

# THE Chemical Age

VOL. LXXIV

18 FEBRUARY 1956

No. 1910

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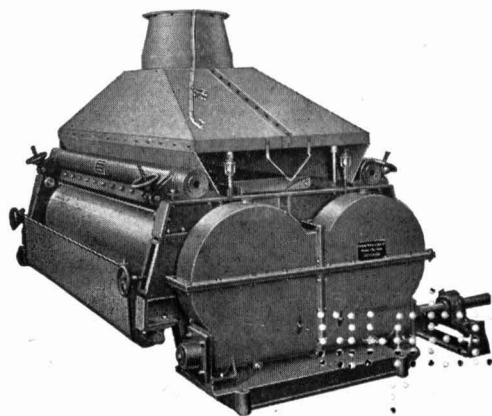
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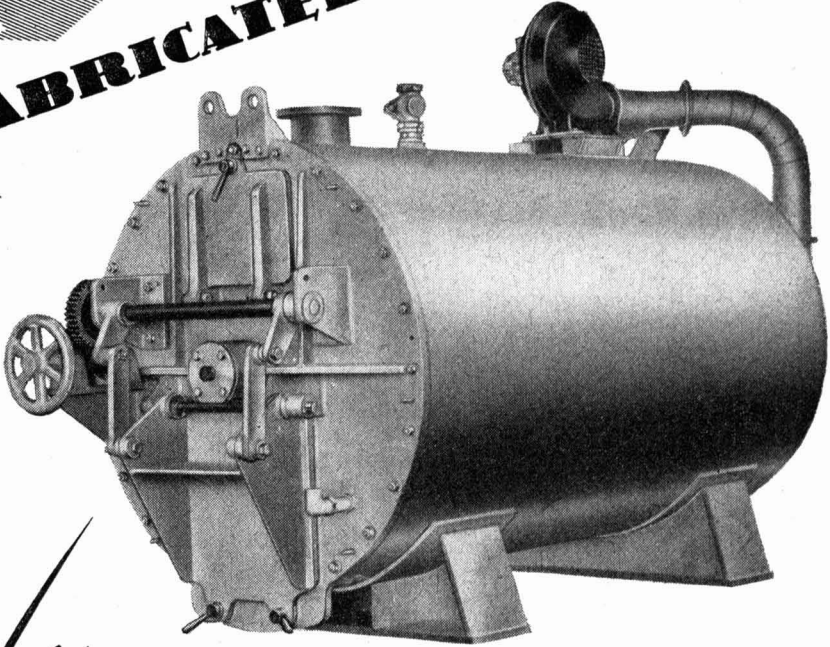
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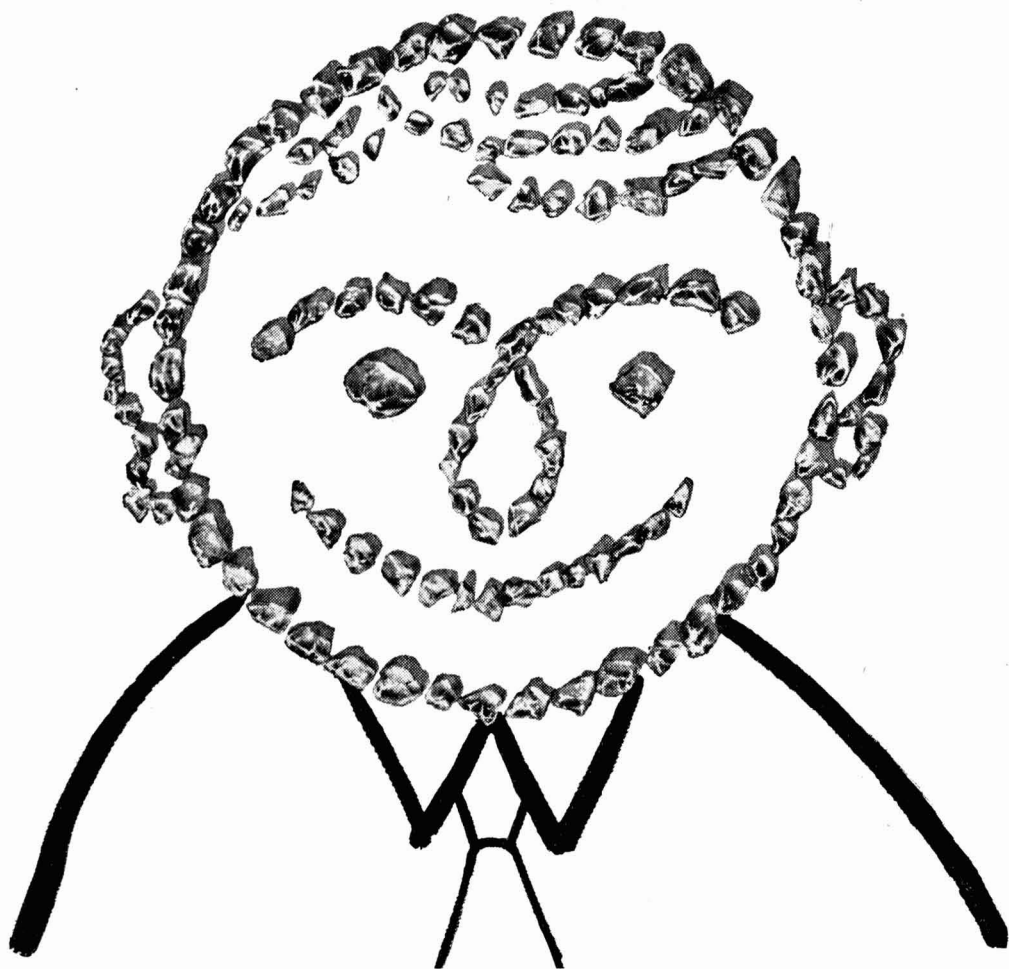
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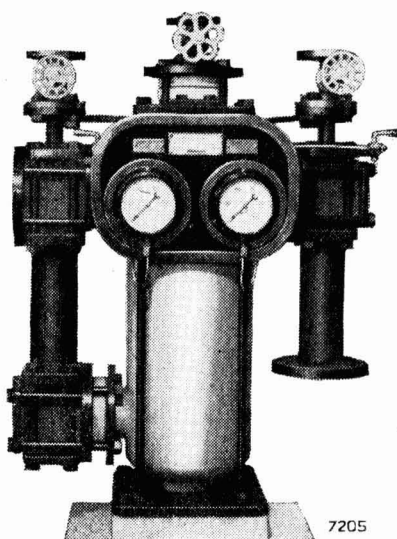
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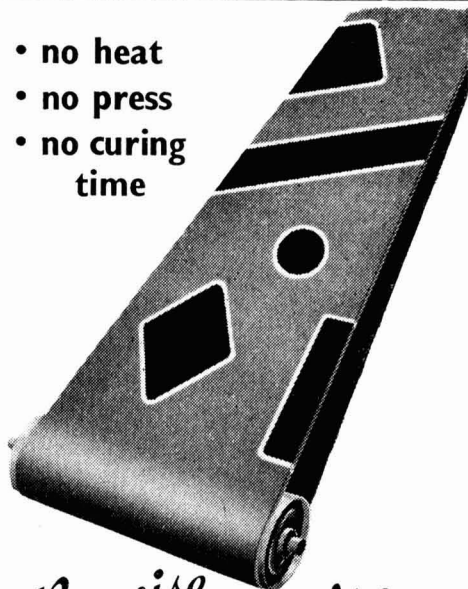
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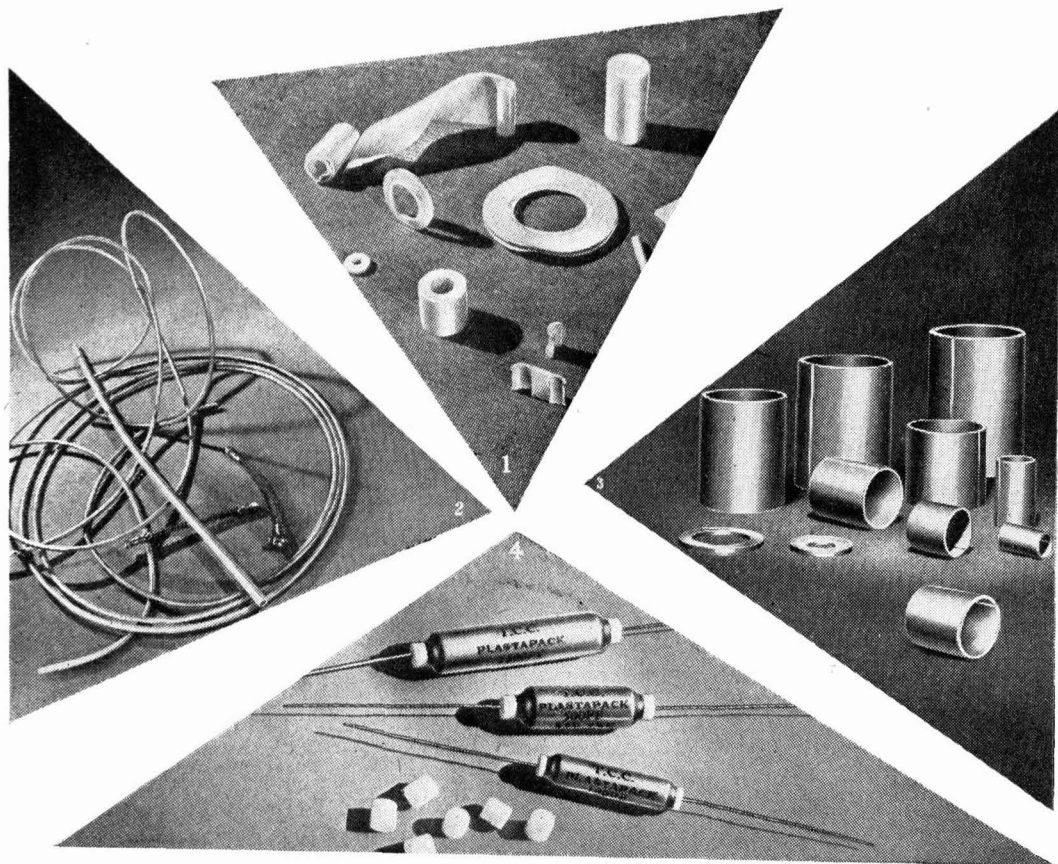
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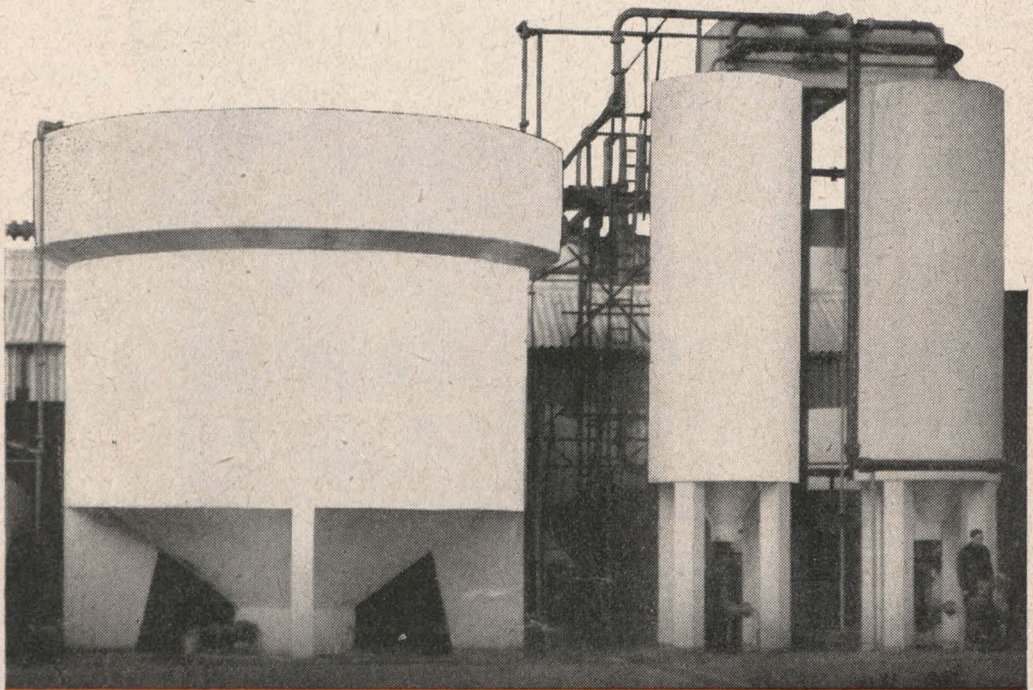
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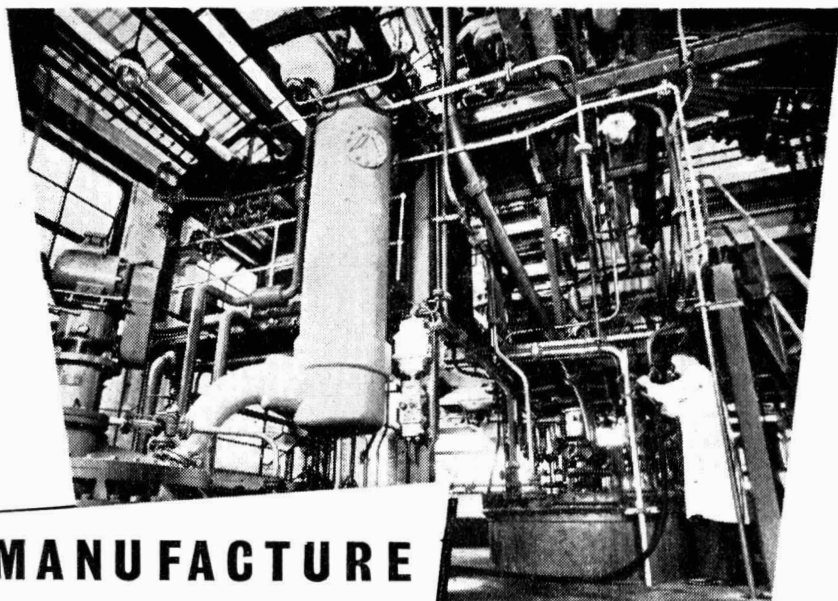
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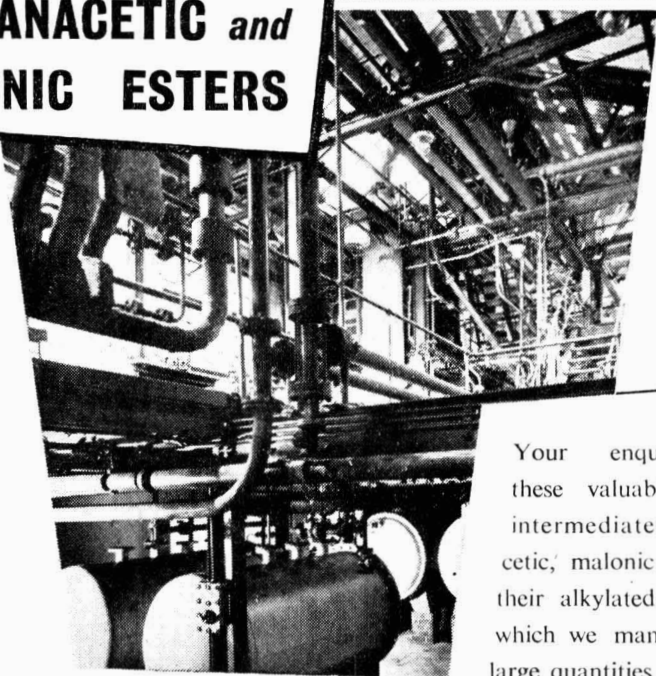
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## CONTENTS . 18 FEBRUARY 1956

