minutes, dissolved in 2.5N HCl and 10 per cent potassium iodide, and the liberated iodine was titrated with 0.1N thiosulphate.

### *Precipitation with Bases*

Ostroumov[96,97] has examined the use of several bases for the precipitation of the hydroxides of several metals. A 20 per cent solution of pyridine was used with advantage to precipitate U, Zr, and Ti. The precipitate was less contaminated with Mo, Co and Ni than when other precipitants were used, and a single precipitation was sufficient. Iron, chromium and aluminium were simultaneously brought down, as would be expected. The formation of highly dispersed basic salts through hydrolysis of the zirconium and titanium was prevented by maintaining the solution 10 per cent in ammonium chloride. Ostroumovs' work was anticipated by that of Jefferson[98] who used quinoline, piperidine, aniline, benzylamine, dimethylaniline, *o*-tolidine and xylidine. Aniline was also used by Allen[99] who in addition used phenylhydrazine. All these basic reagents secured quantitative precipitation of zirconium, but also brought down many other ions.

In conclusion, we may note a recent fluorimetric method which has been devised using flavanol (3-hydroxyflavone) as reagent. The intensity of the blue fluorescence was found to be proportional to the amount of zirconium in the range 0-50 μg. in a volume of 25 ml. The method, which was proposed by Alford, Shapiro and White,[100] ensured freedom from interference from all the heavy metals except hafnium by utilising electrolysis before addition of the reagent. The method was used for determining zirconium in sands, clays, and refractories.

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## *Colour in Textiles*

THE 1953 Mather Lecture 'Common Sense on Colour in Textiles,' delivered at the 43rd annual general meeting of the Textile Institute in Bristol on 29 April was given by Dr. C. M. Whittaker, Hon. F.T.I. In the course of an interesting paper, Dr. Whittaker said 'A new age is upon you, the age of the new synthetic fibres. I have heard it called the "battle" of the fibres, but I would prefer to say "development," because each appears to have a special field in which it is unchallenged at the moment. It is absolutely certain that the cloth designers will gradually evolve many new fabrics combining beauty with durability.'

The new synthetic fibres were a challenge to the dyeing, printing and finishing industries, as well as to the dye makers, he said, because unless they could be coloured appropriately in the various fastnesses common to already established fibres, their consumption would be limited. The present position recalled the challenge that acetate rayon had once made; then, all the dye chemists started from scratch, and the British won the race.

Intensive research would be necessary, and the demands of the new fibres might even result in an entirely new class of dyes. Small firms should not be discouraged, for elaborately equipped laboratories and big teams were not the pre-requisite for successful research.

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## *Texas Refinery Expands*

### Kellogg to Modernise Amarillo

THE Texas Company has awarded a multi-million dollar contract in connection with the complete modernisation of its Amarillo (Texas) refinery to the M. W. Kellogg Company, a subsidiary of Pullman Inc.

Effect of the Texas Company's overall programme will be virtually to double the current capacity of the refinery. Other major processing equipment in addition to that under contract to Kellogg has also been scheduled. Cost of the new equipment and revamping necessary to complete the renovation is approximated at several million dollars.

Kellogg-designed units will include crude distillation, delayed coking, Orthoflow fluid catalytic cracking, and catalytic polymerization, the first two of which are integrated into a combination unit. The main advantages of the combination type of plant lie in lower initial investment cost and reduced operating expense. Investment cost is decreased because intermediate storage facilities for various products are largely eliminated and the fact that certain towers, furnaces and heat exchangers may be designed to handle product streams from more than one process unit. Operating expense is reduced by the use of centralised control and the reduction of heat losses incurred when intermediate products are cooled for storage.

#### Approximate Capacities

Approximate capacities in barrels per stream day of feed are as follows: crude distillation 15,500; delayed coking, 3,600; cat cracking, 6,000 (about 10,000 with recycle). The polymerisation unit is rated at about 470 barrels per stream day of polymer gasoline.

The catalytic cracker will be of Kellogg's most modern design, the Orthoflow. This is the tenth of this new type of cracking unit to be erected or scheduled, the first one having been put on stream about a year and a half ago.

Although this is the first Orthoflow Kelloggs have designed for the Texas Company, it is the eighth fluid unit they have undertaken for this refiner in the United States. Engineering is under way on all the new processing equipment, and construction is scheduled to start early this summer.

# Trace Element Deficiencies

## A New Soil Additive Ensures Controlled Replacement

TRACE element deficiencies are commoner than most people think, and instances are occurring all over the world where animals fail to thrive on account of the lack of an essential minor element in the grazing, or plant diseases are found to be physiological, and not a disease at all, since the symptoms are accountable to the absence of an element in the soil. Only recently it has been stated that most of the maize grown in South Africa is low in yield on account of such a cause.

### Trace Elements Lost from Soil

An important aspect of this matter is that, although trace elements must be present in soil only in very small amounts, cultivation tends to reduce their concentration to limits which are too low. Whereas wild growths return these small amounts to the soil when they decay, crops are taken off the land, and so the minor elements are used up with more serious results than when the major elements are depleted. It is easy to dress the soil with additional supplies of nitrogen, phosphorus and potash, but dangerous and difficult to supply the small amounts of trace elements required such as copper, cobalt and molybdenum. Cauliflowers may require 3-6 lb. of borax per acre on a light soil, but 12 lb. per acres would be detrimentar. It is difficult to add and spread such small amounts evenly over a wide surface, and there is always the danger of toxic excesses. Crops, particularly orchard crops, are beginning to exhibit trace element deficiencies in many lands because of the reduction of supplies of trace elements in the soil, which also leach out during rain when a soil is uncovered. Because of the difficulty of replenishing these elements, expensive spraying techniques have become the practice since it was discovered that plants could absorb the amounts they required through their leaves.

### Revolutionary Discovery?

A new discovery at the Michigan State College in the United States may, however, revolutionise the method by which trace elements are applied. It has been known for some while that the root hairs of plants adhere strongly to almost insoluble particles of grit and bone in the soil, and it has been proved beyond reasonable doubt, that these root hairs are able to absorb nutrients, and in particular trace elements, from these insoluble particles in a manner which is not as yet understood. The elements are certainly not dissolved and imbibed in the soil moisture.

Tests were made by making a porcelain-like almost insoluble substance in which some of the trace elements were mixed, and then grinding this into a powdered frit in which plants were experimentally grown. Others grown in pure quartz sand, but given the same feeding solution in which the particular trace elements were missing soon developed symptoms of trace element starvation, whereas the plants grown in the frit did not. Nor did any sign of a trace element appear in the drainage water from the frit.

As a result of these experiments American firms are beginning to develop frits containing most of the trace elements required by plants. Since the frits are insoluble there can be no danger of adding toxic quantities to any soil, and an ample dressing of such a frit should supply the soil with enough of the minor elements to last successive crops a lifetime.

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## Private Trading in Copper

IN the House of Commons recently the Minister of Materials, Sir James A. Salter, stated that after reviewing the situation in all its aspects, the Government had decided that private trading in copper should be restored at the earliest practicable date. Notice was being given to the Commonwealth producers and from 5 August the private import and sale of copper would be permitted and the Copper Distribution Orders would be revoked. He understood that the London Metal Exchange would reopen for dealings in copper the same day. An order made with effect from 5 May authorising private contracts for the delivery of metal after the end of public trading.

# 'Metal Surgery'

## New Method of Repairing Fractured Plant & Machinery

WHEN there are fractures, cracks or breaks in machinery, plant and equipment used in the chemical and allied industries, replacements invariably entail costly delays and no small amount of capital expenditure.

It is therefore of interest to learn of a process of 'cold' repair carried out *in situ*, without dismantling: an advantage adding to the speed of the operation. Moreover, through equipment being wholly confined to pneumatic and hand tools, this applies equally to sites where inflammable gases render welding, with its naked flame, impossibly dangerous. Yet the process is in no way in competition with welding: it is new, involving new principles and a high degree of operational skill. It is the Metalock process, executed solely by Metalock (Britain), Limited, of Grand Buildings, Trafalgar Square, London.

The Metalock process was invented by Lawrence B. Scott, a Texas oilwells engineer. Because of inflammable gases in the wells, welding of fractures was impossible, and throughout the 1930's Scott devoted his free time to discovering a 'cold' method of repair. He succeeded by 1935 in perfecting a principle based on the 'wiggle nails' system used to secure stress-points in wood.

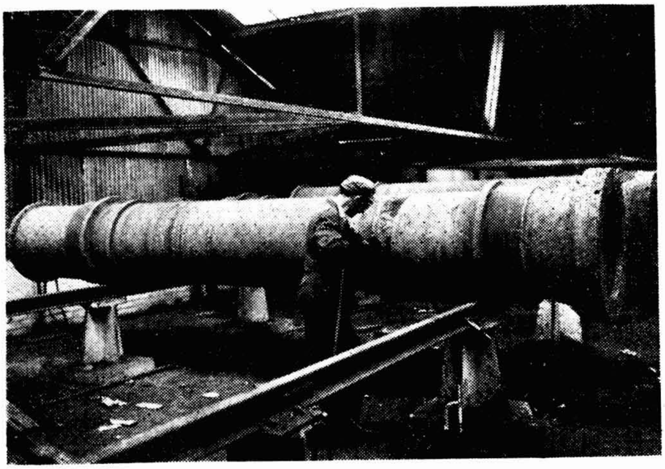
This basic principle, developed and adapted for practical application to castings, forged steel and non-ferrous metals, becomes a principle whereby 'keys' are cold-worked, one at a time, into slots cut transversely across the fracture or crack, restoring to each individual job a precise degree of strength and flexibility.

The precision in each case is carefully calculated relative to the number of keys driven in; this, in turn, is governed by the depth the slots are made to cut into the parent metal. The strength of a key is known: thus if the strength to be restored is ten times that of one key, slots are cut to a depth which will take ten keys exactly. The first key is pneumatically-hammered to lock solidly within the parent metal; the second and subsequent keys are power-locked both into the parent metal and against the former key.