I.C.I. Titanium Cheaper	430
The Chemistry of Silicones	431
BAC Salary Recommendations	432
The Norwegian Chemical Industry	433
Quantitative Organic Analysis	435
Canadian Plastics Industry	442
The Chemist's Bookshelf	443
Home News Items	445
Overseas News Items	446
Personal	447
Publications & Announcements	449
New Colour Schedule	450
Law & Company News	451
Next Week's Events	453
Tin Research in 1955	452
Marking Techniques	452
Market Reports	454

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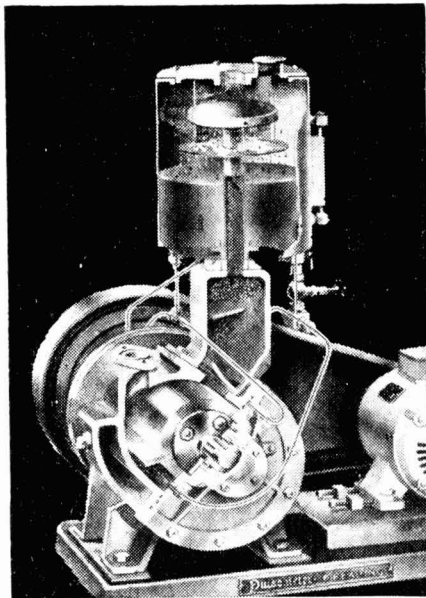
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## Dating the Past

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ARCHAEOLOGY and other studies of the distant past have been aided recently by the new geochemical method of dating matter, radio-carbon dating. In its short lifetime this method has become the best-known technique of geochemical science—indeed, many people have heard of it although they have probably never heard of geochemistry. The ready assumption that this radio-carbon method owes its existence to atomic fission research is far from correct. Parentage must be credited to cosmic ray research. If in many parts of the world scientists had not despatched Geiger-counter-carrying balloons into high altitudes, the fundamental premises for radio-carbon dating would never have been worked out. For this aerial research has shown that the interaction of cosmic rays and air produces an appreciable neutron intensity up to heights of 50,000 feet. These neutrons are short-lived. They are destroyed, mainly through collision with nitrogen. The nitrogen atom plus one neutron becomes a hydrogen atom plus one atom of  $^{14}\text{C}$ , or radio-carbon. The radio-carbon atom is also unstable—it loses a *beta*-particle and becomes an atom of nitrogen. But this takes a fairly long time. Any pound of radio-carbon in existence now will be changing into

nitrogen at such a rate that only half a pound will have disappeared in 5,568 years, and half the residual half-pound in the next 5,568 years.

The processes of radio-carbon formation and decay having been taking place for so many thousands of years, an equilibrium has been reached—with rate of formation equal to the rate at which accumulated radio-carbon decays. The average rate of formation per second per square centimetre of the earth's surface can be calculated from balloon measurements of neutron intensity. This is 2.4 atoms per second per square centimetre. If this is also the decay rate for accumulated radio-carbon, it is then calculable that there must be about 80 tons of radio-carbon on the earth. Only this amount would give a decay rate of 2.4 atoms per second per square centimetre.

Radio-carbon behaves no differently in chemical actions from ordinary carbon. It therefore takes part in the air-plant-air cycle and the air-plant-animal-sea cycle. Neutron intensity varies with latitude and this should cause variations for radio-carbon formation at different parts of the earth's surface, but again time has brought about equality. It is assumed that winds and ocean currents have

balanced the formation differences of latitude. This hypothesis might be considered unsound if practical measurements had not given it good confirmation. Wood samples from many different countries have shown the same radio-carbon content, and this content is in close numerical agreement with the figure deducible from theory.

The possibility of radio-carbon dating arises because assimilation of carbon dioxide ceases when matter ceases to be a part of a plant or animal. It cannot acquire any more radio-carbon; and what it already contains must decay steadily at a known rate. The accurate measurement of matter's radio-carbon content enables the date when it ceased to be part of a living system to be calculated, for the 'equilibrium' radio-carbon content of living matter is already known, both by theoretical calculation and experimental determination.

Measurement is an intricate procedure. The carbon in a test-sample is converted into carbon dioxide by combustion (or acidification of carbonates), and the carbon dioxide is then precipitated as calcium carbonate to separate it from any radon impurities. Acidification produces carbon dioxide again, which is reduced to carbon by magnesium at high temperature. The carbon is made into a slurry and spread on a cylinder for placement in a Geiger counter. The counter has to be screened with special devices to eliminate cosmic ray effects and shut out natural radio-activity. A new simplified method which is said to be more accurate converts the test-sample's carbon into acetylene, and the acetylene is measured in a Geiger counter.

It would, of course, be fairly easy to present the world with some plausible means of dating old things, and no one could prove whether the dates put forward were right or wrong. However, for a number of preserved ancient articles the original dates are reasonably well known, and radio-carbon dating of such objects has given convincing agreement. Wood from an ancient Egyptian coffin known to be 2,280 years old was radiodated to be 2,190 years old plus or minus 450 years. A famous American giant

redwood tree cut down in the last century has a known age since each growth ring in the wood indicates a single year. Wood samples from between the 2,905th and 2,802nd rings gave a radio-carbon age of 2,710 years plus or minus 130 years. The age of Stonehenge has been estimated by archaeological research at 3,750 years. By astronomical evidence it has been calculated to be 3,800 plus or minus 200. Charcoal and cremated human remains found a few years ago at Stonehenge have given a radio-carbon date of 1848 BC plus or minus 275. There is now a sufficiency of this kind of evidence of agreement in dating to place the radio-carbon method beyond doubt.

Other radio-active dating methods have been considered. But ages of minerals deduced by measuring isotope ratios for certain lead and uranium isotopes do not give enough agreement. Lead is lost from minerals, radon leaks out of them, and also some of the necessary decay calculations cannot be precisely done. No method offers the same reliability and simplicity as the radio-carbon method. However, sedimentary rocks can rarely be radio-dated by any method for they do not often contain enough radio-active matter.

Radio-carbon dating should not be dismissed as a sort of modern museum-piece, of practical interest only for students of the remote past. Although many of its contributions must lie in that field, others may have an impact upon modern knowledge. The movements of deep ocean waters can be investigated more accurately by radio-dating. The deeper water cannot assimilate radio-carbon from the air and it is therefore as date-measurable as dead matter. Ocean-bottom samples have been radiodated and the indicated age of the water suggests it has much slower circulation movement in the world than previously supposed. The age of oil deposits and the period of time required for hydro-carbon formation are being investigated by radio-carbon dating methods. Former ideas have already been considerably shaken. Petroleum formation no longer seems to require hundreds of thousands of years, perhaps only a few thousand years.

# Notes & Comments

## A Case of Perfection

**G**OOD technical publicity aimed at the intelligent but relatively non-technical reader is one of the important operations of salesmanship. Indeed, it is one of increasing importance. We have from time to time chided British industry for a tendency to regard this kind of thing with apathy. Comparisons with American efforts by industry have often been unflattering. However, it is a more than happy change to be able to give unstinted praise to a new British industrial publication that in our view would receive an 'Oscar' for any post-war year and in competition with any British or American publication of this kind—if, of course, there were, as there might well be, Oscar awards for commercial and industrial publicity efforts. The publication is Messrs. Fisons' 'The Phosphorus Story', written for them by Sylvia Laverton, B.Sc., A.R.I.C., and illustrated by John T. Polak. Its angle is, of course, the fertilizer use of phosphorus-containing materials, and it is aimed at the practical user. If it merely dealt in detailed recommendations for various products made by this company, none of the excellence of presentation would lead us to praise it so highly. But the text is lifted high above this sales-list level. The basic principles of why and how are put across with forceful simplicity. Virtually, this is the horse of science being put before the cart of empirical application. The booklet has 48 pages and 29 illustrations in colour, eight of the latter being of full-paged size. These are superbly done whether their aim is ordinarily illustrative or diagrammatic. Art has been delightfully recruited in the service of science.

## Worth the Trouble

**M**OST of the major groups of chemical products are finally used by practical people engaged in other sorts of manufacture. Most of the purposes for which these chemicals are used have a sound scientific basis,

and the use of fertilizers by farmers is not within these broad terms at all exceptional. More industry-produced publications of this kind must be worth all their trouble and cost through the long-term benefits that they can bring—in greater technical understanding, in increased consumer-interest, and, perhaps not least, in prestige gains for the company and the chemical industry.

## Pipelines

**N**OT much depth and length of freezing winter weather is needed in Britain to underline the old story of unplanned plumbing and poor pipeline materials. Press reports at the end of the recent cold spell referred to pipe-bursts by the thousand in all areas. In one of our own domestic cases, the household plumbing is particularly well sited—with all exposed sections placed near chimney flues or hot-water pipelines—but a cold water pipe supplying the cistern of an outside lavatory did not survive. Made of copper, it split under expansion pressure in two places. This was the one weak spot in an otherwise well-planned system of water-piping. It need not have been. Polythene piping would have been sufficiently flexible to stand the expansion. It seems that local authorities in the country differ in their attitudes towards polythene piping for cold water. There has surely been long enough by now for a decision of general acceptance to have been reached. 'Tests are still in progress. . .' It might be pointed out that every time the thermometer stays below 25—30°F for a few days, materials that are at present accepted for cold water pipes receive a large-scale national test and the final result is poor.

## Powerful Pointer

**I**N America the tube section of US Steel has recently introduced polyvinylchloride piping into the oil field market. This active interest of a vast metal goods company in plastics piping is a powerful pointer towards the future. A 3,500-foot long pvc pipeline weighed

little more than a ton and could be carried on one truck, (see *Chemical & Engineering News*, 1956, **34**, 402). A pipe-laying gang were able to put down 2,800 feet of two inch piping in less than 105 minutes. Plain-ended or thread-ended sections are made, but there seems some preference for the former. Jointing is easily done using a solvent cement; although a day or more is needed for the joint to develop its full strength, the immediate strength is adequate for continuous pipe-laying to proceed at a maximum pace.

### ICI Titanium Cheapest

BY REDUCING the price of their raw titanium to about 21s (below \$3) per lb., ICI have become producers of the cheapest, high-purity titanium in the world. Current price in the US, the biggest producer and user of titanium, is \$3.45 per lb.

It was in August 1953 that ICI announced they were to build a plant to produce 1,500 tons of titanium a year by a new sodium process of their own development. By 1955 the plant was completed and in operation. Titanium produced by the ICI process differs from the coke-like 'sponge' titanium produced by the conventional Kroll process in that it is in the form of small granules which can be pelleted with alloying materials.

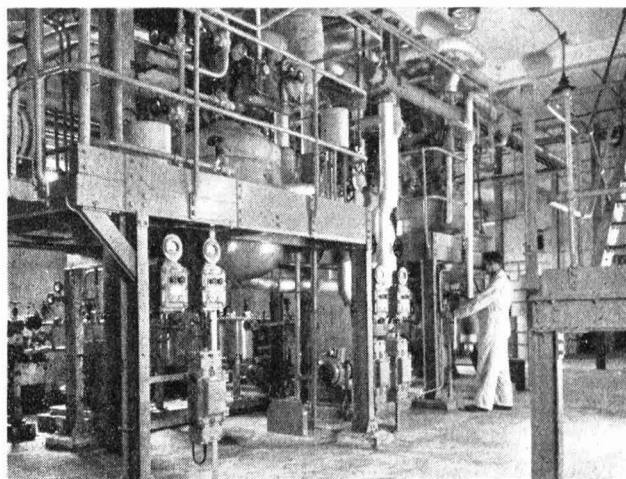
So far only 12 companies have entered the field of raw titanium production on a large scale, and competition to improve ex-

traction techniques and bring about price reductions has been fiercely contested. As the result the price of high-grade titanium has dropped in five stages from \$5 per lb. in 1954 to the current US price of \$3.45. ICI'S new price may mean that titanium may have a wider industrial importance than the confines of the aircraft industry.

### Anglo-Dutch Symposium

THE Institution of Chemical Engineers and the chemical engineering group of the Society of Chemical Industry have accepted the invitation of the chemical engineering group, Het Koninklijk Instituut Van Ingenieurs, and the section for chemical technology, De Koninklijke Nederlandske Chemische Vereniging, to hold a symposium on 'The Scaling-up of Chemical Plant & Processes' in London in June next year. The symposium will be planned on the lines of the one held in Amsterdam last year which was a two-day event.

Realising that the symposium will have a wide appeal the organizers are determined to present papers of a high standard and they invite original contributions on theoretical and practical aspects of chemical engineering. British authors are invited to forward the titles and summaries of papers they propose submitting, to Mr. R. C. Odhams, the hon. secretary of the chemical engineering group or Mr. R. Edgeworth Johnstone, the chairman of the publications committee, at The Institution of Chemical Engineers, 56 Victoria Street, London SW 1.



*A new photograph taken in the silicones plant at Ardeer. This plant, which belongs to Imperial Chemical Industries Limited, came on stream less than a year ago*



# The Chemistry of Silicones

## Lecture to RIC London Section

**SILICONES**—Their Manufacture, Application and Analysis' was the title of a lecture given on 1 February by Mr. J. S. Hughes, B.Sc., F.R.I.C. and Mr. R. L. Bass, B.Sc., A.R.I.C., before the London section of the Royal Institute of Chemistry at the South-West Essex Technical College, Walthamstow.

Mr. Hughes began his lecture on manufacture and application by referring briefly to Kipping's pioneer work in this field. He described the two methods at present in use for the production of the starting materials, the alkyl and aryl chlorosilanes—the first a Grignard reaction between silicon tetrachloride and alkyl or aryl magnesium chloride, the second the direct synthesis method due to Rochow.

### Distillation & Blending

The subsequent distillation and blending followed by hydrolysis and condensation to produce varying types of silicone products were then discussed. Finally, Mr. Hughes described, with the aid of demonstrations, some of the many varied applications of silicone products including their incorporation in paints, water repellent preparations, lubricants and rubbers.

Mr. Bass, dealing with the analysis of silicones, began by discussing the methods available for the analysis of the alkyl and aryl chlorosilanes and the liquid silicones. Qualitatively, silicon was detected by ashing after any fillers present had been separated by either solvent extraction or depolymerization. The usual combustion methods enabled carbon and hydrogen contents to be determined and, although it was possible to use dry combustion for the evolution of silicon, it was not to be recommended.

The safest method for the estimation of silicon was by combustion of the silicone with sodium peroxide in a Parr bomb and subsequent determination of the silicon either gravimetrically as silica, or as silicomolybdate oxine, or colorimetrically as the molybdenum blue complex.

The use of infra-red spectroscopy was of great value particularly for mixtures where analysis by fractional distillation was time

consuming. This made it particularly useful for production control. Use was also made of the reactivity of certain atoms or groups attached to silicon atoms, thus hydrolysable chlorine could be determined by hydrolysis and titration of the acid liberated.

Great use was made of accurate determinations of physical properties such as specific gravity, boiling point, refractive index, in analysis. This was illustrated by reference to the use of specific gravity determinations in the analysis of the methyl chlorosilanes. Mr. Bass commented on the use of vapour phase chromatography but emphasized that the work was in its infancy.

With regard to the analysis of finished products the lecturer stated that chemical analysis was not used extensively in routine testing, more use being made of measurements of physical properties.

Afterwards the lecturers answered questions on varied aspects of silicones including their removal from glass, molecular weight determinations, thermal stability and adhesion.

---

## Titanium Pigment Prices Up

INCREASED prices for the standard range of titanium pigments produced by Laporte Titanium Ltd. came into force on Monday, 6 February. The company states that the higher selling prices are due to increased costs in wages, raw materials, freight and other charges.

The new prices are:— Runa R.H., £10 per ton; Runa R.G., £8 per ton; Tiona G and Tiona W.D., £12 per ton; Tiona S, £10 per ton; Tiona 80, £9 12s per ton; Tiona 50 titanium white, £9 per ton; Tiona 25 titanium white, £6 per ton; Tocarba 25 titanium pigment, £6 per ton.

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### ICI Subsidiary Sells Premises

Marston Excelsior Ltd., a subsidiary of ICI, have sold their premises in Paul Street, Wolverhampton, to the Wolverhampton Die Casting Co. Ltd.

## Salaries for Chemists

### New BAC Recommendations

A REVISED edition of the 'Recommended Scale of Minimum Salaries for Chemists and Chemical Assistants' has been published by the British Association of Chemists. The Association emphasizes that the recommendations are for minimum salaries. In many cases, dependent on the responsibilities, nature and location of the post, it will be necessary to offer rates significantly greater than these scales in order to attract the better type of chemist or assistant.

The minimum salary recommended for senior chemists in posts carrying exceptional responsibility is £2,000 per annum upwards. For senior chemists in posts at executive or management level, a minimum salary of £1,250-£2,000 per annum is recommended.

Qualified chemists should, according to the new scales, receive a minimum salary of £750 per annum rising by increments of not less than £60 per annum for a minimum of eight years. The qualifications specified for this scale are: M.B.A.C., or a degree in science, or A.R.I.C., or equivalent technological qualification, such as A.S.D.C., A.I.R.I., etc., plus one year's subsequent academic or industrial experience. Other rates for qualified chemists remain much the same as before, except that increments have been added to the recommended minimum salaries. Slight alterations have been made in the previously recommended scales for chemical assistants and junior assistants.

The Association recommends that facilities for part-time education during the day time (eight hours per week with pay), should be granted to all assistants up to the stage of obtaining a degree, A.R.I.C., or H.N.C.

### UK Agents for US Firms

C. J. W. MACAULAY, chemical consultant and marketing adviser, National House, Wardour Street, London W1, has been appointed official accredited sales representative for the UK on all products of the chemical divisions of the Food Machinery & Chemical Corporation, of the US.

The chemical divisions are: Buffalo Electro Chemical Co. Inc., (Becco Sales Corporation) of Buffalo, New York, producers of peroxygen chemicals; Ohio-Apex Division of Nitro, West Virginia, manufac-

turers of primary plasticizers; Westvaco Chlor-Alkali Division of New York, manufacturers of alkalis, chlorinated chemicals, carbon disulphide, carbon tetrachloride, etc.; and Westvaco Mineral Products Division of New York, phosphate manufacturers.

The Becco Division recently announced that it had successfully produced a stabilized hydrogen peroxide, 100 per cent, in crystal form available in commercial quantities.

Mr. Macaulay has also been appointed technical representative and selling agent in the UK and South Africa of the Wyandotte Chemicals Corporation, Wyandotte, Michigan, for the company's new product, 1,3-dichloro-5,5-dimethylhydantoin, sold under the trade name, Halane.

### SIMA Exhibition Opened

THE British instrument industry has an output of £60,000,000 a year, of which £15,000,000 is exported, said Sir Norman Kipping, J.P., director general of the Federation of British Industries, when he opened the permanent exhibition of the Scientific Instrument Manufacturers' Association at 20 Queen Anne Street, London W1, on 9 February.

Sir Norman added that of the 50,000 workers in the instrument industry, 2,500 were engaged on research and development work.

The object of the exhibition (see THE CHEMICAL AGE, 1956, 74, 248; and 1955, 73, 1414) is to provide a centre where overseas visitors can see a representative selection of instruments made by over 140 member firms in all parts of the country. An extensive catalogue library is being built up to aid enquiries. The centre will also serve as a common meeting ground for makers and users of instruments in this country.

### New Type Fertilizer

Trace Element Fertilisers Ltd., of Surrey, has been formed to market Sustanum, a new-type fertilizer which incorporates processes evolved by Mr. E. L. Schioler, a Danish agricultural scientist. Among the chief of these processes is a method of embedding the fertilizer chemicals in a special carrier material which allows the gradual surrender of the major nutrients and trace elements to plants over a long period.

# Norwegian Chemicals

## Survey of Developments

A SURVEY of developments in Norwegian chemicals, published by the Norwegian Export Council, states that the contribution of the chemical industry to the value of industrial production as a whole is about 36 per cent. It is thus one of the most important sectors of the entire industrial field.

Artificial fertilizers are produced on a national scale. The greatest producer is Norsk Hydro-Elektrisk Kvälstofaktieselskab, which bases its production on synthetic ammonia, produced at plants at Rjukan, Notodden and Glomfjord. By catalytic oxidation this ammonia is converted to nitrogen oxides which form the basis for nitric acid and a great range of chemical compounds.

By far the most important product is nitrate of lime, 15.5 per cent. The addition of five per cent ammonium nitrate gives the product the correct consistency. From calcium nitrate Norsk Hydro also makes nitrate of soda with mainly the same chemical composition as Chili saltpetre. A special zeolite process, developed by Norsk Hydro, is used, which exploits the sodium content of sea water.

As a principal producer of artificial fertilizers, Norsk Hydro has also taken an interest in complete fertilizer, to which phosphate and potassium are added. Production has so far been at the rate of 60,000 tons a year but an increase to 160,000 to 170,000 tons is expected for 1955 as a result of a new complete fertilizer plant which came into production at Glomfjord.

Odda Smelteverk A/S is Norway's largest producer of calcium carbide. Output, now about 35,000 tons a year, is either packed for sale or forms the raw materials for the production of calcium cyanamide, of which Odda Smelteverk is the only producer in Norway.

### Two Superphosphate Manufacturers

Superphosphate is produced by two firms, Lysaker Kemiske Fabrik A/S, with an annual output of 30,000 to 40,000 tons, and Det Norske Zinkkompani A/S, producing 90,000 to 95,000 tons a year. This latter concern makes use in this way of the

large quantity of sulphuric acid recovered from the roasting of sulphide ore for zinc production. Production capacity of the two plants is 60,000 and 95,000 tons respectively. As Norwegian requirements for superphosphates are now about 160,000 tons a year, they can be met almost entirely from home production. In 1954 about 2,500 tons of single superphosphates and about 13,000 tons of double superphosphates were imported.

### Greatly Increased H<sub>2</sub>SO<sub>4</sub> Production

The production of sulphuric acid in Norway has greatly developed since the war. There are now four producers, one of which, Aktieselskabet Borregaard, has started production to meet its own large requirements for the production of staple rayon. The acid is used in the spinning baths to neutralize the large quantities of caustic soda in the viscose.

Another producer, Det Norske Zinkkompani A/S (The Norwegian Zinc Co. Ltd.) has recently begun the construction of a phosphoric acid plant for processing up to 200 tons of raw phosphate per day with sulphuric acid obtained from the roasting of zinc ore. The plant will treat imported raw phosphate and the method used will be the Dorr Company's process. The plant is expected to be completed by the end of 1956.

The annual production of sulphuric acid in Norway is now about 100,000 tons. The amount imported is constantly being reduced, and will probably cease altogether.

In the silicate industry, cement accounts for by far the biggest production. Cement is produced by three companies. Before the war production capacity was about 300,000 tons but owing to the rebuilding and new construction since the war, production has increased to about 800,000 tons of cement.

Sulphite alcohol is produced at three factories in Norway, with a total yield of about 20,000,000 litres a year. Aktieselskabet Borregaard which is by far the largest producer, has carried out a modernization and extension scheme which has raised its sulphite alcohol capacity to 15,000,000 litres a year. The alcohol plant is said to be the largest of its kind in the world. The installa-

tions for producing derivatives from the alcohol are more than big enough to process the entire alcohol output.

The company has developed a considerable production of synthetic organic products with sulphite alcohol as base. Production capacity of these synthetics, which are made from acetaldehyde, is about 10,000 tons a year. In 1954, output was about 6,500 tons. Export is estimated at 2,000 to 3,000 tons, but a considerable amount is processed to various products such as crotonaldehyde, acetic acids, ethyl acetate, butyl acetate, octanol, etc.

### Paint & Varnish Industry

The paint and varnish industry has grown considerably in Norway since the war. Plants have been expanded and modernized and a large number of new products have come on the market.

It is estimated that altogether about 30 firms have begun production of paint and varnish with a total output of about 30,000 tons worth about 100,000,000 kroner. Oil paints are the biggest single item with about 25 per cent of total production. The rest consists of emulsion paints, and spirit, cellulose, and synthetic varnishes.

The Norwegian vitamins industry has an annual output worth about 10,000,000 kroner. Special attention has been devoted to A and A plus D vitamin concentrates, using the liver of halibut, shark, tunny, and whale as raw material. The production technique has been highly developed and several of the processes used have been sold on licence to most other countries. Among recently introduced products are the so-called multi-vitamin pellets containing the six most important vitamins. Production has also started of A and D vitamin powders, which are particularly useful for mixing in animal fodder.

Norway is the only country in the world that has built up a complete fat hardening industry independent of the oil mill industry. The raw materials for fat hardening are primarily whale oil, herring oil, and fish liver oil.

At the outbreak of the last war, the Norwegian fat hardening plants had a total capacity of about 100,000 tons of fat a year. Since the war, capacity has been almost doubled, and Norway is now the largest producer in the world. The principal plants are De Nordiske Fabriker De-No-Fa- A/S—

one of the largest plants of its kind in the world—and Sandar Fabrikker A/S.

Jahres Kjemiske Fabrikker A/S concentrates on refining sperm whale oil. This oil has a different composition from ordinary whale oil, as it contains large quantities of fatty alcohols attached to fatty acids. It is therefore unsuitable for edible purposes, but the fatty alcohols can be isolated and from these are made a number of products, especially fatty alcohol sulphonates, which have a wide field of application. They are used, for example, in the washing agents industry for the manufacture of synthetic washing powders, in the textile industry for washing raw wool, in the cosmetics industry, and as special plasticizers for plastics. The plant has a refining capacity of 5,000 to 6,000 tons a year.

Norway has a number of plants for regular distillation of fatty acids, and a large plant for fractional distillation. The fractional distillation plant, operated by Sandar Fabrikker A/S, is based on the latest American methods and has an annual capacity which more than covers Norway's requirements for stearic acid, palmitic acids, myristic acids, lauric acids, and other fatty acids, both in technical and pure qualities as well as in special mixtures for various purposes, for example, the production of candles, soap, rubber, and varnish.

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### Dangerous Ether Bottles

AN APPEAL for empty ether bottles to be returned free from traces of sodium wire is made by May & Baker Ltd. The company states that from time to time it has received empty Winchester quart bottles containing small amounts of sodium wire. Although all bottles that have been used for ether are examined before washing, it is difficult, says the firm, to detect remnants of sodium in wire or any other form that has been introduced by customers. This practice has resulted in several incidents, potentially serious, in the company's bottle washing department.

The statement continues: 'In the interests of safety, May & Baker ask that where sodium has been used by a chemist to dry the ether, the empty bottle should be rinsed with methylated spirit before being returned to the supplier. This company also states that ether anhydrous can be supplied when a very dry grade is required.'