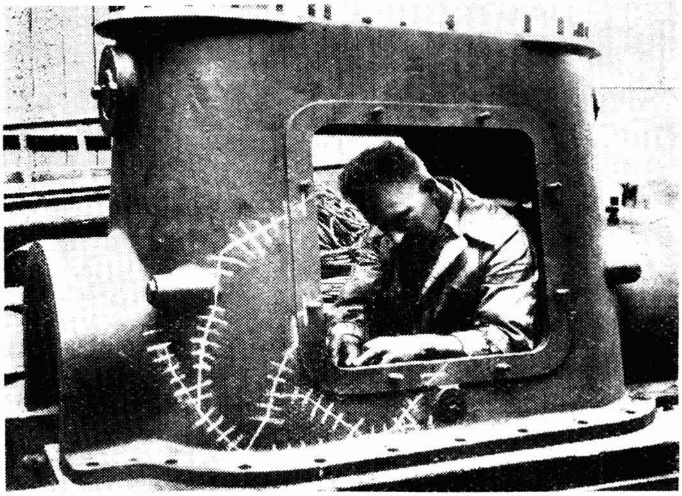
Such is the fundamental principle of Metalock. The keys, together with the 'studs' and the 'plates' used in two subsequently-developed techniques, are made from a highly ductile, heat-resisting alloy of great tensile strength, flexibility and a low co-efficient of expansion.

The second development is called Metalace, a system of employing 'studs' in conjunction with the 'keys' already mentioned to seal cracks completely in tanks or cylinders against leakage.

The third technique, called Masterlock, is the answer to breaks at points of concentrated stress in sections subject to overloading. The Masterlock inlay of high-strength alloy plate is locked in place by dowels



***Here is one of the 30 flasks repaired by the Metalock process at the Staveley Coal and Iron Company, Ltd., Chesterfield, over a period of twelve months. The cost of replacement would have been about £600 per flask and collectively the Metalock repairs effected a substantial saving***



*The 6 ft. 11 in. fracture in the $\frac{7}{8}$ in. by $1\frac{1}{4}$ in. thick crankcase of this compressor threatened to disrupt the smooth efficiency of a works in the Midlands. Two Metalock operators were on the job within twenty-four hours and six days later the compressor was fully restored and again in service. The repair they accomplished is seen here nearing completion*

cold-worked into matching half-holes between the parent metal and the plate.

By 1946 Metalock was firmly established in Canada and the USA, with a record of success among top-flight producers and official approvals, including that of the USA Navy specification for repairs on warships.

The same year Major E. C. Peckham, an experienced Canadian engineer, returned from war service in Britain and Europe, realised the value of the process to over-strained and replacement-starved Britain and introduced Metalock to this country in 1947.

The high degree of skill involved enforced a delay while British operators were Canadian trained. Today 37 technicians cover British industrial interests throughout Europe and the East with an immediate service.

Each operator's kit is equipped with hand and pneumatic tools, all of which run off a supply of between 80-100 lb./sq. in. The largest tool has a consumption of 14 cu. ft./min., compressed air for which is usually available in most chemical plant and factories. In those instances where it is not, a compressor is hired in the immediate vicinity, and as the repair necessitates only the intermittent use of compressed air, a portable compressor provides a substantial saving on the small jobs.

The basic technique is constant for all jobs. Cracks, fractures or breaks are first clamped in precise alignment. The metal in the example illustrated above was of a thickness varying from $\frac{7}{8}$ in. to 11/16 in., the fracture was 6 ft. 11 in. Two operators restored the machine to its former functional efficiency in six days.

After clamping, a jig was used to drill lines of blind holes in the parent metal transversely to the fracture. The resulting pilot holes were opened out to size and their depth calculated to restore a precise degree of strength. The channel of metal between the holes was removed by a gun tool, providing a series of holes connected by parallel sections. Into these apertures the Metalock keys were driven and peened into the parent metal by pneumatic hammers, one after the other. The job was 'finished' with a grinder, resulting in a repair described by Mr. E. C. Peckham, managing director of Metalock (Britain), Limited, as looking like a series of medical sutures.

The ability of the process to withstand pressure is widely in evidence, and its powers to withstand vibration and stress are instanced in some of the more extensive jobs, such as the repair of a 6 ft. 6 in. fracture in a 5 in. thick crankcase, or a similar fracture in a bridging-piece; two major repairs which took four operators 20 days, and five operators 53 days respectively.

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## Suits from Dynel

The first suits to be made of Dynel will be introduced in New York shortly, Union Carbide and Carbon Corporation has announced. Dynel is one of the company's acrylic fibres. The suits, of light-weight flannel made of 65 per cent wool and 35 per cent Dynel, will retail at $69.50 (approximately £24 16s.).

# Nickel in Modern Industry

## Canadian Company's Chairman on its Importance

THE outstanding rôle of nickel in the modern industrial world has been 'completely confirmed' by the invaluable knowledge and experience accumulated during the past few years of concentration on preparedness.

This was the view expressed by Dr. John F. Thompson, chairman of The International Nickel Company of Canada, Ltd., in his address to shareholders at the recent annual meeting.

He said that effective development of new uses of nickel had been temporarily stopped—except in special cases—by Government restrictions on end-uses of nickel. Some of the company's peace-time markets had been lost temporarily. Some may have been permanently diminished or even permanently lost. The company would, however, discover new fields and expand certain uses, at present small, as the preparedness demand increased.

The concentration on preparedness had widened the range of the company's experience with many alloys in many fields and in sometimes novel conditions. This accumulated knowledge and experience would be invaluable to them when nickel could again be supplied without restrictions for all peacetime requirements. They had completely confirmed the outstanding rôle of nickel in the modern industrial world.

### Production at Capacity Maintained

For the third successive year, said Dr. Thompson, the company maintained production at capacity and supplied more than 75 per cent of the nickel used in the free world. During the past three years, in response to unprecedented demand, the company delivered nearly 100,000,000 lb. more nickel than they delivered during any previous three-year period, exclusive of World War II. Their 1952 deliveries of nickel in all forms totalled 249,000,000 lb.

Distribution of nickel during 1952 was made internationally in accordance with allocations recommended by joint action of the Canadian and other member governments of the International Materials Conference. From free-world supplies of primary nickel, which were larger in 1952 than in the previous year, significant quantities were made available to the civilian economy after taking out amounts allocated for the defence programmes and making deliveries to the USA Government stockpile.

Referring to the use of primary nickel in aircraft alloys for jet engines and gas turbines, Dr. Thompson said that the production of military aircraft in the USA, the UK and Canada in 1952 consumed large amounts of nickel-containing alloys.

### Special Alloys Produced

Additional consumption could be foreseen in gas turbines and aircraft jet engines for other than military uses. British commercial transports equipped with jet engines, containing special alloys developed and produced by the company's UK subsidiaries, were now in regular scheduled airline operations. Experimental gas turbines in locomotives had been sufficiently satisfactory to justify production orders for such equipment.

Alluding to the market for copper—another of the company's principal products—Dr. Thompson spoke of the concern expressed that in the face of increasing competition from aluminium, stainless steels and similar materials, the market would be unable to absorb the expected enlargement of world copper production. His own experience with that type of competition was that in the long run good development and sales efforts on any one commodity tended to expand the markets for all.

The developing of markets for copper in the coming years would be greatly helped by the high cost of construction, maintenance and repair, and the consequent economy resulting from the use of more permanent materials.

In his concluding remarks Dr. Thompson said the company was still animated by the conviction that there are many uses for nickel as yet undiscovered and that by determination and persistent effort those new uses would be found and developed profitably.

# College Expansion

## Parliamentary Committee Discussion

REFERENCE to the Government's proposal to put further resources at the disposal of London University, so that a major expansion of the Imperial College of Science and Technology could be carried out, was made at a recent meeting of the general committee of the Parliamentary and Scientific Committee.

It was stated that the number of full-time students at the College would be raised from the present total of 1,650 to 3,000 during the period 1957/62. In addition, the Government proposed to make resource available for further developments in other parts of the country and was consulting the University Grants Committee for that purpose.

Sir Roderic Hill, Rector of the Imperial College of Science and Technology, had suggested that members of the Parliamentary and Scientific Committee might like to visit the College later in the year with a view to discussing the proposed plans for expansion.

On the subject of British scientific abstracts, the secretary said it would be recalled that representations were made by the committee to the Lord President of the Council regarding the urgent need for Government financial aid being given to maintain the service of these abstracts. Subsequently, it was announced that the Government proposed making a temporary grant of £5,000 to keep the service going until the result of the appeal to industry was made known. The position was still not entirely satisfactory, but it was being closely watched.

The chairman, Sir Wavell Wakefield, reported that an application for membership had been received from the Research Department of the Aluminium Development Association. The Steering Committee recommended that the application be granted and this was unanimously agreed.

# G. E. Davis Memorial Lecture

THROUGHOUT the English-speaking world George E. Davis is recognised as the pioneer in chemical engineering. Addressing a meeting on chemical engineering at the Centenary of Engineering in Chicago last year, Professor W. K. Lewis, of Massachusetts Institute of Technology, said: 'The first truly constructive step towards the establishment of the new profession came in the recognition that the problem was primarily one of education. The credit for this belongs to George E. Davis, who, in 1887, gave the first course of lectures on chemical engineering in the Manchester Technical School. These formed the basis for his two-volume "Handbook of Chemical Engineering," published in Manchester in 1901.'

The George E. Davis Memorial Lecture being organised by the North Western Branch of the Institution of Chemical Engineers will be given in Manchester on 10 October next. Mr. Norman Swindon, a former pupil of Davis, will be the lecturer. The occasion will provide chemical engineers with an opportunity to demonstrate their faith in the principles first enunciated by Davis and to pay their respects to the memory of the pioneer of their profession.