# Quantitative Organic Analysis

## Recent Advances Described to SAC Midland Section

THE second meeting of the Midlands Section of the Society for Analytical Chemistry to be held in Nottingham took place at the Technical College on 15 December. The vice-chairman of the Section, Dr. R. Belcher, D.Sc., F.R.I.C., F.Inst.F. (Chemistry Department, The University, Edgbaston, Birmingham 15), delivered an address on 'Some Recent Advances in Quantitative Inorganic Analysis'.

The material was drawn from the literature of the past two years and was grouped under the following headings:—

- (1) *Primary Standards.*
- (2) *Indicators.*
- (3) *Reagents*
- (4) *Titrants.*
- (5) *Established Methods.*

The search for new substances possessing the required properties of primary standards is never-ending, but of those advanced recently, the only one worthy of consideration in Dr. Belcher's opinion was 4-aminopyridine (1). This compound, recommended by van Hall and Stone, was very attractive, on paper at least, as it appeared to fill the gap of a really suitable base for the standardization of acids. 4-Aminopyridine was a high melting ( $161^{\circ}\text{C}$ ), weak, monotropic nitrogen base (dissociation constant  $1.3 \times 10^{-5}$ ) with an equivalent weight of 94.12. Methyl red indicator could be used with either 0.1N or 0.5N acid. The standardization of acids with 4-aminopyridine yielded normalities within one part per thousand of those found using sodium carbonate.

Although only available as a technical grade chemical at present, the free base could be readily purified by recrystallization from benzene or toluene, or by sublimation at reduced pressure, and it could be recovered easily after use. 4-Aminopyridine was quite stable and not hygroscopic, but it had a definite vapour pressure and therefore drying times had to be restricted to conserve material.

In the field of indicators there was very little outstanding, so Dr. Belcher singled out a few which were of some interest.

Rancke-Madsen and his co-workers had investigated the use of redox indicators in

acidimetric titrations. The principle was based on the fact that certain redox systems were dependent on the hydrogen ion concentration. They had shown that weak bases ( $pK_B$  10) such as acetate ion, succinate ion and pyridine could be titrated acidimetrically using indicators consisting of the ceric-cerous redox system plus nitro-ferroin or ferroin (2). Although reasonable accuracy could be obtained, the execution of the titrations required some skill. They should in all cases be carried out very slowly and with vigorous shaking, in particular shortly before the colour transition took place. The transitions were not reversible.

The weak acid was titrated past the equivalence point to the colour transition of one of the indicator systems mentioned above, and then the over-titration corrected by means of a blank experiment on pure water, so that the end volume in the titration of the weak base was almost identical with that in the titration of water.

### Two Transition Intervals

In an extension of this work it was shown that a similar indicator system could be prepared from the thallic-thallic system upon the addition of potassium iodide and starch (3). The result was an indicator with two transition intervals in the pH scale. The first colour transition (appearance of blue iodine-starch colour) was clear, reversible and easily reproducible at exactly the same values of pH, while the second transition (disappearance of blue colour) could be satisfactorily reproduced but took place at a higher pH. This indicator system could be used in the titration of carbonate ion as a monovalent base. The method was fairly accurate, but could not be characterized as a quick method.

The properties of adsorption indicators had been somewhat exaggerated in the past, but Muller and Dettler (4) had recently carried out halogen determinations by this means. Acid violet, a triphenyl-methane dye, was used for the quantitative determination of chloride and other halide ions with silver nitrate. The Volhard method normally required the filtration of silver chloride and back-titration of the silver

nitrate excess, but when acid violet was used these procedures were unnecessary. Accurate values were obtained, and they agreed with those obtained by the Mohr method and by Fajan's method with fluorescein. Electrolytes did not interfere in the titration, unless they were present in high concentration.

### Novel Application

Triphenylmethylarsonium chloride had been applied titrimetrically in a novel way by Gibson and White. They found that the triphenylmethylarsonium cation formed stable, highly-coloured compounds with permanganate (5) and dichromate (6) ions. Since these compounds,  $(\text{Ph}_3\text{MeAs}) (\text{MnO}_4) \cdot \frac{1}{2} \text{H}_2\text{O}$  and  $(\text{Ph}_3\text{MeAs})_2\text{Cr}_2\text{O}_7$ , were readily soluble in such organic solvents as chloroform, ethylene dichloride, and tetrachlorethane, they could be used as the basis of titrations with extractive end-points (comparable with Andrews-Jamieson procedures (7)).

The permanganate method had been applied successfully to the titration of ferrous iron, arsenite and oxalate with N/10 — N/100 potassium permanganate solutions, and the dichromate method to the titration of ferrous iron with N/10 potassium dichromate. The back titration of permanganate with ferrous iron etc., was equally satisfactory. The great advantage of the titrations was that they could be carried out in the presence of normally interfering coloured cations ( $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cr}^{3+}$  and  $\text{Mn}^{2+}$ ) of molar concentrations up to 400 times that of reducing agent in the case of permanganate, and up to 50 times in the case of dichromate.

The titrimetric determination of the fluoride ion with thorium nitrate solution was commonly accomplished with the aid of alizarin red S as indicator. Banerjee (8) had recently developed a rapid titrimetric method for the determination of microgram amounts of fluoride in the range 1-100  $\mu\text{g}$ . in 50 ml. final volume of solution.

The method was based on the fact that SPADNS (the sodium salt of 2-(*p*-sulphophenylazo) - 1,8 - dihydroxynaphthalene - 3,6-disulphonic acid) formed a coloured lake with thorium and zirconium, the colour of the Th-SPADNS lake being the more pronounced. When a slight excess of thorium was present in the titration of fluoride with standard thorium nitrate solution, it caused a sharp colour change of the indicator from scarlet-red to blue-violet.

The method was applicable to pure solutions of fluoride. The interference by various ions had been studied, and it was evident that the procedure was not specific for the fluoride ion. Consequently, it was necessary to separate the fluoride from interfering substances by distillation prior to the actual titration. No special advantages were claimed for SPADNS over alizarin red S.

Cheng and Bray (9) had investigated the possibility of using for analytical purposes the dye, 1-(2-pyridylazo)-2-naphthol (PAN), which was known to form coloured chelates with many heavy metals. Most of the metals reacting with PAN formed reddish chelates, but the chelate compounds with cobalt and palladium were greenish in colour. The stability of the complexes was greatly influenced by the pH of the solution.

The dye was applied successfully as an indicator in the complexometric titration of zinc, copper, cadmium etc., with ethylenediamine tetra-acetic acid in the presence of the alkaline earth metals, with which PAN does not form coloured chelates. When Eriochrome Black T or murexide was used as indicator in similar complexometric titrations, interference was encountered in the presence of the alkaline earths. Further, PAN had been used as an organic reagent for colorimetric determinations and spot tests.

### Effect of Masking Agents

The effect of masking agents on the formation of the coloured chelates had also been examined. More recently Flaschka (10) had extended the use of this indicator and had shown that several pairs of metals could be determined in the one solution by titrating in both an acid and alkaline medium.

Under the heading of reagents, Dr. Belcher said that the investigation of specific precipitants and reagents in qualitative microchemical tests for the various condensed phosphates had never been completed satisfactorily. However, recently McCune and Arquette (11) had given an interesting lead towards solving this problem by studying the reactions of pyrophosphate and triphosphate with the Werner complexes, tris(ethylenediamine) cobaltic chloride  $[\text{Co}(\text{en})_3\text{Cl}_3]$  and hexammine-cobaltic chloride  $[\text{Co}(\text{NH}_3)_6\text{Cl}_3]$ .

They had found triphosphate, but not

pyrophosphate to be precipitated by  $\text{Co(en)}_3\text{Cl}_3$  at  $\text{pH}$  3.5, and *vice versa* at  $\text{pH}$  6.5. The precipitates dried at  $110^\circ\text{C}$  were  $\text{Co(en)}_3\text{H}_2\text{P}_3\text{O}_{10}\cdot 2\text{H}_2\text{O}$  and  $\text{Co(en)}_3\text{HP}_2\text{O}_7$ . Orthophosphate, trimetaphosphate, and tetrametaphosphate were not precipitated.

Although triphosphate could be precipitated from a mixture containing pyrophosphate, some pyrophosphate was coprecipitated and some triphosphate remained in solution. Nevertheless,  $\text{Co(en)}_3\text{Cl}_3$  might prove a valuable reagent for triphosphate.  $\text{Co}(\text{NH}_3)_6\text{Cl}_3$  was not such a potentially valuable reagent however, since it precipitated  $\text{P}_3\text{O}_{10}^{5-}$  and  $\text{P}_2\text{O}_7^{4-}$  instead of  $\text{H}_2\text{P}_3\text{O}_{10}^{3-}$  and  $\text{HP}_2\text{O}_7^{3-}$ . The yield of both was increased by increasing  $\text{pH}$ , and orthophosphate was also precipitated.

Some two to three years ago 2-(*o*-hydroxyphenyl)benzoxazole was developed as an organic precipitant for cadmium (12). Byrn and Robertson (13) have now shown this reagent, in the presence of ethylenediamine tetra-acetic acid (EDTA) as a masking agent, to be an excellent quantitative precipitant for copper at  $\text{pH}$  11 and virtually specific for this metal when present with other metal ions encountered in the analysis of nickel-copper alloys, bronze, aluminium alloys and cast iron.

#### Few Interferences

The only interferences were those metals which precipitated from EDTA solution at  $\text{pH}$  11, and these could be separated by filtration before the addition of 2-(*o*-hydroxyphenyl)benzoxazole. The method was simple, direct, and accurate, and the precipitate had the favourable conversion factor of 0.1313.

Considerable interest had been stimulated of late in the use of sodium tetraphenylboron for the determination of potassium. Although it was more rapid and specific than the classical chloroplatinate and perchlorate methods, the reagent was expensive. An inexpensive and simple routine method had now been proposed by Manasevit (14) for the rapid direct determination of potassium. Alcoholic fluoboric acid was used as the precipitating agent from ice-cold solution.

In the presence of up to 500 mg. sodium chloride, solutions containing 20-250 mg. potassium chloride had been analysed with a relative error less than one per cent, and with good reproducibility. Moderate to

comparatively high ratios of the chlorides of  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$  and  $\text{Li}^+$  to potassium did not interfere, and combinations of these chlorides (except for calcium and aluminium) were permissible. Interference was encountered in the presence of:— $\text{NH}_4^+$ ,  $\text{Ba}^{2+}$ , and  $\text{SO}_4^{2-}$ .

For many years various organic arsonic acids had been developed and used analytically, but only recently had it been considered of interest and value to investigate the analogous phosphoric acids. Banks and Davis (15) had studied the reaction of thorium with benzene-phosphoric acid, and shown it to be quantitatively precipitated as  $\text{Th}(\text{C}_6\text{H}_5\text{PO}_3)_2\cdot 3\text{H}_2\text{O}$  at  $\text{pH}$  value as low as 0.5. The compound could be dried at  $140\text{--}180^\circ\text{C}$  and weighed. On ignition the precipitate underwent decomposition, and finally at  $800\text{--}1,000^\circ\text{C}$  formed  $\text{Th}(\text{HPO}_3)$  which was stable to  $1,200^\circ\text{C}$ .

#### Other Interferences

Although the method was proposed as a means of determining thorium gravimetrically in the presence of reasonably small amounts of rare earth ions and bismuth, there were numerous other interferences. Dr. Belcher considered the reagent to show no great advance over those usually advocated for thorium.

The classical method for the determination of silica in silicate rock did not give highly accurate results. A simpler and more direct method being desirable, attempts had been made by many investigators to precipitate the silica as a sparingly soluble salt of silicomolybdic acid with organic bases. 5,6-Benzoquinoline and 8-hydroxyquinoline had been used as organic reagents for the quantitative precipitation of silica in this way under suitable conditions of acidity (16). As the salts were stable and non-hygroscopic, they could be weighed directly after drying at  $110\text{--}150^\circ\text{C}$  as  $\text{H}_4\text{SiO}_4\cdot 12\text{MoO}_3\cdot 4\text{C}_6\text{H}_7\text{N}$  and  $\text{H}_4\text{SiO}_4\cdot 12\text{MoO}_3\cdot 4\text{C}_{10}\text{H}_9\text{ON}$ , or alternatively they could be ignited at  $550^\circ\text{C}$  with free access of air (to prevent the reduction of molybdenum) to silicomolybdic anhydride.

Although there was nothing startling in the way of new titrants, there was need for further investigation in several cases. This might lead to a more general acceptance of one or two of them in the future if their promise was maintained.

The use of potassium diperiodato cuprate

(III) and potassium ditellurato cuprate (III) as volumetric reagents on the microscale had been well investigated by Beck during recent years (18, 19, 20, 21). The results suggested that an evaluation of the reagents at macro concentration levels might be of interest. Keyworth and Stone (17) had now demonstrated that applications of copper (III) oxidation at this level were limited by the difficulty of end-point detection, the uncertainty of product composition, and the possible competition via the oxidizing action of the complexing anion, even though reagent solutions were easy to prepare and appeared to be stable.

Chloramine-T was first suggested as a titrant by Noll (22) about 30 years ago as a substitute for iodine in analytical chemistry. It did not find general usage, however. Since then Afanas'ev (23) had reported that chloramine-B was a good substitute for chloramine-T. More recently Singh and Sood (24) had employed chloramine-B as an oxidizing agent in strong hydrochloric acid medium for various volumetric estimations using iodine monochloride as a catalyst and pre-oxidizer (comparable with the Andrews-Jamieson procedures using iodate volumetrically (7)).

Chloroform was used as an indicator, it being coloured pink owing to the liberation of iodine during the titration but light pale yellow at the end-point because of the formation of iodine monochloride. These workers had also used chloramine-B for indirect volumetric estimations (25). Advantages of chloramine-B over chloramine-T were not specified.

Although several applications of mercurous salts as reductimetric titrants in acidic medium were recorded in the literature, no investigations had been carried out in alkaline medium until the studies of Burriel, *et al.* (26). They had shown that in the presence of iodide the ferricyanide ion could be titrated accurately in this way, the end-point being determined potentiometrically or with barium diphenylamine sulphonate.

The great advantage of this procedure lay in the fact that the reagent was stable to air and titrations could be carried out without its elimination. Dr. Belcher thought this was an interesting extension of the use of mercurous salts as reductimetric reagents since they already had wide applications in analytical chemistry.

Erdey first recommended ascorbic acid as a reductimetric titrant in 1950 (27), claiming

that it could be used for the direct titration of ferric iron (28). Since then procedures had been proposed for the determination of many other inorganic cations and anions, and also for various organic compounds. The work had become so extensive that it had been given the title of 'ascorbimetry'. Time alone would tell whether the properties of this reagent would be sufficient for it to be generally used.

Finally under the heading of new titrants, Dr. Belcher discussed the renewed interest shown in sodium vanadate as a volumetric reagent. Syrokonskii and Stepin (1936) used N-phenylanthranilic acid as indicator in the titration of ferrous iron with ammonium vanadate, obtaining excellent results (29). Simultaneously, Lang and Gottlieb (30) employed vanadate solution for the titration of quinquivalent molybdenum with diphenylamine or its *p*-sulphonic acid as indicator.

The volumetric use of vanadate solutions did not achieve wide attention, however, until comparatively recently when much work was done with them in India and to a lesser extent in America. Gopala Rao and his co-workers (31) had shown that sodium vanadate had special advantages over potassium dichromate and permanganate as a volumetric reagent. Thus it could be used for the estimation of ferrous salts when other reagents gave too high results.

#### Sodium Meta-vanadate

Sodium meta-vanadate had been employed as an oxidizing agent by Singh and co-workers (32) in a similar way to the aforementioned Andrews-Jamieson procedures (7), both direct and indirect volumetric determinations having been carried out. One of the most interesting applications was the vanadimetric estimation of hypophosphite (A) and phosphite (B) by silver salt catalysis (33). A measured volume of (A) or (B) was allowed to react with excess of a standard vanadate solution on a boiling water bath for about 15 minutes in the presence of silver sulphate as a catalyst and appropriate concentration of sulphuric acid.

The mixture was cooled and then titrated with a standard solution of ferrous ammonium sulphate to determine the unreacted vanadate, using N-phenylanthranilic acid as indicator. West and Skoog (34) had carried out a study of the reaction of ammonium meta-vanadate and sodium oxalate in strong sulphuric acid solution, and found that sodium oxalate was a suitable and convenient



primary standard for solutions of quinquevalent vanadium. There appeared to be the possibility in 'vandometry' of a titrimetric method which showed sufficient promise for it to be grouped along with the more well-established volumetric oxidation procedures.

The last section of Dr. Belcher's lecture was devoted to some of the more outstanding recent developments in established analytical methods.

Although the gravimetric determination of nickel by precipitation with dimethylglyoxime was very satisfactory for its separation from a large number of foreign ions, if ferric iron and cobalt were present together, a voluminous amorphous precipitate was produced. Methods had been devised to prevent its formation by reduction of the iron to the ferrous state, but other difficulties then arose. Byrn and Robertson (35) had solved this ancient problem by the addition of *N,N*-dihydroxyethylglycine, which chelated the iron and so prevented formation of the iron-cobalt-dimethylglyoxime contaminant.

#### Thorium Determination

Thorium was often determined or separated from other elements by the iodate method. The only serious interferences were from:—Zr, Ti and Bi. Tillu and Athvale (36) had shown that thorium could be precipitated quantitatively in 40 per cent nitric acid solution as iodate, in the presence of oxalic acid which complexed the above interfering elements. Thorium was thus freed from all the cations in a single operation from solutions containing sulphate and phosphate radicals. The method was very quick, and thorium oxide in a sample of manazite could be readily estimated with precision in eight to nine hours.

Dutt and Chowdhury (37) had determined thorium volumetrically. The thorium was precipitated with *m*-nitrobenzoic acid according to the method of Neish (38). The precipitate of thorium *m*-nitrobenzoate was then dissolved in sulphuric acid and titrated with titanous chloride to determine the nitro-group, which gave the amount of thorium directly.

The Volhard titration method for the determination of chloride had been applied successfully to the determination of lithium as its chloride (39) following its separation from sodium and potassium chlorides by extraction with 2-ethyl-1-hexanol. The titra-

tion of chloride was conducted directly in the alcoholic phase after a single extraction. Since silver chloride was less soluble in alcohol than in water, this eliminated the need for an agglomerating agent to prevent dissolution of the silver chloride (nitrobenzene was soluble in ethyl alcohol which was used to dilute the extract). The method was rapid, precise to within  $\pm 0.5$  per cent, and applicable in the range 1-50 mg. of lithium (the total quantity of chloride should not exceed 500 mg.).

#### Non-Aqueous Titration of K

Procedures for the volumetric determination of potassium initially precipitated by sodium tetraphenylboron had received extensive attention. The high solubility of potassium tetraphenylboron in organic solvents suggested the possibility of a non-aqueous titration. Flaschka (40) had thus developed a procedure in which an acetone solution of the salt was titrated with a solution of perchloric acid in acetic acid using crystal violet as the indicator. Very sharp end-points could be obtained.

Sieverts and Major (41) long ago observed that iron solutions were reduced on treatment with hypophosphite at the temperature of a boiling water bath, but the ferrous iron so formed could not be titrated against potassium permanganate since the phosphorous acid was also present in the mixture was readily oxidized by this oxidant. Furthermore, Mitchell (42) observed that considerable error was caused by the presence of hypophosphite when ferrous salts were titrated with potassium permanganate.

It had now been shown that ceric sulphate and sodium vanadate solutions gave accurate results when ferrous iron solutions were titrated in the presence of hypophosphite or phosphite or both (43). *N*-phenyl-anthranilic acid was used as indicator.

The Zimmermann-Reinhardt reagent was expensive and its preparation tedious. Somasundaram and Suryanarayana (44) showed that sodium acetate and borax were good substitutes for it in the permanganometric estimation of iron in pure solutions, even with excess hydrochloric acid. However, in solutions obtained from extraction of haematite and magnetite the above substitutes were a failure. Further investigations (45) proved that though manganous acetate under identical conditions served

just as well, potassium sulphate was found to be better in many respects.

In the most recent investigations (46) a combination of potassium sulphate and potassium fluoride was reported. A more sharp and lasting end-point was given than with the Zimmermann-Reinhardt reagent and it was even better under identical conditions. The acid concentration was found to be the main influencing factor which limited the scope of application of the reagent, as for the Zimmermann-Reinhardt reagent itself.

#### New Titrimetric Method

Because of the time-consuming and tedious nature of the gravimetric determination of sulphate, numerous attempts had been made to devise a rapid titrimetric method. A new, direct, titrimetric method had been described by Fritz and Freeland (47), in which the sulphate sample in 30-40 per cent alcohol (no end-point is observed in water alone) was titrated with barium chloride or barium perchlorate using alizarin red S as the indicator. A sharp, vivid colour change from yellow to pink marked the end-point.

Equilibrium was quickly attained, so that titration could be rapid. Coprecipitation errors were greater than for gravimetric sulphate methods, but most of these could be avoided by the preliminary removal of cations with an ion exchange column. In the absence of interfering anions the method was as precise as the gravimetric method and considerably faster.

There had been a growing need for a good analytical procedure for the quantitative determination of hypophosphite in the presence of phosphate, since most of the existing methods were neither desirable nor precise. Bernhardt (48) had found that cerium (IV) would oxidize hypophosphite quantitatively to phosphite in sulphuric acid solution.

The excess cerium (IV) was ascertained by titration with ferrous solution using ferroin as an indicator. Oxidation was complete in 15 hours at room temperature, or in 30 minutes at 60°C. Under the prescribed conditions, phosphite underwent no oxidation. Both hypophosphite and phosphite could be oxidized quantitatively to phosphate by boiling for 15 minutes in the presence of excess cerium (IV) solution. Thus it was possible to determine also, phosphite in the presence of phosphate, or

of both hypophosphite and phosphite if total lower valent phosphorus must be determined.

The determination of carbon dioxide was one of the most common of the analyst's problems and therefore a great number of papers had been published on this subject. Blom and Edelhausen (49) had developed a direct carbon dioxide titration method for the detection and determination of substances separated on a gas-liquid partition column. The titration was performed in pyridine or acetone as a solvent and with sodium methylate solution as titrant. The method was rapid, adaptable to samples of almost any concentration, inexpensive, and highly accurate, so avoiding the disadvantages of the more usual procedures. However, it would be difficult to develop an automatic recorder operating on this principle.

Suggested general applications of the method were to the semi-micro and micro determination of carbon and oxygen, determination of carbon dioxide formed in wet-combustion analysis, and determination of carbon in steel.

#### Direct Titration of Bi

Existing methods for the titrimetric determination of bismuth were subject to numerous interferences. In a recently proposed method, Fritz (50) titrated bismuth directly at pH 1.5-2.1 with disodium ethylenediamine tetra-acetate, forming a stable, soluble complex. Excess thiourea was added to form a weak complex with bismuth and thus prevent any precipitation before or during the titration. The disappearance of the last yellow colour due to this complex marked the end-point.

Independently, Cheng (51) had developed a simple method in which bismuth could be titrated by ethylenediamine tetra-acetic acid at pH 1.5-2.0 using potassium iodide as the indicator. In both methods bismuth could be accurately titrated in the presence of many other ions, including large amounts of lead.

Finally, a new volumetric method had been proposed for the determination of beryllium in beryls and associated minerals (52). It involved the direct precipitation of beryllium as  $\text{BeNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$  in presence of complexone II, dissolving the precipitate in dilute perchloric acid and titrating the liberated phosphate with standard bismuth

perchlorate. Results for samples agreed within  $\pm 0.2$  per cent of the standard values.

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## To Study Ionizing Radiations

THE British Food Manufacturing Industries Research Association is to collaborate in a new Government research programme to investigate the problems of preserving food through the use of ionizing radiations. Dr. Banfield, M.Sc., Ph.D., the director of research, states that a research unit is to be established at Cambridge, following a recommendation by the Food Investigation Board of the Department of Scientific & Industrial Research.

The British Food Manufacturing Industries Research Association will second two members of its staff, a senior and junior assistant, to the team at Cambridge, and will be directly concerned in the planning of research as well as having access to all information coming from laboratories engaged on similar work throughout the country.

The new project is a result of the recent report by Dr. R.S. Hannan, of the Food Investigation Organization, which summarized present knowledge on the subject. The report, 'Scientific & Technological Problems Involved in Using Ionizing Radiations for the Preservation of Food, Special Report No. 61' is available from HMSO, Price 7s 6d.

## Obituary

PROFESSOR WILLIAM CUDMORE MCCULLAGH LEWIS, B.A., M.A., F.R.S., who was Brunner Professor of physical chemistry at Liverpool University from 1913 until his retirement in 1947, died on 11 February at his home at Malvern. Up to a few years ago Professor Lewis, who was aged 71, lived at Abbey Road, West Kirby. He was at one time lecturer in physical chemistry at London University and in dental metallurgy at the National Dental Hospital, London. A Fellow of the Chemical Society and the Royal Society, Professor Lewis was a member of the Faraday Society and of the American Chemical Society.

The general index to volume 12 of 'Thorpe's Dictionary of Applied Chemistry' has recently been published by Longmans, Green & Co., price 42s.

## Canadian Plastics

### Industry's Good Year

CANADA'S plastics industry has just experienced an unusually good year and can look forward with reasonable confidence to a continuance of healthy conditions during 1956, said Mr. V. G. Bartram, president, Canadian Resins & Chemicals Ltd., in a review of 1955.

A major reason for this happy state of affairs is the increased level of business in general. Greater diversification in plastics end products, intensive development work that has led to the utilization of plastics in conjunction with other materials and a broader use of previously developed applications all contributed to the 1955 picture.

The number of plant expansion programmes completed in 1955 and projected for 1956 augurs well for the industry's future. An increase in the number of manufacturers of basic raw materials for plastics has made Canada more independent of imports than at any previous time.

Mr. Bartram went on to point out that while export markets have improved, they cannot be relied on as a steady market for Canada's increased plastics production. West Germany's fast-growing plastics industry is now reported to rank second to that of the US, while Britain is a close third. Plastics production is also growing in other countries throughout Europe, such as France and Italy. Japan, too, boasts a growing plastics industry.

## Aluminium Project

### Olin Mathieson's Big Investment

OLIN Mathieson Chemical Corporation plans to enter the aluminium industry with an initial investment of \$120,000,000 it was announced recently by Thomas S. Nichols, president. This is said to be the first time that coal mined directly on the site will be used to provide the power required for the reduction of alumina to pig aluminium.

Approximately \$90,000,000 will be invested in the aluminium plant, \$60,000,000 of which will be provided by a loan from the Prudential Insurance Company. Prudential has also financed the power subsidiary corporation with a loan of \$30,000,000. Olin Mathieson have a 50 per cent interest in this company.

The new plant will be situated in the Ohio River valley and will have a capacity of 230,000 tons of alumina and 60,000 tons of aluminium per year. At first, only about 115,000 tons of alumina per year will be required by the aluminium plant and the surplus will be available to the market. Most of the 60,000 tons of aluminium produced will be consumed by Olin Mathieson's metals division.

Advantage will be taken of the reserves of coal in West Virginia. Reserves within the area of Olin Mathieson's new operations are estimated at more than 300,000,000 tons. The initial requirement of coal per year is about 2,000,000 tons and reserves are believed to be adequate for expanded operations in the future.

The power plant will consist of two units of 225,000 kilowatts each. Both power units will be operated by the Ohio Power Company and integrated into the American Gas and Electric Company system.

Bauxite will be shipped from Surinam in Dutch Guiana and Olin Mathieson has signed a long-term supply contract for its initial requirements. First shipments are scheduled to arrive early in 1957.

## New British Standard

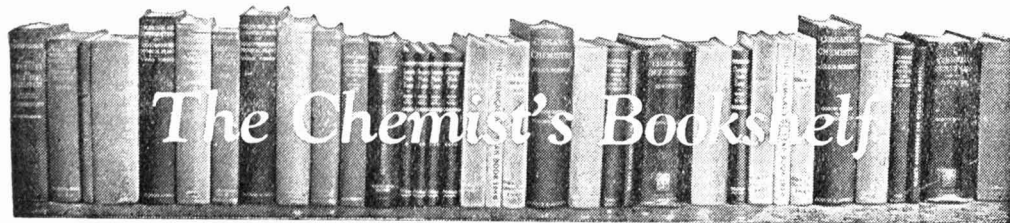
A NEW British Standard has been published by the British Standards Institution. The standard is BS 2647:1956 and refers to steam heated jacketed pans for processing industries (excluding catering industries).