# Solar Energy Possible

A SUGGESTION that man will eventually turn to the sun for energy to run his machines was made by Professor Farrington Daniels, professor of chemistry at Wisconsin University, when speaking at the 75th anniversary celebration of the Case Institute of Technology at Cleveland, Ohio.

Professor Daniels, who is president of the American Chemical Society and was formerly chairman of the board of the Argonne National Laboratory for atomic research, pointed out that it was likely that supplies of coal, gas and oil would be exhausted in another 2-3,000 years. Some energy sources capable of expansion were water power, 'moon power' through the tides and atomic energy, but all were limited.

Solar energy would be available for the indefinite future and in calories of heat it was adequate, but the temperature was too low for practical use at present. Much greater emphasis should be placed on long-range fundamental research for the utilisation of solar energy.

Possible ways of using solar energy included solar engines, direct conversion of sunlight into electricity through thermopiles and electrochemical cells, house heating, evaporation of sea water, attainment of extremely high temperatures by focusing mirrors and photo-chemical storage of energy in chemical products and crystals.

# Good Paint Adhesion

### Resin-Chromate-Phosphate Primer

'WASH PRIMER,' a conditioner or pre-treatment coating for metals, is showing excellent results in increasing the adhesion of protective paints to metals; however, because of the unfamiliar basic nature of this chemical coating, its adoption has been slow. This primer is adapted to a wide variety of hard-to-finish metals, such as stainless steel, aluminium, zinc, cadmium, tin, magnesium alloys and galvanised iron.

Developed by the Bakelite Division of Union Carbide & Carbon Corp., New York, its sole purpose is to increase the adhesion of other coatings. Normally green in colour, 'Wash Primer' is essentially composed of basic zinc chromate pigment in a solution of polyvinyl butyral resin, and is supplied in a two-compartment container. One compartment holds the resin component; the other holds phosphoric acid solution. To thin the primer, the acid is added and stirred slowly, on site. The site mixture must be used within eight hours.

The primer may be applied by spray, brush, or roller, to conditioned metal. It dries rapidly so that considerable economies can be achieved in drying schedules. The pre-treatment may be applied to damp surfaces but not to those that are wet, and should be applied only to clean metal surfaces, within 24 hours of cleaning. Some vinyl topcoats require a special intermediate coat to obtain good adhesion.

This resin-chromate-phosphate solution exhibits outstanding adhesion properties because of the quality of the resin itself in this respect, and to the slight etching of the surface by the acid component which creates excellent anchorage. When applied over steel, the rust-inhibiting film of iron phosphates, caused by the action of the acid on the metal, helps to develop a tight, adherent, bending surface for overcoating.

# Future Unlimited

### Petrochemicals Expansion Predicted

DECLARING that the future of the petrochemical industry is unlimited, Dr. Gustav Egloff, director of research of Universal Oil Products, recently told a meeting of the Western Petroleum Association in San Antonio, Texas, that the demand for petrochemicals has grown to such an extent that original suppliers can no longer keep up with the growing demand.

The vast markets which petrochemicals now have in agriculture are small compared to those which are forthcoming, he said. Despite the rapidly increasing use of chemical fertilisers and pesticides, their value was just beginning to be appreciated in some areas. Present plans called for the production of 3,400,000 tons of ammonia, within the next three years, and more than 75 per cent of this total would be derived from natural gas.

Another field cited as a growth factor was plastics. Here petrochemicals had a large market in phenolic shell moulds for use in foundry operations, and although requirements for this purpose were less than 3,000,000 pounds in 1952, some experts predicted rapid expansion of this use until it attained a 200,000,000 pound per year level. Large markets for the industry's output were also seen in synthetic latex-based paints for interiors.

Textile fibres represented one of the largest markets for petrochemicals. Synthetic textile fibres which are or will be in large scale production in the near future include nylon, Dynel (an acrylic fibre produced by Union Carbide and Carbon Chemicals Company), Orlon (another acrylic fibre produced by Du Pont), Acrilan (an acrylic by American Viscose Corporation), and Saran (a Dow Chemical Company synthetic fibre). The principal petrochemicals required for these textiles are benzene, acrylonitrile, butadiene, cyclohexane, *p*-xylene, ethylene, glycol, and vinyl and vinylidene chlorides.

# Electrodeposition Conference

AN INTERNATIONAL conference on electrodeposition and metal finishing, sponsored by the International Council for Electrodeposition, of which the Institute of Metal Finishing is a prominent member, is to take place in or near London in April, 1954. Authors are now invited to submit papers, which should deal preferably with work, of an original nature, in the field of electrodeposition and metal finishing generally. Manuscripts should be forwarded to Dr. S. Wernick, the IMF, 32 Great Ormond Street, London, W.C.1.

# *India's Natural Resources*

### Ministry's Annual Report

THE Indian Government has now received the report of the Central Ministry of Natural Resources and Scientific Research for 1952-53. Among the main activities of the Ministry are a survey of existing natural resources, exploration for new materials, dissemination of scientific knowledge, co-ordinated research work on utilisation of resources and encouragement of the industrial application of scientific knowledge.

The report states that three more national laboratories were opened during the year, bringing the total to ten. These were the Central Road Research Institute, Delhi; the Central Electro-Chemical Research Institute, Karaikudi; and the Central Leather Research Institute, Madras.

### Research Projects

Among research projects undertaken in the national laboratories are the production of nicotine sulphate from tobacco waste, preparation of synthetic rice from fortified tapioca, thermal improvement of low-grade coal, preparation of foam glass and chemical porcelain, and a process for using waste furnace ash as a substitute for cement.

The functions of the Atomic Energy Commission included surveying the country for minerals useful in the release of atomic energy, to work and develop such minerals on an industrial scale, and to take steps leading to the use of atomic energy in India for industry.

Exploratory work by the Commission led to the location of important deposits of uranium in Bihar and beryl in Rajasthan, Bihar and Delhi. The Physics Division of the Atomic Energy Commission at the Tata Institute of Fundamental Research in Bombay has acquired the necessary equipment for nuclear research, including a 1,000,000-volt cyclotron. Fundamental research on the properties of atomic nuclei and behaviour of elementary particles is being carried on. The Commission was instrumental in setting up India Rare Earths, Ltd., at Alwaye, a state enterprise owned jointly by the Government of India and the Travancore-Cochin State Government, for processing monazite sands.

The Commission has also decided to set up a pilot plant for the recovery of uranium minerals from copper filings, a uranium-thorium plant for processing residual cake containing thorium and uranium left over from the monazite, and a production unit for manufacture of the standard electronic equipment needed in nuclear work.

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## *Aluminium Development*

THE annual general meeting of The Aluminium Development Association was held at 33 Grosvenor Street, London, W.1, on Friday, 10 April, 1953, with the retiring president, Mr. H. G. Herrington in the chair. Introducing the report for 1952, he noted the continuing progress of the Association as shown, for example, by numbers of inquiries answered (2,750), publications distributed (132,000) and film shows given (over 400) and also by short-term and long-term development and research investigations pursued during the year, particularly in structural engineering, naval architecture, large riveted joints, welding and finishing. Close co-operation continued with many government departments, other research, development and technical organisations, the BSI, professional institutions and learned societies.

The year 1952 had opened uncertainly owing to supply difficulties, but at its close there was fabricating capacity available, and this change had some effect on the Association's programme. There was likely to be more competition in the future, but the ADA would be regarded as a spearhead of the aluminium industry's competitive efforts.

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## *Container Charges*

NEW arrangements relating to the supply of bottles containing BDH laboratory chemicals come into operation as from 4 May. Stoppered bottles, other special bottles and bottles containing 500 g. or over (or of liquids, 500 ml. or over) will continue to be charged and returnable as at present; but ordinary capped or corked bottles containing less than 500 g. (or 500 ml.) will be supplied without charge.

Since there will be no credit to be allowed on their return it will be understood that after 4 May the rule that only bottles carrying a charge ticket can be credited will need to be strictly enforced. The new measures will not at present apply to 'AnalaR' chemicals.

# The Chemist's Bookshelf

POLYSACCHARIDE CHEMISTRY. By R. L. Whistler and C. L. Smart. Academic Press Inc., New York (Academic Books Ltd., London). 1953. Pp. XV + 493. $10.80. 86s. 6d.

Although polysaccharides are assuming an ever greater importance in technology and in biochemistry and medicine, there is no reasonably comprehensive modern monograph in this field, and all chemists will be grateful to Whistler and Smart for undertaking the onerous task of filling this gap in the literature.

Their book is written mainly from the viewpoint of the academic carbohydrate chemists, but the principles of manufacturing methods and the profuse technological and other applications of polysaccharides are adequately discussed. Introductory chapters deal with the occurrence of polysaccharides and their role in living organisms. Sources and structures of polysaccharides are summarised in two useful tables. A long and valuable chapter is devoted to methods for the determination of homogeneity, molecular weight and structure. Individual polysaccharides, grouped according to their origins, are then discussed. First cellulose, starch, xylans, pectins and other compounds from plants, then products from algæ and fungi (e.g., alginic acid, laminarin) and bacterial polysaccharides and dextrans are dealt with, followed by chitin, hyaluronic acid, heparin, and other substances from the animal kingdom.

Details of the extraction, determination of structure, properties and applications are given for each polysaccharide. An exhaustive citation of literature on the more technological aspects of cellulose, starch, etc., would neither be possible nor desirable in a book of this type. However, the literature to 1952 is well covered, and numerous references to papers later than this are included. Illustrations provide a little light relief, as for example the photograph of a native collecting gum arabic in Africa.

The paper, type, format and indexes (subject and author) are excellent, and there appear to be few obvious errors. ('Bourne' is incorrectly spelt on p. 99; this mistake is repeated in the index.)