Three different pressures have been selected: 40, 80 and 100 lb. per sq. in., these being the three most commonly in use. The standard applies specifically to pans for use in the processing of food, chemicals and other materials. The pan depth and shape are said to be such that the contents can be readily observed and ladled out if necessary.

Low pressure pans as used in the catering industry will be covered in a British Standard shortly to be published.

Dimensions for pans with both hemispherical and dished bottoms are specified, and recommendations in relation to various components are given. Requirements for hydraulic testing and marking are also specified.

Copies of the standard are obtainable from the British Standards Institution, 2 Park Street, London W1, price 2s 6d.



INTERNATIONAL COMMITTEE OF ELECTROCHEMICAL THERMODYNAMICS AND KINETICS (CITCE) SIXTH MEETING. Butterworths Scientific Publications, London. Pp. xvi + 567. 84s.

This volume is a record of the sixth meeting of Comité International de Thermodynamique et de Cinétique Electrochimiques held at Royaumont and Poitiers in September 1954. It includes brief reports of the introductory addresses at the conference and also reports of an administrative nature about the membership and activities of the Committee, but over 90 per cent of the volume is devoted to the 55 papers presented to the meeting and the discussion on these papers.

The first section, entitled 'Fundamental Principles, Nomenclature and Definitions', contains seven papers of which the first is the most extensive, being a report on electrochemical nomenclature and definitions. This report is given in English and French—the remaining papers in the volume are given in English and the discussion in English, French or German.

A short section of four papers on experimental methods follows. It includes an interesting and comprehensive paper by Haïssinsky on the applications of radioactive methods to the study of surface states and surface reactions of metals.

The electrochemical behaviour of metals and metalloids is covered in the next section which is split into two sub-sections. The first of these deals, in nine papers, with the electrochemical information on the equilibria of a number of systems, reported in most cases in the form of equilibrium potential—*pH* diagrams. The second sub-section of the papers is entitled 'Polarization Curves and Electrochemical Kinetics' and includes some work in the irreversible polarization at very short time intervals (from  $5 \times 10^{-8}$  sec.) after the commencement of the cathodic deposition of nickel.

Applications of electrochemical measurements are grouped together in four sub-sections—corrosion (nine papers), batteries and accumulators (four papers), general and analytical chemistry (two papers), and miscellaneous (five papers).

The last section comprises a group of five papers on the special subject of the meeting—polarography. The first of these will probably have the widest general interest, as it is a review of progress in the last decade in polarography and voltammetry, and it contains 163 references.

The volume has been carefully edited and the tables and diagrams are clear. The new material and the reviews given make the volume of great value to electrochemists and others concerned with applications of electrochemistry. However, by its nature, the volume necessarily contains rather specialized material which will limit its appeal.

—C. KEMBALL.

RATIONAL APPROACH TO CHEMICAL PRINCIPLES. By J. A. Cranston. Blackie & Son Ltd., Glasgow. 2nd edition. 1955. Pp. xii + 231. 10s 6d.

Although the historical developments of chemical theory are an excellent exercise and discipline in logic and the scientific method, their use in teaching may lead to difficulty. The student may find them hard to follow and in later work may have to modify his views and reinterpret his facts in the light of newer theories. This book is an attempt to overcome such difficulties. Omitting much historical development, the physicist's atom is used as a starting point, leading to stoichiometry, valency, reactivity and the ionic hypothesis. With the formulation of the mass action law the aim is to provide a basis for the interpretation of chemical facts.

The book is divided into five sections, the first of which includes a very brief account

of atomic structure and a more detailed consideration of electronic arrangement. The second deals with states of matter. The gas laws, deviations from them, vapour densities and the kinetic theory of gases are considered briefly. A chapter on the liquid state considers vapour pressure and the factors affecting it and mixtures of liquids. A further chapter deals with the properties of dilute solutions. The third section, dealing with chemical combination, includes a concise account of chemical bonds and a chapter on energy of chemical combination. This latter is intended by the author to lay a foundation for the subsequent study of thermodynamics. In view of this it is perhaps a pity that heat evolved is given a positive sign.

The last two sections, comprising over half the book, deal in some detail with electrically charged atoms and with chemical equilibrium. The concept of electrode potential is used to introduce the electrochemical series and properties related to electrode potential are considered. Oxidation and reduction are considered from an electrical standpoint, redox potentials are discussed and there is a chapter outlining the ionic theory. The law of mass action is discussed in some detail and there is a useful chapter in which the influence of temperature and pressure changes on chemical equilibrium is illustrated by reference to typical industrial reactions. Some carefully chosen examples illustrate the principles of heterogeneous equilibrium and a chapter on ionic equilibrium includes such topics as acids and bases and their strengths, the dilution law, hydrolysis and solubility product. There is an appendix on *pH* measurements dealing with the use of indicators and electrical methods and with *pH* changes during acid-base titrations. Problems, which seem to have been carefully chosen, follow each chapter and there are a number of miscellaneous problems, with answers, at the end of the book.

Although the book would seem to provide a rational basis for the understanding of many chemical facts it requires, in certain respects at least, supplementing by other text books or lectures. Experimental methods generally are given in bare outline or not at all. The section dealing with states of matter is rather sketchy particularly with regard to the colligative properties of solutions. Buffer solutions are only briefly

considered. In spite of these limitations the book can be recommended as providing an interesting and stimulating approach to physical chemistry which should be within the grasp of the average student.—W. R. MOORE.

DECHEMA-MONOGRAPHIEN Nos. 283-292, Vol. 24. Published for DECHEMA by Herbert Bretschneider & Kurt Fischbeck, Frankfurt am Main, Western Germany, 1955. Pp. 288. Price: to members of DECHEMA DM.27, to non-members DM.33.70.

This volume covers a series of papers presented on the occasion of the presentation of the DECHEMA awards of the 'Max-Buchner-Forschungsstiftung' and at the conferences held at DECHEMA-Haus, Frankfurt am Main. These conferences claim to present important new results of research and development in the fields of chemical apparatus and chemical technology and to encourage their discussion among experts in the respective fields.

The following papers in German are contained in this volume:—

H. Sachsse, 'Die Herstellung von Acetylen durch unvollständige Verbrennung von Kohlenwasserstoffen mit Sauerstoff', E. Bartholomé, 'Probleme grosstechnischer Anlagen zur Erzeugung von Acetylen nach dem Sauerstoff-Verfahren', H. Rumpf, 'Über physikalische Gesetzmässigkeiten bei der Schlagzerleinerung, der Windsichtung und der Strömung von Staubluftgemischen und ihre Anwendung zur Entwicklung technischer Geräte', G. O. Schenck, 'Apparate für Lichtreaktionen und ihre Anwendung in der präparativen Photochemie', E. Wicke, 'Strömungsformen und Wärmeübertragung in Gaswirbelschichten', E. L. Piret, 'Verdampfer mit natürlichem Umlauf', E. L. Piret, 'Wärmeübergang durch Eigenkonvektion bei vermindertem Druck', E. Lüscher, 'Das Quantometer in der Betriebskontrolle', H. Kronmüller, 'Schnellregelungen mit dem Magnetikregler', O. H. Blunck, 'Radioaktive Strahlen in Wissenschaft und Technik'.

#### To Enlarge Factory

Steeley Magnesite Co. Ltd., Hartlepool, will shortly spend £2,000,000 on extending their factory.

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# HOME

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## Pfizer Appoint UK Distributors

Pfizer Ltd., of Folkestone, Kent, have appointed Kingsley & Keith Ltd., of London, as UK distributors for their range of industrial chemicals.

## A. J. White Ltd.

Smith Kline & French Laboratories, of Philadelphia, have offered to purchase the whole of the 800,000 10s stock units at 25s each, ex the five per cent interim dividend payable 1 March, of A. J. White Ltd., manufacturing chemists, of Brixton, London, who have had close association with the US Company for 30 years. The directors of A. J. White Ltd. intend to recommend the offer and to accept it for their own holdings. Current market price of the 10s stock units is about 168s 10½d.

## Sima Dinner-Dance

The Scientific Instrument Manufacturers' Association will hold their annual dinner-dance at the Dorchester Hotel, London, on 13 April, when the principal guest will be Sir Owen Wansbrough-Jones, K.B.E., C.B., M.A., Ph.D., chief scientist of the Ministry of Supply.

## Analytical Chemistry

Two papers were presented at a meeting of the Midlands Section of the Society for Analytical Chemistry held on 7 February in the Mason Theatre, The University, Birmingham. They were: 'The Analytical Chemistry of Germanium' by H. J. Cluley, M.Sc., F.R.I.C. (GEC Wembley) and 'The Analytical Chemistry of Gallium' by G. W. C. Milner, M.Sc., F.R.I.C., A. Inst. P. (AERE Harwell).

## To Expand Kent Refinery

BP's Kent Oil Refinery on the Isle of Grain is to be considerably expanded. At present the refinery is capable of processing some 4,500,000 tons of crude oil a year. The new expansion scheme, consisting of the addition of further distillation equipment, other processing plant and services, will raise this figure to about 7,000,000 tons a year. This expansion scheme, expected to be completed in 1957/1958, will cost some £19,500,000 and is additional to the installation, announced last November, of a 130,000 tons a year aviation gasoline plant at the Kent refinery at an estimated cost of £6,500,000.

## Dangerous Goods & Explosives in Ships

The 16th list of Amendments to Appendix A of the 1951 Report of the Departmental Committee on the Carriage of Dangerous Goods & Explosives in Ships can now be obtained from HM Stationery Office, price 6d.

## Record Glass Output

In 1955, the British glass container industry produced 27,132,600 gross of bottles and jars, 1,997,500 gross more than the record production of 25,135,100 gross in 1951, and 2,441,100 gross more than in 1954.

## Anglo-Polish Trade Talks

After discussions with representatives of the Polish Government under the Anglo-Polish Trade Arrangement of 1954, agreement was reached on 6 February in London about the details of trade in 1956, the last year of the current Arrangement. Some adjustments were made to the lists of quotas for import into each country and both lists show some increase on last year, but the pattern of trade remains substantially the same.

## Army Buys Plastics

The Witton Moulded Insulation Works of GEC have produced a plastics junction box for the Army capable of withstanding rough treatment and extreme climatic conditions in the field. The box, which, with the associated plugs, is moulded from a high impact Bakelite material (X199), has undergone extensive trials at the School of Military Engineering in Chatham as well as field trials with the Army in Germany. Quantity production of this box for the Army has begun, and GEC have permission also to produce it commercially.

## Third Edition of Organic Chemistry

In May, Chapman & Hall Ltd. will publish the 'Third Edition of Organic Chemistry' by L. F. Fieser & Mary Fieser. An internationally known work, it has been completely revised to develop in orderly sequence the principles and concepts of modern organic chemistry and the applications of the fundamental science to technology and to biochemistry and medicine. Running to 1,150 pages, the book will be priced at £2 10s.

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# OVERSEAS

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## Chilean Sulphur for Britain

The Chilean Foreign Trade Council has authorized the export of 10,000 tons of sulphur, valued at about \$30,000, to Britain.

## Shell Finance Jap Oil Refinery

The Shell group will provide the major part of £10,000,000 for the building of an oil refinery on the site of the former Japanese naval depot at Yokkaichi, near Nagoya. Partners with the Shell group in this venture, which will represent the biggest British investment in Japan since the war, will be the Showa Oil Co. and the Mitsubishi group.

## Celanese Adds Vinyl Propionate

The chemical division of Celanese Corp. of America has added vinyl propionate to its vinyl monomer line. Two other vinyl monomers, vinyl acetate and methyl isopropenyl ketone, already are marketed by Celanese in commercial quantities. Vinyl propionate is priced at 50 cents per pound, delivered in LCL drum quantities.

## Pyrethrum Demand

The steadily increasing demand for pyrethrum is to a large extent credited to the US who are appreciating its properties as an insecticide, says Mr. N. Hardy, executive of the Kenya Pyrethrum Board, who forecasts that Kenya's pyrethrum crop this year will be about 2,800 tons, valued at £1,000,000. Last year the total East African output was valued at £1,250,000.

## Libyan Oil Concessions for US

Eight US oil companies have been granted oil concessions covering an area of 145,000 square miles in Libya. A Libyan Embassy statement says that the area, mostly desert, has 'very fair' oil prospects. Under the agreement 50 per cent of net profits will go to the Libyan Petroleum Commission whenever output reaches 15,000 barrels daily.

## Fire-Retardant Yarn

The Celanese Corp. of America is now producing a fire-retardant acetate filament yarn in both natural and solution-dyed colours. Mr. John W. Brooks, director of marketing of the company's textile division, said the fire-retardant yarn has been in commercial production for almost a year, with the major volume being used by manufacturers of dolls' wigs.

## Trade Agreement

Under a new trade agreement between Holland and Czechoslovakia for the year ending February 1957, the main Dutch export goods will be chemical and pharmaceutical products and rayon yarns.

## Cuban Paint Plant

A new paint plant recently opened in Havana, Cuba, has an annual capacity of 750,000 gallons. Value of the Cuban paint market is about \$10,000,000 a year, and domestic production has reduced paint imports by 20 per cent.

## Gas Deal

The Imperial Oil Co.'s 51 per cent interest in Alberta's Provost gasfield has been bought by Provost Gas Producers in a multi-million dollar transaction. Gas reserves at Provost are estimated at 550,000,000,000 cubic feet.

## First African Cyclotron

The first cyclotron on the African continent, built by the South African Council of Scientific and Industrial Research at a cost of £100,000, has been opened in Pretoria by the economics minister, Dr. van Rhyn.

## Orlon Plant Project

The Du Pont Company of Delaware are contemplating building a plant for the manufacture of 40,000,000 pounds of Orlon acrylic fibre a year at Waynesboro, Virginia. If the project is approved it will increase the company's production of Orlon staple and tow to approximately 100,000,000 pounds a year. All of the Orlon now produced by the company is manufactured at Camden, South Carolina, although research work is conducted at Waynesboro.