This work will be valuable not only to carbohydrate chemists, but to many others, especially technologists and workers in biochemistry and medical sciences. Advanced students would profit by a study of selected chapters. This book should be in all libraries; many individuals will be tempted, in spite of the somewhat high price, to purchase a copy for their personal use.—W.W.

AN AMERICAN IN EUROPE.—The Life of Benjamin Thompson, Count Rumford. By Egon Larsen. Rider and Company, London, 1953. Pp. 224. 15s.

Benjamin Thompson, Count Rumford, was born two hundred years ago near Boston, Massachusetts. Leaving America in 1776 he became distinguished as soldier, statesman, philanthropist and man of science. It is in the last of these characters that he is most remembered. His best-known experiments concerned the nature of heat, in Rumford's day a matter of considerable controversy. According to one view heat was a material substance called 'caloric.' On the other hand, Boyle regarded heat as a form of energy. Rumford showed the latter view was correct. He was the first to make a determination of the mechanical equivalent of heat and to show the passage of heat by radiation and convection. He devised a calorimeter, improved the Argand burner, designed the candle photometer and published papers on capillarity. He aimed at the 'application of science to the common purposes of life' and was interested in such matters as economy of fuel and the design of stoves, still of considerable importance today. Much of his work was published in a series of 'Essays,' well known and widely circulated in their day. Not the least of Rumford's works was the founding of the Royal Institution. He was a fellow of the Royal Society, which awards a Rumford Medal in his honour.

In addition to his scientific work he held high office as soldier and statesman in Bavaria, where for fourteen years he served the Elector, introducing many reforms into the Army and Departments of State. On his return to England he became a leading member of a group applying scientific knowledge to the objects of philanthropy. He left England to carry on his scientific work in France, where he died in 1814.

This book is an authoritative and very readable biography of Rumford based on much original material and including a number of rare reproductions illustrative of Rumford's life and times. It tells the story of the many parts he played, his relationships with such contemporaries as Davy and Faraday, and of his two unhappy marriages, the second of which was to the widow of the French chemist Lavoisier. Not the least fascinating parts of the book are those taken from the diary of Rumford's daughter, giving her love affairs, impressions of life at the beginning of the nineteenth century and her efforts to get on with her brilliant father. The final part of the book, consisting of extracts from his 'Essays' and including an account of his most famous experiments on the nature of heat, is illustrative of the many aspects of his scientific work.

Chemists and physicists of all kinds will find much of interest in what, in the words of Sir Eric Rideal, who contributes a foreward, is 'a magnificent account of the life of one whose ideas and concepts after two hundred years are still worth serious consideration.'—W.R.M.

SELECTED TOPICS IN MODERN INSTRUMENTAL ANALYSIS: Edited by D. F. Boltz. Pp. viii + 477. Prentice-Hall, Inc., New York. 1952. $8.

This book is designed to present the material, theoretical and in some cases practical, for an introductory training course in instrumental analysis. It comprises ten chapters, each one written by a specialist, and covering the following topics: electrometric *p*H measurements; polarographic analysis; fluorometric analysis; spectrophotometric analysis; spectrochemical analysis; electrometric and opticometric methods of analysis; analytical applications of X-ray diffraction; mass spectrometry; raman spectroscopy; radiochemical analysis.

Speaking comparatively, the content of the several chapters is somewhat uneven. The general pattern proposed by the editor is to include fundamental principles, the mode of construction and operation of typical instruments, and their practical applications in chemical analysis and research. Detailed directions for operating commercial instruments, and detailed laboratory procedures are not normally regarded as being necessary. However, even within this framework the balance between theory and practice is not by any means the same throughout. Thus, in the chapter on fluorometric analysis a few elementary laboratory exercises are included. The chapters on spectrophotometric and spectrochemical analysis give quite a high proportion of valuable practical detail; and the chapter on X-ray diffraction gives a particularly full series of exercises dealing with calculations, together with a considerable amount of generalised practical information.

Other chapters give the impression of a more theoretical approach. There is, however, in an appendix, a useful outline for a suitable laboratory course based on the topics considered in the book, and this includes instruction for selected experiments. There is also a helpful selection of study problems.

The book will undoubtedly be found of use in the circumstances which it is designed to meet—the presentation to students of a soundly based introduction to a wide variety of instrumental techniques in analytical chemistry. But in addition it would be a valuable addition to the general library of the average analytical laboratory, particularly if there is any proportion of the workers who have not already had a specialised training in instrumental analysis as a whole. A study of it would probably also benefit specialists in one technique, since it would enable them to relate their own particular instrumental method to instrumental analysis as a whole, and to obtain a balanced picture of the whole field.—C.L.W.

# · PERSONAL ·

**Mr. Charles A. Adams**, C.B.E., who has been in charge of the Food Standards and Labelling Division of the Ministry of Food since 1943, retired on 30 April after 42 years in the Government service. On 1 May, the Food Standards and Labelling Division was amalgamated with the Food Hygiene Division under **Mr. N. R. C. Dockeray**. The new division is known as the Food Standards and Hygiene Division. The Minister of Food has approved the appointment of Mr. Dockeray, Assistant Secretary, Food Standards and Hygiene Division, as a member of the Food Standards Committee.

Mr. Adams was educated at the University College of Wales, Aberystwyth and took a B.Sc. degree, with Honours in Chemistry, at London University. He entered the Government Chemist's Department in 1911. He was called to the Bar of the Middle Temple in 1925. He joined the Ministry of Food as an assistant secretary in March, 1943, to take charge of the newly formed Food Standards and Labelling Division. He was awarded the C.B.E. in the Birthday Honours List in 1948.

Mr. Adams is a Fellow of the Royal Institute of Chemistry and a past vice-president of the Council of the Society of Public Analysts. He has represented the Ministry of Food on the Council of the British Standards Institution since December, 1947. He has been a member of the Food Standards Committee since its inception in 1944. Mr. Adams has agreed to continue to serve on the Foods Standards Committee and to act as vice-chairman of its Preservatives Sub-Committee.

**Dr. W. Idris Jones**, Director General of Research to the National Coal Board, who is to succeed **Dr. G. E. Foxwell** as President of The Institute of Fuel in October of this year, is a native of South Wales and began his university career in 1919 at the University College of Wales, Aberystwyth. After graduation he entered Gonville and Caius College, Cambridge, as a Rhondda Research Student in 1922, later being elected to a Frank Smart Studentship and becoming Supervisor of Chemical Studies and a part-time demonstrator in chemistry. He was awarded the Ph.D. degree in 1925.

He was a member of the Cambridge Rugby XV from 1923 to 1925; and captained the Welsh XV in 1925 and the Anglo-Welsh XV in 1926.

In the next phase of his career Dr. Idris Jones was employed as a research chemist at Billingham with Imperial Chemical Industries, Ltd. Here he made his first incursion into the field of fuel technology and, after some research work on the development of methanol synthesis catalysts, he became successively assistant manager of boiler and water-gas plants and, later, a group manager in the Coal Hydrogenation Division. In 1933 he was appointed director of research of Powell Duffryn, Ltd., and at Ystrad Mynach he developed the group's research laboratories. The next 14 years brought him into contact with all aspects of fuel research; mining, coal preparation, briquetting, carbonisation and gasification and the working-up of tar products. He directed the research work on the development of the 'Phurnacite' process and was closely associated with experiments on 'Colloidal fuel' carried out in collaboration with the Cunard Steamship Co. In November, 1946, he was appointed to his present post.

The Capper Pass Awards, which are made annually by the Councils of the Institution of Mining and Metallurgy and of the Institute of Metals, from a sum of £200 placed each year at their disposal by the directors of Capper Pass & Son, Ltd., Bristol, to encourage the publication of papers in the 'Transactions of the Institution of Mining and Metallurgy' and in the 'Journal of the Institute of Metals,' have been awarded for 1952 as follows: £50 respectively to **Messrs. E. Davies**, M.Sc., F.I.M., and **S. G. Temple**, M.Sc., A.I.M.; **Mr. C. P. Paton**, B.Eng.; **Dr. E. C. Ellwood**, F.I.M., and **Mr. T. A. Henderson**, B.Sc.; and **Mr. P. M. J. Gray**, B.Sc., A.R.S.M.; and £25 to **Mr. E. A. Hontoir**, B.Sc., A.I.M.

**Dr. R. S. Dicks**, formerly senior process engineer for the Shell Oil Company, has joined the Textile Division of Celanese Corporation of America. In collaboration with **Mr. Kenneth D. Bowen**, Director of Manufacturing Co-ordination, he will direct the process engineering section in a study of the productivity of all chemical processing equipment in textile division plants.

MR. J. T. SHARPLES, B.Sc.Tech., A.M.I.E.E., recently resigned his position as engineer-in-charge of the heating element department of Metropolitan-Vickers Electrical Company, Ltd., to take up an appointment as district engineer & Manager (Northern Counties) with Barlow-Whitney, Ltd., industrial heating engineers, London and Bletchley. He will operate from their new address, 32 Deansgate, Manchester 3 (Tel.: Blackfriars 3851). Mr. Sharples received his technical education at Manchester University, taking an honours degree in electrical engineering. He spent 21 years on heating problems with his late company.

A new board of directors of the 111-year-old McArthur Chemical Co., Ltd., and its subsidiary, Chemicals Limited, was elected at a special general meeting of shareholders. Control of the McArthur company was purchased recently by St. Maurice Chemicals, Limited, which in turn is owned jointly by Shawinigan Chemicals, Limited, of Montreal, and Heyden Chemical Corporation, of New York. Members of the new board are MESSRS. V. G. BARTRAM, P. W. BLAYLOCK and H. S. SUTHERLAND, of Shawinigan Chemicals; MESSRS. J. P. REMENSNYDER, SIMON ASKIN and F. A. DEGENER, of Heyden; and MESSRS. ROBERT BERRY and G. A. LEE, members of the former McArthur board.

At the annual meeting of St. Maurice Chemicals, that company's board of directors was increased from eight to ten, ARTHUR R. BROADMAN of New York, chief engineer of Heyden Chemical Corporation, and P. W. WRIGHT, of Shawinigan Chemicals, being added, and HENRY G. WALTER, jnr., of Heyden, being elected to replace PAUL VAN DER STRICHT, of New York.

## *New Sulphuric Plants*

IT was recently announced that International Processes, Inc., of Illinois, are to erect the first sulphuric acid plant in the U.S. to employ the Kachkaroff-Guareschi process (THE CHEMICAL AGE, **68**, 269). Various sulphur sources which have hitherto proved uneconomical in the lead chamber process are to be exploited, including gypsum, spent oxide, and cold gases from copper converters.

Two plants, one of which produces 150 tons per day of 100 per cent acid, are already in operation in Great Britain, and two more are to be erected shortly.

## *Obituary*

### Sir Thomas Kirke Rose

The death has occurred at the age of 87 of SIR THOMAS KIRKE ROSE, who until his retirement in 1926 was for many years chemist and assayer of the Royal Mint. Educated at Dulwich and the Royal School of Mines, Sir Thomas worked for a time in this country and in the USA for various commercial concerns specialising in gold extraction from ores. He took his degree at London University in 1891 and four years later obtained his degree of D.Sc. In 1890 he joined the staff of the Royal Mint and spent the remainder of his career there. His appointment as chemist and assayer was made in 1902. He was knighted in 1914. Sir Thomas was the author of *Metallurgy of Gold*, a standard work on the subject. He also wrote *The Precious Metals* and a number of contributions to the transactions of learned societies. In 1915 he was elected president of the Institute of Mining and Metallurgy and was awarded the gold medal of the Institute in 1921. At one time he was vice-president of the Institute of Metals.

### Dr. Samuel Smiles

The death has occurred at the age of 75 of SAMUEL SMILES, F.R.S., O.B.E., D.Sc., emeritus professor of chemistry in the University of London. He was acknowledged to be the leading authority on relations between physical properties and chemical constitution and published an exhaustive treatise on the subject. Various papers of his were published in the Transactions of the Chemical Society, of which he was formerly senior honorary secretary and afterwards vice-president. He was educated at Marlborough and the universities of London, Paris and Jena, and in 1907 he was appointed assistant professor of organic chemistry at University College, London. He became the first professor of organic chemistry at Armstrong College, Newcastle, twelve years later and was appointed to the Daniell chair of chemistry at King's College, London, in 1920.

# · HOME ·

### Key Industry Duty

The Board of Trade are now considering the question of the renewal of the various existing exemptions of commodities (mainly chemicals) from Key Industry Duty for the period 19 August, 1953, to 18 February, 1954. Any representations on this subject should be addressed to the Industries and Manufactures Department, Division 1, Board of Trade, Horse Guards Avenue, S.W.1, as soon as possible, and in any case not later than 6 June.

### Coronation Bonus

Imperial Chemical Industries, Ltd., will give £1 as a Coronation gift to all in their employ on Coronation Day—about 106,000—and to pensioners of the company, numbering about 9,600. As the company is to pay tax so that each recipient has £1, the total cost is estimated at well over £115,000.

### New Telephone Number

The new telephone number of Charles Hearson & Co., Ltd., the well-known laboratory furnishers, 68 Willow Walk, Bermondsey, London, S.E.1, is BERmondsey 4494 (four lines).

### Agricultural Chemicals Shown

In our report of the Olympia section of the British Industries Fair we omitted to mention that Metallurgical Chemists Ltd., Gresham House, 24 Old Broad Street, London, E.C.2, were amongst the exhibitors. The firm, who are manufacturers of metallic salts, metal oxides and spray chemicals had on show a selection of their well-known agricultural and industrial chemicals including 'Coxysan' potato spray, 'Talbot' lead arsenate, 'Cyanolime' rabbit fumigation powder, KYP, DDT formulations, 2,4-D esters, and A/1 metallic compounds.

### New Jenolite Premises

Jenolite (Scotland), Ltd., opened new and larger premises at 304/312 High Street, Glasgow, on 24 April, when Mr. W. C. Kirkwood, general manager, Scottish Industrial Estates, Ltd., performed the opening ceremony. An important feature in the new premises is a laboratory which will be used to handle corrosion tests and similar duties involved in their work of pretreatment of metal and prevention of corrosion.

### Nickel-Copper Alloy Prices

British Driver-Harris Co. Ltd., of Manchester have announced, as and from 4 May, a reduction of 2d. per lb. in their nickel-copper series of alloys, consequent upon the recent reduction in the price of electrolytic copper. This reduction applies particularly to their well-known 'Advance' product, and particularly to 'Special Advance' for low-temperature thermocouple purposes.

### Fuel Efficiency Services

It was announced in Parliament this week that the Minister of Fuel and Power has now received the report of the Pilkington Committee upon an enlarged industrial fuel advisory service in accordance with a recommendation of the Ridley Report. The Government is now considering its detailed proposals for the setting up of an industrial organisation to provide fuel efficiency services.

### Heat Treatment of Steels

THE programme of the BISRA conference on Heat Treatment Practice at Ashorne Hill, near Leamington Spa, 15-17 June, is now published. Sessions for 16 June will be on 'Heat Treatment of Engineering Steels,' 'Heat Treatment of Large Forgings,' 'Heat Treatment of Surfaces,' and 'Surface Treatments involving Change in Composition of the Steel.' During the evening films will be shown. On 17 June there will be sessions on 'Isothermal Heat Treatment' and 'Temperature Measurement and Control.' Enrolment for the conference should be made before 20 May with Mr. A. M. Sage, British Iron and Steel Research Association, 11 Park Lane, London, W.1.

### To Equip Laboratories

The United Kingdom Government have authorised the Sondes Place Research Institute of London to buy and ship on their behalf the necessary equipment for Pakistan's scientific and industrial research laboratories, as the United Kingdom's contribution under the Technical Co-operation Scheme of the Colombo Plan. Mr. R. M. Mactaggart, of the Institute, is expected to arrive in Karachi shortly to discuss and finalise arrangements for this purpose.

# • OVERSEAS •

### Bauxite Clay Discovered

A report received from the Directors, Geological Survey of Pakistan, says that a bed of bauxite clay overlies coal at Muzaffarabad and can be traced intermittently for two miles. In places the thickness of the clay is four feet. Analysis of the clay shows 61.5 per cent $Al_2O_3$ and 21.1 per cent silica.

### ICI Canadian Subsidiary

The incorporation of Imperial Chemical Industries of Canada was announced in Montreal this week. It was stated earlier that construction of a plant to manufacture 'Terylene' yarn and staple fibre at Millhaven, near Kingston, Ontario, would be initiated by a wholly-owned Canadian subsidiary. Initial estimates of the cost of the plant exceed $20,000,000.

### Manganese Deposits

Negotiations between private French and American companies and French government services with a view to setting up a mining company to explore the rich manganese deposits in Gabon (French West Africa) have now reached the final stage. US Steel, it is understood, will undertake to buy 300,000 tons of manganese yearly when commercial production starts—probably not before 1960.

### USA Chemistry Scholarship

More than 1,000 college scholarships and fellowships were made available to deserving students in the USA during the past year by chemical and related companies, according to a survey just completed by the Manufacturing Chemists' Association, Inc. The grants ranged in value from $300 to $5,000 a year. This represents a substantial increase over previous years.

### New Chilean Copper Plant

The new plant at the Chile Exploration Company's copper mine at Chuquicamata (Anaconda group) was officially inaugurated recently but will not be completed until the end of the year. It is intended to treat copper sulphide ores which will eventually replace the oxide ores. The plant will eventually permit production to reach some 19,000 tons of fine copper monthly as compared with the present output of 16,000 tons.

### Non-Caking Fertiliser

The Illinois Farm Supply Co., East St. Louis, Illinois, is producing a fertiliser that does not cake, as a result of discovering that, by adding a surface active agent to the fertiliser, the reaction is speeded up and the resulting fertiliser is fine-grained and free-flowing. Laboratory tests were conducted to determine the effect of various surface active agents on fertiliser samples containing a wide range of nitrogen, phosphorus, and potassium analyses. As a result, it was found that an alkyl-aryl sulphonate-type. anionic surface active agent, Santomerse No. 1 (Monsanto Chemical Co.) gave the best results at minimum cost of treatment.

### More Titanium in South Africa

Deposits of dark blue sand at Morgan's Bay, near Keimouth, in the Cape Eastern Province, have been found by assay to contain a high percentage of ilmenite, from which is obtained titanium. Mr. W. T. Miller, an engineer and miner, has obtained the mineral rights, and has been prospecting since November. He said that in his opinion the area has the richest concentrated deposits yet found anywhere in the world. The assay results for the area range from 8 per cent to nearly 90 per cent of heavy mineral, he added. The first area is one mile by 1½ miles, with a probable depth of up to 300 ft. The second area is four miles by one mile, and probably 50 ft. deep. Work has begun on the building of a laboratory, offices and works, and the installation of the machinery for a pilot concentrating plant is expected to be completed during April.

### A/S Borregaard Acetate Rayon

Mr. Arne Meidell, managing director of Norway's biggest timber company A/S Borregaard, said last week that apart from pulp, paper, and various chemicals, the timber logs entering his factories are now increasingly being turned into yarn for making textiles. Indeed, he said, export has now started of finished cloth made from yarn produced from timber at A/S Borregaard's factories. 'We consider it to be our duty to carry this refining process to the farthest possible extent in order to extract the utmost value from the timber we receive,' he said.

# Publications & Announcements

THE latest issue of 'Tower Laboratory News'—No. 9 of the new series—gives details of the Model 205 single-pan constant-load balance, which will give direct reading to 0.1 mg., and automatic weighing below 100 mg.; the Falmer magnifier; universal electric ovens and incubators; a wide range of polythene laboratory ware, with prices; the IP constant temperature bath and the general purpose thermostatic water baths; and 'Quickfit' spherical ground joints, etc.