## Petroleum Revolution Started Manhunt

In a speech to the National Office Management Association at Beaumont, Texas, recently, Mr. James H. Pipkin, vice-president of The Texas Co. said that the growing shortage of executive talent in US business had brought about 'the fiercest manhunt in American history'. The increasing complexity of the manpower shortage stemmed from the petroleum revolution which began in 1901 and had made management progressively more difficult and demanding. Mr. Pipkin claimed.



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# PERSONAL

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FIELD MARSHAL VISCOUNT ALANBROOKE has been appointed deputy chairman of the Triplex Safety Glass Company. Lord Alanbrooke joined the board of Triplex in 1953.

MR. MARK RHODES has retired from the Board of Monckton Coke & Chemical Co. Ltd. (formerly Monckton Holdings). MAJOR T. W. ADAM, MR. L. A. SIM and MR. S. SWAIN have been elected directors of the company.

MR. G. F. CUMMING, manager of Harrison & Crosfields chemical division and a director of Durham Raw Materials, an associated Harrison & Crosfield company, has been appointed to the board of Dillon's Chemical Co., of Montreal, an associated company of Harrison & Crosfield (Canada). MR. G. O. PEAKE, secretary of Harrison & Crosfield and of Durham Raw Materials, has also been appointed to the board of Dillon's Chemical Co.

Sigmund Pumps Ltd. of Team Valley, Gateshead, announce that SIR WALTER JAMES DRUMMOND, M.Inst.C.E., M.I.-Mech.E., has joined their board. Sir Walter, who was with Harland & Wolff, Belfast, and later at the RNC Greenwich, served on the shipyard staff of Sir W.G. Armstrong Whitworth and Co. Ltd. until 1922, before joining the Ashington Coal Co. Ltd. Sir Walter has served on the advisory council of the Department of Scientific & Industrial Research and on numerous other bodies connected with industry and research.

Results of elections held at the annual general meetings of the various regional sections of the Society for Analytical Chemistry have been announced. They are:—Midlands Section (held on 24 January): *chairman*, MR. J. R. LEECH; *vice-chairman*, DR. R. BELCHER; *honorary secretary*, MR. G. W. CHERRY, 48 George Frederick Road, Sutton Coldfield, Warwickshire; *honorary treasurer*, MR. F. C. J. POULTON. North of England Section (held on 28 January): *chairman*, MR. J. R. WALMSLEY; *vice-chairman*, MR. A. N. LEATHER; *honorary secretary and treasurer*, MR. A. C. WIGGINS. J. Lyons & Co. Ltd., 5 Laurel Road, Liver-

pool 7. Scottish Section (held 20 January): *chairman*, DR. F. J. ELLIOTT; *vice-chairman*, DR. MAGNUS PYKE; *honorary secretary and treasurer*, MR. J. A. EGGLESTON, Boots Pure Drug Co. Ltd., Airdrie Works, Airdrie, Lanarkshire. Officers have also been elected for the Microchemistry Group:—*chairman*, DR. G. F. HODSMAN; *vice-chairman*, MR. D. F. PHILLIPS; *honorary secretary*, MR. D. W. WILSON, Sir John Cass College, Jewry Street, Aldgate, London EC3; *honorary treasurer*, MR. G. INGRAM.

As a mark of appreciation for his assistance in the development of Italian agriculture, MR. T. AINSLIE ROBERTSON has been made a Commenda of the Order 'Al Merito della Repubblica'. The Order was bestowed on him on 6 February by the Italian Ambassador in London. Mr. Robertson was a director of Solplant, the Italian associate company of Plant Protection Ltd., from 1948 until his retirement from the board last month. He is a director of Plant Protection Ltd. and Cooper. McDougall & Robertson Ltd., chairman of Chipman Chemical Co. Ltd. and chairman of the Glasshouse Crops Research Institute.

SIR HENRY FRANK HARDING JONES, M.B.E., M.I.C.E., M. Inst. Gas E., M.I.Chem.E., deputy chairman of the Gas Council, who received a knighthood in the New Year Honours List, was knighted by Queen Elizabeth, the Queen Mother, at a ceremony at Buckingham Palace on 7 February. Sir Henry, who was educated at Harrow and Cambridge, is the son of the late MR. FRANK HARDING JONES, who was president of the South Metropolitan Gas Co., and the grandson of MR. HARRY EDWARD JONES, who was an eminent consulting engineer and the chairman of several gas companies. After taking an engineering degree at Cambridge, Sir Henry was articled in 1927 to Mr. (now SIR) GEORGE EVETTS a leading consulting gas engineer. From 1930 until the outbreak of war Sir Henry devoted himself to the integration of individual gas companies into more economic units, work now being carried out on a larger scale by the nationalized industry. When the gas industry was nationalized, Sir Henry was appointed

chairman of the East Midlands Gas Board. He was appointed deputy chairman of the Gas Council in February 1952.

MR. W. ALEC JORDAN, formerly editor-in-chief of *Chemical Week*, has entered practice as a chemical business consultant, with offices at 270 Park Avenue, New York City. Prior to entering journalism, Mr. Jordan had had extensive experience in technical service and chemical sales management. He will now specialize in handling, for overseas clients, their US market development, product promotion and related chemical business affairs.

Mr. F. G. W. KING, B.Sc., M.I.MECH.E., F.I.R.I., technical director of the Dunlop Rubber Co. Ltd., Fort Dunlop, for the past 20 years, will retire in March. A graduate of the University of Wales, Mr. King joined Fort Dunlop technical department at the age of 26, and among the achievements attained at Fort Dunlop under his direction was the production of bullet-proof tyres during the war. After the war Mr. King was closely associated with the establishment of the Dunlop research centre, the largest rubber manufacturers' research centre in Europe, first as chairman of the committee which planned it, and then as chairman of the development and research board concerned with its central policy on research and development. Mr. King is a vice-president of the Research Association of British Rubber Manufacturers; a member of the research committee of the Federation of British Industries; of the Council of the Tyre Manufacturer's Conference and of the Board of Governors of the National College of Rubber Technology. For two years he was a member of the high polymers committee of the Department of Scientific & Industrial Research, and is a past chairman of the Midland section of the Institute of the Rubber Industry.

MR. THOMAS W. HOWARD, M.A., F.R.I.C., has succeeded his cousin the late MR. GEOFFREY E. HOWARD, as chairman of Howards & Sons Ltd., and Howards of Ilford Ltd. Mr. Thomas W. Howard, who is 41, was educated at Marlborough, Trinity Hall, Cambridge and Zürich. He joined Howards & Sons Ltd. in 1939 and was made a director in 1940. He has been managing director of Howards of Ilford Ltd. since 1953 when that company was formed. He is chairman of the Drug & Fine Chemical

Group of the Association of Chemical and Allied Employers and a member of the London Regional Committee of the Association of British Chemical Manufacturers. He is chairman of the Ilford North Boy Scouts Association and a member of the Local Advisory Committee of the Ministry of Pensions and National Insurance. He is a playing member of the MCC.

The Council of the City and Guilds of London Institute have conferred the Fellowship of the Institute (F.C.G.I.) upon REGINALD THOMAS COLGATE, A.C.G.I., D.I.C., D.Sc., F.R.I.C., M.I.Chem.E., chief technical works manager and chief chemist, Huntley & Palmers, Ltd., Reading, in recognition of his distinguished contributions to industry. Mr. Colgate studied chemistry under Professor H. E. Armstrong from 1906 to 1910 at the Cental Technical College as the City and Guilds College was then called, gaining an honours certificate as well as the A.C.G.I. in 1909, the D.I.C. in 1910, and his B.Sc. in 1911. From 1910 to 1912 he was a lecturer and assistant to Professor Armstrong, during which time he wrote extensively on his research work, alone or in collaboration with the Professor and others. In 1914 he was awarded the D.Sc. by the University of London. In 1913 Dr. Colgate was appointed chief chemist to Huntley & Palmers, Ltd., and since 1945 has held the additional post of chief technical works manager. He has been an active member of the Society of Chemical Industry, having held several honorary offices since 1927, including that of treasurer, secretary, and chairman of Council. In 1946 he was appointed first Chairman of Council, British Baking Industries' Research Association (DSIR), which office he still holds. In 1948 he was a member of the Government-sponsored mission to the US to report on new regulations concerning purity of food products. In 1947 Dr. Colgate was awarded the medal of the Society of Chemical Industry.

#### US Selenium Production

US production of selenium metal and compounds in the third quarter of 1955 was 152,751 lb. of contained selenium, according to the Bureau of Mines, US Department of the Interior. A total of 59,365 lb. of selenium metal and salts was imported during the period, 50,265 lb. from Canada, and 9,100 lb. from Mexico.

# Publications & Announcements

A PAMPHLET (issue U 5401), describing the Hayward Tyler-Byron Jackson chemical pump, has been published by Hayward Tyler & Co Ltd., Luton, Beds. This pump is available in four basic sizes giving a range of capacities up to 600 IGPM and heads up to 230 feet. The pump is designed to allow removal of the complete rotating element, bracket and stuffing box assembly as a unit without disturbing the suction or discharge piping. The cover is made of moulded synthetic rubber which prevents any risk from sprayed chemicals and a catch basin protects the bracket and base plate from injury. All parts except the pump case and impeller are completely interchangeable. A selection chart illustrates the full range of sizes available.

\* \* \*

A FLAMEPROOF battery electric truck has been designed and built by Brush Coachwork, Ltd., of Loughborough, Leicestershire, to meet the needs of industry. These trucks can be used safely in areas where explosive or inflammable materials are present. The advantages electric trucks have over petrol driven trucks are cheapness of operation, long life, silent running, and freedom from poisonous fumes. The Brush flameproof truck, based on the company's standard industrial truck, has a payload of one ton and a turning radius of six feet three inches, and its control gear and motor are totally enclosed to the standards laid down by BSS 229/1946, groups II and III which cover the use of equipment in the presence of blast furnace gas, hydrocarbons met in the distillation of crude oil, liquids derived from coal tar, solvents used in industrial processes, and coal and coke-oven gas.

\* \* \*

FOOTWEAR made from pvc and having oil-resisting qualities is being supplied by Panorama Equipment Ltd., 29/36 Seymour Mews, Wigmore Street, London W1. The new pvc shoes are claimed to give complete protection against oils, acids, greases etc. and are fitted with moisture-absorbing insoles made from Viscovita synthetic material. Ventilation grooves are provided on the inside of the shoes, keeping them cool and fresh for the wearer. In all climatic conditions, it is claimed, the feet are kept completely dry. The shoes are produced in

one single moulding without any seams and are said not to crease, lose shape or develop cracks. Cleaning is accomplished by rinsing inside and out with warm water and allowing to dry. Waffles are moulded on to the sole and heel to prevent slip or slide on greasy surfaces. Gum boots, which are also being manufactured, have been designed to suit conditions where sterilization and cleanliness are necessary. They are said to be capable of withstanding most conditions and to have a very long life. Resistance to all organic substances (e.g. liquid manures) is claimed. Like the shoes, the gum boots are also moulded in one piece. Repairs can be effected by welding. This same company is also introducing eight inch ankle boots made in pvc and having similar properties to the shoes and gum boots.

\* \* \*

'MECHANICAL Handling Equipment' is the title of a brochure put out by The British Wedge Wire Co. Ltd. (Wedco), Warrington. 'Some of our older customers' says a foreword to this brochure, 'still tend to look upon us as manufacturers of woven wire belts and woven wire belt conveyors only. We also manufacture many other types of conveyors including elevators'. Examples, with illustrations, are given of the various types of equipment manufactured, ranging from simple link belts to complicated conveying and elevating gear. The simplest belts made are made of steel wire woven into a mesh rather like that of a wire fence. These are suitable only for the lightest loads as they tend to stretch and narrow if subjected to heavy stress. They can be reinforced to give a more robust product by passing crossrods through the spiral coils in the mesh. By using many different arrangements of wires and rods it is possible to obtain belts suitable for a wide range of uses. Many industries appear to use 'Wedco' conveyor equipment if the illustrations in this brochure are anything to go by. Food manufacturers, car manufacturers, paper makers, brewers and many others are shown using various forms of this firm's equipment. All equipment is claimed to be tailored to suit the customers own requirements and is installed by British Wedge Wire who also offer a service after sales scheme.

## New Colour Schedule

A NEW British Standard, BS 2660, has been published which reduces the range of paint colours used in building and decorating to 101 standard colours. It is expected that as the standard is adopted, authorities and others concerned with decoration and protection by paints—public bodies, local councils and architects and, ultimately, the public—will use the new colour range.

In drawing up this standard the purpose has been to select aesthetically pleasing colours of contemporary and traditional styles which, at the same time, can possess proper resistance to the effect of weathering and exposure on building surfaces. The standard, which took up more than five years' research, is the result of collaboration between such bodies as the Royal Institute of British Architects, the paint industry, the British Colour Council, Government departments and the Building & Paint Research Stations.

Copies of the new standard are available from the British Standards Institution, Sales Branch, 2 Park Street, London W1, price 7s 6d. Larger specimens of individual colours for colour matching purposes will be available shortly, price 1s 6d each, or £7 7s for the complete set.

## NCB Engineering Conference

AN international conference on chemical engineering in the coal industry will be held by the National Coal Board from 26 to 29 June, 1956, at the new laboratories of the board's Coal Research Establishment at Stoke Orchard, near Cheltenham, Gloucestershire.

The conference will comprise four technical sessions: 'The Physical and Chemical Pre-treatment of Coal', 'Fluid Bed Carbonization', 'Briquette Carbonization', and 'Liquid By-Products'. Delegates will receive and discuss seven papers given by English, French, German, Dutch and American scientists and chemical engineers dealing with fundamental and practical aspects of these subjects. English, French and German will be the working languages of the conference.

On Friday, 29 June, delegates and other guests will inspect the new laboratories at Stoke Orchard and examine the work of the Establishment, where special emphasis is

being given to the development of smokeless fuels.

As accommodation is restricted, attendance will be limited to scientists and engineers with a particular interest in this field, and will be by invitation only.

## Metallurgy Awards

THREE Capper Pass Awards for 1955 have been made by an adjudicating committee representing the Institution of Mining and Metallurgy and the Institute of Metals.