* * *

NUMBER 2 in the Royal Institute of Chemistry series of lectures, monographs and reports for 1953 is 'Plant Growth Substances,' based on a lecture by Professor R. L. Wain before the London Section of the Institute at Wye College on 12 July 1952. The monograph deals largely with the several lines of investigation which have been undertaken at Wye College, but includes a survey of some of the work that has been done since the isolation of the auxins *a* and *b* by Kögl in 1934. Copies may be obtained from the Institute, price 5s. each.

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ANTI-VIBRATION mountings specially designed for scientific instruments and light machinery are illustrated and described in a leaflet (List No. HX.20) issued by Howard Clayton-Wright, Ltd., of Wellsbourne, Warwickshire. The range shown covers stud type mountings which can be loaded in any plane and in any combination of torsion, shear, compression or tension. In construction, these 'Harrisflex' mountings, consist basically of rubber chemically bonded to metal, the rubber acting as the anti-vibration medium.

* * *

A DISTINCTIVE new pack for Gibbs S.R. toothpaste has been introduced by D. & W. Gibbs, Ltd., to meet a change in general marketing conditions and display methods. The pack is the same size as before, but in new colours with light blue background and the letters S.R. in a heavier red type than hitherto. It is now similar in design to the packs used for Gibbs S.R. in other countries. Synonymous with the new pack, changes in the actual toothpaste have been made to give the product a fresher flavour.

THE published volume of the Proceedings of the Chemical Engineering Group of the SCI for 1951 has just been received. The very interesting contents include papers on 'The Application of High Speed Centrifuges' by R. H. Dolton; 'Physiological Considerations Relating to Workers in the Chemical Industry' by Dr. M. W. Goldblatt; 'Some Sulphur Recovery Processes' by G. M. Rowell; 'The Planning of Maintenance in Chemical Works' by H. Birchall; 'Economic Reactor Design' by Dr. G. T. Meiklejohn and R. T. Snell; and 'Possible Applications of Gas Turbines' by L. Lubbock.

* * *

A DATA sheet recently received from F. J. Hone & Co. describes the Hone shaking machine, designed for the estimation of total olefinic and aromatic hydrocarbons in gasolene in accordance with the ASTM specifications. Each sulphonation flask is immersed in its individual ice-water bath in a chemical reagent jar, and held in position by a special spring cap. Four jars are held rigidly at an angle of 45° in the direction of motion and are subjected to a strictly horizontal sinusoidal stroke of 3 ± 0.5 in. at 250 ± 25 cycles per minute. The design eliminates the possibility of trapped fingers in moving parts, and is virtually silent.

* * *

THE fourth edition of 'M. & B. Laboratory Chemicals' has just been issued by May & Baker, Ltd., and is a complete revision of the previous edition. A number of deletions and additions have been made, together with some improvements in the specifications given. In conformity with modern practice, specific gravities at 15.5° have been replaced by weights per ml. at 20°, except in the case of the lower aliphatic alcohols. As well as in English, the names of the reagents are given in French, Spanish, Italian and 'BP Latin.' Deletions include benzocaine, chloracetamide, $\beta\beta'$-dichlordiethyl ether and piperazine hydrate, and among the additions are aluminium iso-propoxide for the Meerwein-Ponndorf reaction, alumina for chromatography, cyclohexane and cyclohexanol, self-indicating silica gel, 2: 3: 5-triphenyltetrazolium bromide, and M & B 938.

NEW entries in the BDH Catalogue of laboratory chemicals include lauroyl and myristoyl chlorides; these should prove of considerable interest, particularly in the Friedel-Crafts synthesis of higher ketones. A new mixed indicator for the *p*H range 10-14 provides a means of determining the *p*H of strongly alkaline solutions by comparison with a colour standard which has been in demand for many years. As we announced recently (THE CHEMICAL AGE, **68**, 591) standard discs are being produced for use with the Lovibond comparator and the BDH-Lovibond Nessleriser. For the latter, a new disc has also been produced for the determination of 0.2-1.0 mg. in $SiO_2$ in solution, by matching the molybdenum blue colour produced by the reduction of silicomolybdate with 1-amino-2-naphthol-4-sulphonic acid. This method should prove of great use in the determination of soluble silica in boiler feed water. Other additions are methylene blue (Terry's) SS, and Zeo-Karb 226. Quinoline (synthetic) and silicochloroform are restored to stock.

* * *

INTERESTING advances in the design and construction of Exide-Ironclad traction batteries for electric industrial trucks, locomotives and road delivery vehicles are announced by Chloride Batteries Ltd., Clifton Junction, Swinton, Manchester. The old wood-veneer separator—always liable to impose a limit on battery life—has now been replaced by one of Porvic, the new microporous chemically inert material. This forms a continuous diaphragm between the positive and negative plates and has proved in service to be virtually indestructible, even in the most arduous working conditons. Porvic separators, being over 80 per cent porous, enable the cells to deliver heavy rates of discharge with the minimum of voltage drop. Further, new Exide-Ironclad batteries can now be stored without risk of deterioration for an indefinite period before filling in as Porvic cannot shrink or split and all hydration troubles in storage are eliminated. Advances have also been made in the antimonial lead alloys used for the plate grids in Exide-Ironclad batteries. These new alloys, evolved as a result of prolonged experiment and research are highly resistant to corrosion in service and will help to ensure maximum life for the batteries.

A COMPARATOR for mild steel metal arc electrodes, providing a ready-to-hand method by which welders, designers and others are enabled to obtain the basic characteristics of the electrodes, as specified by the makers in accordance with British Standard 1719, is described and illustrated in a leaflet issued by the British Welding Research Association, 29 Park Crescent, London, W.1, by whom the comparator has been produced. On the front of the rule appears the essential information on the coating, position, current and voltage for given electrode groups, together with the nearest American equivalent. On the reverse side are shown the particular electrodes and manufacturers' names.

* * *

THE first issue of a bi-monthly magazine for employees has been published by M. W. Kellogg Company, petroleum refinery and chemical plant engineer contractors, New Jersey, N.J. Entitled 'Kellogg World,' the two-colour 16-page publication will be sent to the homes of all employees of the company, a subsidiary of Pullman Incorporated. The first issue features articles about the company's operations and programme and the activities of employees.

* * *

A NEW feature of the 1953 edition of 'British Chemical Plant,' just issued by the British Chemical Plant Manufacturers' Association, is a foreign language key which adds materially to the usefulness of the publication. Now published every two years, this directory has three main sections:—(1) a list of members' names and addresses, with their overseas agents where they have wished to publish them; (2) an illustrated section consisting of members' advertisements; and (3) a classified index of products and services prefaced by advice to inquirers and followed by a key in French, German and Spanish. The number of members listed is 192, as against 168 in the 1951 edition. The manner in which this publication has grown with each edition reflects not only the growth in the representative nature and strength of the BCPMA but the firm establishment in the UK of chemical engineering as the fourth primary technology. A limited number of free copies of the directory is available to chemical plant users, who should apply, on their trade notepaper, to the Secretary, Mr. J. L. Good, BCPMA, 14 Suffolk Street, London, S.W.1.

# *Law & Company News*

## *Commercial Intelligence*

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

### Mortgages & Charges

(Note.—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.)

Clay & Son, Ltd., London, E., fertiliser manufacturers, etc. (M., 16/5/53.) 2 April, mortgage to Midland Bank, Ltd., securing all moneys due or to become due to the bank; charged on three policies of assurance and moneys assured thereby, etc. (subject to etc.). £43,825. 31 October, 1952.

United Sulphuric Acid Corporation, Ltd., Widnes. (M., 16/5/53.) 8 April, charge supplemental to a Trust Deed dated 5 October, 1951; charged on certain land and premises at Widnes with fixed plant, machinery, etc. (comprised in a conveyance dated 20 February, 1953). £3,000,000 (£2,250,000 in instalments paid up to date of this return). 9 July, 1952.

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### Increases of Capital

The following increases of capital have been announced: William Edge & Sons, Ltd., from £1,000 to £51,000; H. H. & L. Gee, Ltd., from £100 to £1,000; Howards of Ilford, Ltd., from £100 to £1,000,000; Lyon & Lyon, Ltd., from £350,000 to £480,000; Totem Chemicals, Ltd., from £2,000 to £4,000.

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## *New Registrations*

### Bofors (Gt. Britain) Ltd.

Private company. (519,451.) Capital £20,000. Manufacturing, analytical consulting, pharmaceutical and general chemists, importers and exporters of and dealers in chemicals, pharmaceutical products, etc. Subscribers: Wm. H. Hicks, A. Clifton.

### London & Scandinavian Metallurgical Co. Ltd.

Private company. (519,332.) Capital £250,000. Metallurgical and chemical manufacturers, metallurgists, metal merchants, importers and exporters, and dealers in metals, alloys, chemicals, ores and mineral substances. Directors: H. Grunfeld, E. I. Grunfeld, W. Sachs, R. Nilson, M. N. T. Gubbins. Reg. office: 39 Hill Road, Wimbledon, S.W.19.

### Vendex Co. Ltd.

Private company. (519,139.) Capital £1,000. Manufacturing, research, dispensing and analytical chemists and druggists, etc. Directors: E. W. Herren and E. G. Fidler. Reg. office: 30 Hart Street, Henley-on-Thames, Oxon.

### Corrosion Proof Products Ltd.

Private company. (519,110.) Capital £1,000. Manufacturers of and dealers in cements, gravel, sand, concrete, lacquers, metals, synthetic resins, natural and synthetic rubber, tar, pitch, asphalt, carbon, asbestos and similar materials, etc. Directors: L. S. Mills, A. Moore, R. L. Shiell. Reg. office: 14 Southampton Place, W.C.1.

### Tunisian Industrial Research Ltd.

Private company. (519,138.) Capital £50. Manufacturing, consulting, research, dispensing, processing and analytical chemists and druggists, manufacturers of and dealers in chemicals, drugs, manures, fertilisers, etc. Directors: J. Grant and J. P. L. Spiteri. Reg. office: 107 Fenchurch Street, E.C.3.

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## *Company News*

### Albright & Wilson Ltd.

The expansion programme of Allbright & Wilson Ltd. has been well maintained according to the chairman, Mr. Kenneth H. Wilson, in a statement issued with the annual report and accounts for the year ended 31 December last. The new factory at Barry is already producing silicones and other chemicals. The Kirkby plant recently came into operation and the new phosphorus plant at Portishead is scheduled to produce early in 1954. To cover these developments a further loan of £1,500,000 was negotiated, subject to the approval of the Capital Issues Committee. Net profit of the group for 1952 (after all charges, including taxation) was £594,653, compared with £859,256 for the previous year. A final ordinary dividend of 10 per cent is recommended, making 15 per cent for the year.

### Brotherton & Company Ltd.

Efforts are being intensified by Brotherton & Co. Ltd., not only to maintain the position that has been won for the company's products, but to improve those products and expand along new lines of development. In a statement issued with the annual report and accounts for the year ended 31 December last, the chairman, Mr. Bertram L. Ratcliffe, goes on to say that a site has been acquired in Cheshire for erecting laboratories to follow up the work at the central research station in Leeds and develop existing and new products. A start would soon be made on the erection of a large and improved liquid sulphur dioxide plant at the Bromborough works to meet increasing demand. Further plant to ensure more efficient production of sulphuric acid and sulphate of ammonia at Birmingham was about to be installed. As already announced, a final dividend of 7½ per cent is recommended, making 12½ per cent for the year.

### Bowman's Chemicals Ltd.

'Exceedingly difficult' trading conditions during the year ended 31 October last are referred to in the directors' report to be presented at the annual meeting of Bowman's Chemicals Ltd., at Warrington, on 29 May. In the latter part of the year, states the report, because of the lack of demand for lactic acid and the accumulation of large stocks, it became necessary temporarily to reduce the production of the plant to the lowest level at which the bacterial elements could be preserved, the cost of this reduced production being uneconomic. The loss of £27,252 shown in the accounts was almost entirely due to the fall in stock values. Since October trade had been somewhat better, but on a lower level than in 1950 and 1951.

### Unilever Ltd. and Unilever N.V.

The boards of Unilever Ltd. and Unilever N.V. are recommending to the annual meetings of their respective companies on 10 June, the final ordinary dividends for 1952 as follow: Unilever Ltd.: 8½ per cent actual (1s. 8.4d. per £1 of stock) less tax, making 13½ per cent for the year ended 31 December 1952 (1951—13½ per cent); Unilever N.V.: 7½ per cent actual (Fl. 75 per share of Fl. 1,000) making 12 per cent for the year (1951—12 per cent), less 15 per cent dividend tax. Combined trading profit on the groups' operations throughout the world was £38,921,000 (1951 £53,933,000) and the combined consolidated net profit was £21,056,000 (1951 £18,838,000).

# *Market Reports*

LONDON.—Activity on the industrial chemicals market has been largely confined to urgent deliveries to the chief consuming industries, but there has been a steady inquiry for fresh business, and a more confident tone has been felt in most sections. Price movements have again been few and quotations generally remain firm. A further change in the basis prices of lead compounds came into operation on 6 May, the new basis prices being: dry red lead and litharge £112 15s. per ton and dry white lead £129 5s. The lower rates ruling for zinc compounds has not influenced the demand. Among the coal tar products a steady business has been put through in carbolic acid, and there is a ready outlet for pyridine and creosote oil.

MANCHESTER.—Fairly satisfactory trading conditions have been reported this week on the Manchester market for heavy chemical products. The cotton and woollen textile industries and a number of other chief industrial consumers are calling for reasonably steady deliveries under contracts and in the aggregate additions to order-books had been fairly satisfactory. Shipments of the alkalis and other leading heavies have also been pretty well maintained. Price changes on balance for the week have been few and relatively unimportant. Among the tar products, there is a steady demand for creosote oil and most of the light distillates.

GLASGOW.—There was little or no change during the week in the demand for general chemicals. Naturally the demand for agricultural chemicals is at the moment heavy and altogether business during the past week has been quite satisfactory in the home market.

# DISTEC

## gives you 90% PURITY

## and

## LOW IODINE VALUE in these FATTY ACIDS

| | | |
|---|---|---|
| Caprylic | $C_7 H_{15}$ | COOH |
| Capric | $C_9 H_{19}$ | COOH |
| Lauric | $C_{11} H_{23}$ | COOH |
| Myristic | $C_{13} H_{27}$ | COOH |
| Palmitic | $C_{15} H_{31}$ | COOH |
| Stearic | $C_{17} H_{35}$ | COOH |
| Behenic | $C_{21} H_{43}$ | COOH |

***Also Available:***

Caprylic-Capric
Commercial Stearic
Mixed Unsaturated Acids

### WE'RE GLAD TO MEET PEOPLE WITH PROBLEMS

How often we talk to people with *special* processes needing *special* fatty acids! And as many times, we're pleased to say, we are able to supply just the formulae they require . . . specially made up if necessary. Let us call on you right away for a discussion of your *own* problem.

*For fully descriptive catalogue, prices and samples, write to the manufacturers :*

**HESS PRODUCTS LIMITED, 4 ALBION STREET, LEEDS, 1**
LEEDS 22827

## *Next Week's Events*

MONDAY 18 MAY

**Institute of Metal Finishing**

London: Northampton Polytechnic, St. John Street, 6 p.m. E. S. Spencer-Timms: 'Instruments for the Determination of Coating Thickness: A Review of Commercial Instruments.'

TUESDAY 19 MAY

**Society of Instrument Technology**

Manchester: College of Technology, 7.30 p.m. E. B. Moss: 'Electrical Tachometry.'

**Society of Chemical Industry**

London: Royal College of Science, Imperial Institute Road, S.W.7, 2.15 p.m. Annual general meeting of the Agriculture Group. Followed by ordinary meeting. Sir Geoffrey Clay: 'The Colonial Agriculture Service.'

WEDNESDAY 20 MAY

**Institute of Metal Finishing**

Glasgow: Institution of Engineers & Shipbuilders, 39 Elmbank Crescent, 7 p.m. A. W. Wallbank: 'Some Aspects of Barrel Plating.'

FRIDAY 22 MAY

**Royal Institution of Great Britain**

London: 21 Albemarle Street, W.1, 9 p.m. Sir Lawrence Bragg: 'The Discovery of X-ray Diffraction by Crystals.'

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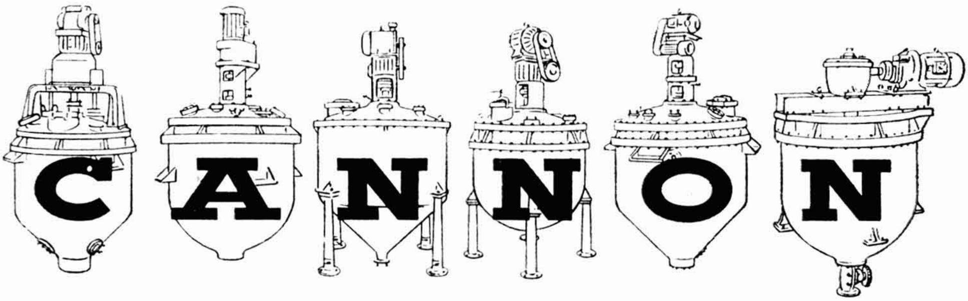
### Tar Works Plant

Proabd (England), Limited, a recently formed British chemical engineering organisation, are fully equipped for the design and manufacture of complete plant for the continuous distillation of tar, recovery of by-products, refining of solvents, extraction and refining of tar acids, production of naphthalene, benzol, toluol and light oils, etc. Their office at Wheatsheaf House, Carmelite Street, London, E.C.4, enjoys technical liaison with the Societe Proabd of Nancy, France, and is under the management of Mr. A. F. Peart.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# CLASSIFIED ADVERTISEMENTS

## SITUATION VACANT

*The engagement of persons answering this advertisement must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

**HONG KONG**
**TAR DISTILLATION PLANT MANAGER**

**ACTIVE TAR DISTILLATION PLANT MANAGER** wanted to operate 12 tons per day plant. Knowledge of tar distillation, chemical and physical characteristics of tar and tar products, and disposal of such products is desirable.

Salary £40 per week inclusive, plus 6 months' leave on full pay with return passage paid after 3 years' service. The advancement of a suitable applicant is assured.

Applications in Duplicate, giving full details of qualifications, experience and personal circumstances with copies of 2 recent testimonials to **MESSRS. ALLEN & WILLIAMS, CHARTERED CIVIL ENGINEERS, 1, VICTORIA STREET, LONDON, S.W.1,** before Thursday, 4th June, 1953.

## FOR SALE

**MORTON, SON AND WARD LIMITED**
offer
**HYDRO EXTRACTORS**

72 IN., 60 in., 48 in. and 36 in., by **BROADBENT**; 48 in. and 42 in., by **WATSON LAIDLAW**; and 42 in., by **MANLOVE ALLIOTT.** All electric, 400/3/50, and complete with starting equipment.

**JACKETED PANS**

100g., 150g. and 200g. New **JACKETED PANS,** all welded on three legs—with or without mixing gear.

One 350g. Totally Enclosed **HOMOGENEOUS LEAD-LINED JACKETED PAN,** arranged with lead covered agitator driven through bevel gears from fast and loose pulley.

**MIXERS**

**"MORWARD" "U"-SHAPED POWDER MIXERS** made to requirements up to 3 tons capacity.

3-cwt. Second-hand **MIXERS** by **CHALMERS** and **GARDNER,** in stock; stainless steel lined troughs.

**LEAD-LINED VESSELS**

Two 100g. and one 75g. Totally Enclosed Cylindrical Lead-lined Vessels. As new.

**STAINLESS STEEL TANKS**

Two Stainless Steel Tanks, Open-top Rectangular, 10 ft. by 5 ft. by 4 ft. deep, and one 8 ft. by 5 ft. by 3 ft. deep, 10's gauge. Second-hand, in good condition.

One **CHRISTY** and **NORRIS DISINTEGRATOR,** Size 00, arranged with automatic feed and motorised.

**PUMPS**

A large selection of **MONO** and other **PUMPS** in stock 2 in. to 6 in., new and second-hand.

**INQUIRIES INVITED**

**MORTON, SON AND WARD LIMITED,**
**WALK MILL,**
**DOBCROSS, NR. OLDHAM,**
**LANCS.**
Phone: Saddleworth 437.

## FOR SALE

"**ALITE**" 400 lb. **MIXER** for sale, type GM, opening at bottom of powder mixing chamber, 6 in. by 6 in. Electrics for 400/440/3/50 supply. **F. J. EDWARDS, LTD., 359, EUSTON ROAD, LONDON.**

**CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELEPHONE 3285 EAST.**

**ECONOMIC BOILERS.**—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p. Twenty others, all sizes.

**NEW GALVANISED PIPING.** Immediate delivery.

TWO Johnson Filter **PRESSES,** 25 in., 18 Frame, practically new.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**

TWO Stainless Steel **TANKS,** 3 ft. 6 in. diam., 200 galls.

ONE Stainless **CONICAL HOPPER,** 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.

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

FOUR Papier-mache O.T. **TANKS,** 8 ft. 3 in. diam., 9 ft. deep. (Unused.)

SIX O.T. **TANKS,** 7 ft. diam., 14 ft. deep, rubber and brick lined.

SIX Aluminium **CONDENSERS,** 14 ft. long by 2 ft. 6 in. diam. 386 Tubes, ⅞ in. o.d.

FORTY Riveted **RECEIVERS,** 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lb. w.p.

**CAST-IRON PIPES,** 5,000 ft. Each 6 in. and 8 in. **NEW VALVES** in Stainless, Gunmetal, Enamel Lined.

Free Catalogue, "Watkins Machinery Record," available.

**FRED WATKINS, COLEFORD, GLOS.**

**GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14. (Tel. East 1844.)**

**STORAGE**
**USE BOILER TANKS**
**FOR CHEMICALS**

**WE specialise in 30 ft. by 8 ft. diam. TANKS (each 9,000 galls).**

**Ready for use.**

**MADEN & MCKEE LTD.**
**317, PRESCOT ROAD,**
**LIVERPOOL, 13.**

30 **CWT. CHAIN BLOCKS,** 10 ft.-12 ft. lift, ex-Government surplus. £15 per set.

**5 CAST-IRON JACKETED PANS,** 36 in. diam. by 27 in. deep, 1½ in. bottom outlet. £20 each.

**1 MILD STEEL WELDED OPEN-TOP TANK,** 60 in. by 27 in. by 42 in. by ⅝ in. plate. £25.

**THOMPSON & SON (MILLWALL), LTD.,**
**CUBA STREET, MILLWALL, E.14.**
**TEL. EAST 1844.**

## FOR SALE

3 **JACKETED INCORPORATORS,** double ' Z " arms, double geared, power-driven tipping motion, with counterbalancing weights.

1—Baker Perkins **MIXER** as above, not steam jacketed, single geared, complete with 25 h.p. A.C. motor.

3—Baker Perkins and Werner Jacketed **MIXERS** screw tipping pattern, friction pulley drive, single geared, with double-fin type agitators.

4—Gardner **RAPID SIFTER MIXERS** and **MIXERS** only, various sizes, one with brass fitted interior and glass-lined end plates.

27—Various **POWDER DRESSING** or **SIFTING MACHINES,** totally enclosed with barrels from 80 in. long by 22 in. diam. to 120 in. long by 30 in. diam., belt driven with collecting worm in hopper bottoms.

1—Simon Horizontal Tubular **DRIER,** 12 ft. long, 100 lb. steam pressure, size 3B, requiring 12 b.h.p.

4—Recessed Plate **FILTER PRESSES,** 30 in. square, 70 plates in each, centre fed.

5—Johnson **FILTER PRESSES,** 24 in. square, side feed and enclosed delivery, fitted 29 plates and 30 frames.

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

Johnson Oil **FILTER PRESS,** Premier type plates 2 ft. 8 in. by 2 ft. 8 in., of which there are 45, with angle lever closing gear.

1—Johnson **FILTER PRESS,** 42 C.I. plates, 32 in. quare, centre feed.

Steam-heated **FILTER PRESS,** Premier type, 32 in. square, with 30 recessed plates.

Wood **FILTER PRESS,** fitted 69 ribbed plates, 2 ft. 8 in. square, with top centre feed and bottom enclosed delivery channel.

1—24 in. **HYDRO EXTRACTOR,** self balancing, swan-neck type, self emptying bottom.

Heavy Cake **CRUSHING MILL,** 2-pair high, by Nicholson, for cake up to 3 in. thick, rolls 30 in. long, top with coarse teeth 9 in. diam., bottom with finer teeth 12 in. diam.

5 Sets A.A. **CRUSHING ROLLS** for linseed, cotton seed, etc., 48 in. long, belt driven, with feed hopper side frames, baseplate and striking gear.

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

Douglas **ROTARY PUMP** for oil, soap, etc., belt driven.

6 Various Horizontal Duplex **STEAM PUMPS,** Worthington and Tangye pattern, 1 in. to 2½ in. suction and delivery.

" U "-shaped Horizontal **MIXER,** 8 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven, end outlet, square horizontal centre shaft with cast radial type mixing arms, last used for lineoleum paste.

1—" U "-shaped **MIXER,** as above, but 7 ft. long.

4—5-roll **REFINERS,** fitted chilled iron, water-cooled rolls, 40 in. long, 16 in. diam., belt and gear driven, with clutch drive suitable for motor, by Baker Perkins, Ltd.

No. 2HS Hammamac **HAMMER MILL,** No. 1 size, Standard Miracle Mill, No. 2 size Standard Miracle Mill and a No. 3 Super Miracle Mill, with fans, piping and cyclones.

7 ft. Torrance Positive-driven **EDGE RUNNER,** 2 Vertical Paint Pug Mills, 2-bar Disc Paint Grinding Mills, and 2 Horizontal 40-gallon capacity Cox Pug Mills for paint.

1—No. 1A Water-cooled **CIRCULATOR MILL.**

**RICHARD SIZER, LTD**
**ENGINEERS,**
**HULL**
**Telephone 31743**

## FOR SALE

**STAINLESS STEEL STEAM-JACKETED STILL.** 50 gal. capacity. 3 ft. 6 in. inside diam. by 1 ft. 7 in. deep at centre. Aluminium domed cover with swan-neck and sight glasses.

**STEAM JACKETED COPPER STILLS** of 150, 100 and 80 gal capacity, fitted swan-neck, sight and light glasses, etc. Complete with coil condenser and receiver. 40 lb. p.s.i. working pressure.

**STAINLESS STEEL CRYSTAL DRYER,** 3 ft. 6 in. diam. by 1 ft. 6 in. deep. **STEAM JACKETED** flat bottom with two stainless steel paddles underdriven through bevel gearing from 1 h.p. 400/3/50 geared motor. Jacket working pressure, 15 lb. p.s.i.

**STAINLESS STEEL STEAM JACKETED** Open-top **BOILING** and **EVAPORATING PANS,** 50 gal. capacity. 40 lb. p.s.i. working pressure.

**MILD STEEL ETHER** or **SPIRIT EXTRACTION PLANT,** comprising 3 ft. diam. by 5 ft. deep extractor with dished bottom jacketed for 5 lb. p.s.i. condenser, separator, storage tank.

**VACUUM DRYING OVEN** by **TAYLOR,** 4 ft. by 2 ft. 10 in. by 4 ft. 6 in. front to back, having ten steam-heated mild steel platens. Hinged door at each end. Working pressure, 15 lb. p.s.i.

**STEAM JACKETED MILD STEEL VACUUM DRYING OVEN,** 3 ft. I.D. by 7 ft. long internally fitted 5-bank steam heating coil supporting 15 aluminium trays in five tiers of three. Rear end dished; domed door secured by 8 swivel clamps. Jacket and coil working pressure, 20 lb. p.s.i.

**DITTO,** 3 ft. I.D. by 5 ft. long internally having 10 **STAINLESS STEEL** Trays in 5 tiers of two. Quick-release cast-iron door with handwheel operated spider locking device. Jacket and coil working pressure, 20 lb. p.s.i.

**PROCESS & CHEMICAL ENGINEERING CO., LTD.,**
**6/8, NORTHUMBERLAND PARK,**
**TOTTENHAM,**
**LONDON, N.17.**
Phone : **TOT**enham 2436 (3 lines).

# 600

**PROCESS PLANT**

**WATER-COOLED BALL MILL** by Houchen, approx. 5 ft. diam. by 6 ft. Capacity 500 gal. Internally lined ribbed cast-iron plates.

**SIFTER MIXER** by Porteous, 62 in. by 27 in. by 32 in. deep. Scroll-type agitator. Brush sifter. Driven through gearing by " V "-rope drive from 6 h.p. S/R. Brook motor, 415/3/50.

200-gal. Vertical S.J. Mild Steel **AUTOCLAVE** by Fraser, Dagenham. Internal dimensions 42 in. diam. by 52 in. deep. Paddle-type agitators overdriven through bevel gears. Bottom and side of vessel jacketed, save for top 9 in. Fitted removable cover. Jacket pressure 330 lb./sq. in.

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