The awards are: £100 to Dr. Maurice Cook, Mr. C. L. M. Cowley and Mr. E. R. Broadfield for a paper on 'The Use of Refractories in Low-Frequency Induction Furnaces for Melting Copper Alloys' (*J. Inst. Metals*, 1955, **83**, 295), £100 to Mr. P. M. J. Gray for a paper on 'The Extraction of Uranium from a Pyritic Ore by Acid Pressure Leaching', (*Trans. Inst. Min. Met.*, 1955, **65**, 55) and £50 to Mr. W. T. Edmonds and Mr. R. C. Lloyd for a paper on 'The Production of Light Alloy Drop Forgings, Their Heat Treatment, Inspection and Testing' (*J. Inst. Metals*, 1955, **83**, 247).

The Capper Pass awards are made from funds provided by Capper Pass and Son Ltd. for encouragement of the publication of scientific and technical papers dealing with processes and plant used in extraction metallurgy and on the subject of assaying, and of papers and processes used in all branches of the non-ferrous metal industry.

## Eighth Technical Exhibition

THEME of the Eighth Technical Exhibition of the Oil & Chemists' Association to be held from 20 to 22 March at the Royal Horticultural Society's New Hall, Westminster, London, will be the technical advances in the industries supplying the paint, varnish, printing ink, linoleum and allied trades. More than 80 companies and research organizations will have stand space at the exhibition.

Brochures of the exhibition have been sent to members in Commonwealth countries, and others are being prepared for dispatch to members in the UK this month. Any person or company wishing to receive a brochure should apply to the general secretary, Mr. R. H. Hamblin, Oil & Colour Chemists' Association, Memorial Hall, Farringdon Street, London EC4.

# Law & Company News

## Commercial Intelligence

### Increases of Capital

SUMMERFIELD & SONS LTD. (Formerly CARBIDE STORES LTD), storekeepers, warehousemen, carriers, dealers in and manufacturers of carbides, cyanamide and other chemicals, etc., 55, Gordon Square, London WC1, increased by £49,000, in £1 ordinary shares, beyond the registered capital of £1,000.

### Changes of Name

MONCKTON COKE & CHEMICAL CO. LTD. Monckton, Barnsley, name changed to MONCKTON (CARBONISATION) LTD., on 26 January 1956.

MONCKTON HOLDINGS LTD., Monckton, Barnsley, name changed to MONCKTON COKE & CHEMICAL Co. Ltd., 26 January 1956.

## New Registrations

### G. S. Trading Company Ltd.

Private company (560,902). Capital £100 in £1 shares: To carry on the business of manufacturers of branded chemicals, man-made fibres, plastics, surface coatings and fireproofing agents, adhesives, fungicides and chemical substances of all kinds etc. Directors: Joseph E. B. Stone, 41 Nuns Road, Winchester, and Geraint D. V. Glynn, Station Hill, Winchester. Registered office: 11a, Southgate Street, Winchester, Hants.

### Enbee Products (London) Ltd.

Private company (560,900). Capital £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in paint removing materials and other scouring, cleaning and washing preparations etc. Directors: Nathan Bromberger and Mrs. Susan A. Bromberger of 29 Hall Lane, Upminster, Essex. Registered office: 54 Cannon Street, London EC4.

### Aynsome Laboratories (Dublin) Ltd.

Private company (15,955). Registered in Dublin, Capital £5,000 in £1 shares. To carry on the business of analytical and consulting chemists etc.

Subscribers (each with one ordinary share): James Maybury, 20 Shanowen Drive, Santry, Dublin, and Miss Mary Sheehy, 10 Mount Street Crescent, Dublin.

## Company News

### Hickson & Welch(Holdings) Ltd.

In his statement to shareholders of Hickson & Welch(Holdings) Ltd., Mr. Bernard Hickson, M.Sc., F.R.I.C., the chairman and managing director, said that for the year ended 30 September 1955, the turnover and profit of Hickson & Welch Ltd., chemical manufacturers, were a record. The chemical manufacturing side of the group had made good progress and new plants which began producing during the year had increased the earning capacity and had contributed in great measure to the year's satisfactory results. John W. Leitch & Co. Ltd., and its subsidiary, The Gardinol Chemical Co. Ltd., which were acquired in December 1954, had also done well during the year. The Indian company, Hickson & Dadajee Ltd., had been re-organized and the output and sales of sulphur black dye increased. Group profit before taxation totalled £406,894, of which £210,323 will be provided for taxation. The following appropriations have been paid or proposed. On six per cent redeemable cumulative preference shares, £5,063. On ordinary shares; interim dividend of four per cent paid 2 June 1955, £12,650; proposed final dividend of 11 per cent, making 15 per cent for the year. £34,788.

### Permglaze Holdings Ltd.

Earnings of the Permglaze Holdings Ltd.group, manufacturers of paints, varnishes and synthetic enamels, for the year ended 30 September 1955, totalled £204,997. After deducting tax, the net surplus of £103,181, which represents the Group's biggest ever net profit, is an increase of £36,252 over the previous year. The directors have recommended a dividend of 15 per cent which, with the interim dividend of 7½ per cent paid last July, makes a total distribution of 22½ per cent against 17½ per cent last year.

### McKechnie Brothers Ltd.

The list of applications in connection with the offer for sale of 300,000 'A' ordinary shares of £1 each at 55s per share in McKechnie Brothers Ltd., of Widnes and Birmingham, closed on 9 February, the offer having been over-subscribed.

## Tin Research

### 1955 Annual Report Published

THE International Tin Research Council has published its 'Annual Report 1955'. This contains a report of the activities of the council during the last year and deals with the progress of research work on hot-tinning, tinsplate, soldering, electrodeposition, metallurgy and organotin compounds.

Two firms are now operating the direct chloride process for tinning cast iron. This process was originally developed in the Council's laboratory and has been described in *Tin and Its Uses*. Results indicate that the adhesion equals and may exceed that obtained by graphite-oxidation processes.

Information regarding the corrosion-resistant properties of tin has been published in a data sheet entitled 'The Chemical Resistance of Tin'. Methods have been devised for studying the effects of corrosion due to condensed moisture. These methods have, however, lacked precision of control and apparatus is now being constructed to enable tests to be carried out on exposure to the controlled variations in atmospheric conditions that are called for by various specifications.

The electrodeposition of tin and its alloys has received further study and the tin-zinc and tin-nickel alloys are gaining ground in industry throughout the world. Systematic research into the mode of action of addition agents in tin and tin-alloy plating baths has continued.

### Organic Compounds

Following their earlier discovery of the biocidal properties of simple trialkyltin and triaryltin compounds, the Organisch Chemisch Instituut, TNO, Utrecht, Holland, has prepared compounds containing mixed aryl and alkyl radicals. More than 60 new compounds have been prepared. A new type of reaction for effecting a tin-carbon linkage has been discovered, and another reaction has been worked out for the introduction of more complex groups into the organotin molecule.

Some dioctyltin compounds have been prepared and tested as stabilizers for pvc. They were found to be about as effective as dibutyltin compounds.

The Council's metallurgical researches have been concerned with the perfecting of certain techniques in the production of the

aluminium-tin bearing which was invented in the Institute a year or two ago.

The Tin Research Institute, which is controlled by the International Tin Research Council, is situated at Fraser Road, Perivale, Greenford, Middlesex.

## Marking Techniques

A BOOKLET of 34 pages entitled 'Marking Techniques' has been published by the Association of British Chemical Manufacturers. This is a sequel to 'Marking Containers' which the ABCM published in 1953, and discusses some of the problems encountered in the labelling of chemical containers and describes the various techniques available.

Standard labels were the subject of an exhibition held by the ABCM from 6 September to 28 October last year and a typical example was reproduced in *THE CHEMICAL AGE* (1955, 73, 1222). This booklet gives much useful information on the design of labels for specific purposes and emphasizes the importance of employing expert advice before deciding size of label, type sizes etc. Instructions are also given for the marking-up of copy for the printer.

The advantages and disadvantages of the different processes available, lithography, letterpress, screen stencilling, paper stick-on labels, printed adhesive tape, transfers, tie-on labels, stencilling etc., are described and short accounts of the theory of these methods are given.

Legal aspects of labelling are also discussed and it is emphasized that expert advice should always be obtained when there is any doubt.

Copies of the booklet can be obtained from the Association of British Chemical Manufacturers, Cecil Chambers, 86 Strand, London WC2, price 7s 6d post free, cash with order.

### Kuwait Oil Find

A recent report in the *New York Times* said that what might prove to be one of the largest oil fields in the Middle East had been discovered by the Kuwait Oil Co. at Rawdartrin, near the Iraqi border. According to the report a well drilled more than 3,000 metres deep had encountered oil sand with a thickness of 450 metres, three times as thick as the oil sand in the prolific Bordan field in Kuwait.

## Next Week's Events

### MONDAY 20 FEBRUARY

#### RIC (London Section)

Dartford: North-West Kent College of Technology, Miskin Road, 7 p.m. 'The Infra-Red Absorption of Organic Compounds' by J. E. Page, B.Sc., Ph.D., F.R.I.C.

#### The Chemical Society

Oxford: Physical Chemistry Laboratory, South Parks Road, 8.15 p.m. 'Steroid Hormones, Natural & Artificial' by Professor C. W. Shoppee, Ph.D., D.Sc., F.R.I.C.

Cardiff: Chemistry Department, The University, 5.30 p.m. 'The Hydride Ion in Organic Chemistry' by Professor E. A. Braude, Ph.D., D.Sc., F.R.I.C.

#### SCI (Pesticides Group)

London: Rooms of the Chemical Society, Burlington House, Piccadilly W1, 5.30 p.m. 'Recent Advances in the Use of Insecticides in Animal Health' by J. Carmichael.

### TUESDAY 21 FEBRUARY

#### SCI (Agriculture Group)

London: Royal College of Science, Imperial College, Imperial Institute Road, South Kensington SW7, 10.30 a.m., and 2.15 p.m. A full-day symposium 'Some Cultural & Chemical Aspects of Crop Production'. Chairman, A. W. Marsden, M.Sc., D.I.C., A.R.C.S., F.R.I.C.

#### The Chemical Society

Belfast: The Queen's University, 7.15 p.m. 'The Fischer-Tropsch Synthesis—A Challenge to the Physical Chemist' by Professor C. Kemball, M.A., Ph.D., F.R.I.C.

#### Institution of Chemical Engineers

Chester: The Grosvenor Hotel, 7 p.m. 'Heat Transfer Media at Elevated Temperatures, for the Control of Reactions' by P. A. Rottenburg, B.A.

#### Oil & Colour Chemists' Association

London: Royal Society of Tropical Medicine & Hygiene, Manson House, 26 Portland Place W1, 7 p.m. 'Instrumentation & Automatic Control With Applications to Resin & Varnish Manufacture' by H. T. Bone, A.R.I.C., A.M.I. Chem. E., A.L.M.

### WEDNESDAY 22 FEBRUARY

#### Society of Instrument Technology

Chester: Board Room of Chester & District Hospital Committee, 5 King Street, 7 p.m. 'Mass Spectrometers', by Metropolitan Vickers Ltd.

#### The Chemical Society

Dublin: Trinity College, 7.45 p.m. 'A Fluorocarbon Chemistry' by Dr. R. N. Haszeldine, M.A.

#### SCI (Food Group)

London: Rooms of The Chemical Society, Burlington House, Piccadilly W1, 6.30 p.m. 'Corrosion Problems in Dairy Technology' by G. A. Botham, B.Sc., F.R.I.C.; E. C. Crossley, B.Sc., F.R.I.C., F.L.S.; and J. G. Davies, B.Sc., Ph.D.

### THURSDAY 23 FEBRUARY

#### The Fertiliser Society

London: Geological Society, Burlington House, Piccadilly W1, 2.30 p.m. 'N. P. K. Residues from Fertilisers & Farmyard Manure in Long-Term Experiments at Rothamsted' by R. G. Warren, B.Sc.

#### SCI (Yorkshire)

Leeds: The University, 7 p.m. Third Hodsman Memorial Lecture, 'New Developments in the Production of Town's Gas' by J. H. Hyde, M.Sc., M. Inst. Gas E.

#### SCI (Edinburgh)

Edinburgh: North British Hotel, 7.30 p.m. 'Some Developments in the Study of Physical Adsorption' by D. H. Everett, M.B.E., M.A., D. Phil.

#### The Chemical Society

Aberystwyth: Davies Chemical Laboratories, University College of Wales, 5.15 p.m. 'Some Aspects of the Organic Chemistry of Phosphorus' by Professor H. N. Rydon, Ph.D., D.Sc., F.R.I.C.

### FRIDAY 24 FEBRUARY

#### SCI (N. Ireland)

Belfast: Agriculture Lecture Theatre, 7.15 p.m. Annual general meeting.

#### The Chemical Society

Birmingham: Chemistry Department, The University, 4.30 p.m. 'Some Radiation Problems in Nuclear Energy Research' by Dr. W. Wild.

#### RIC (London Section)

London: Norwood Technical College, West Norwood, 6.30 p.m. 'The Chemist in the Detection of Crime' by J. B. Firth, C.B.E., D.Sc., M.I.Chem. E., F.R.I.C.

### SATURDAY 25 FEBRUARY

#### Institution of Chemical Engineers

Manchester: Reynolds Hall, College of

Technology. 2 p.m. Symposium. 'Modern Methods of Counter-Current Vapour Liquid Contacting with Reference to Plates, Packings & Grids'.

#### RIC (London Section)

London: Caxton Hall, Westminster SW1. 7.30 p.m. to 11.45 p.m. Joint buffet dance with the London section of the SCI.

## Market Reports

LONDON.—The movement against contracts to the chief industrial outlets has been fully maintained during the past week, and there has been a steady flow of new business both on home account and for export. The supply position generally remains good and prices are on a firm basis. Among the soda products there is a good demand for the sulphides of soda, and for nitrate, bichromate and prussiate of soda, and the potash compounds are unchanged on a steady demand. Elsewhere there has been a good demand for fertilizers. The coal tar

products market shows little change, and prices well held throughout.

MANCHESTER.—Steady to firm conditions continue to feature pretty well all sections of the Manchester chemical market, though actual changes on the week have been few. Contract deliveries of the alkalis and other leading heavy products have continued on a satisfactory scale and fresh enquiries have been fairly numerous, home users as well as shippers being prominent. Taking the fertilizer section as a whole, the movement of supplies is now reasonably steady and a further improvement is looked for during the coming weeks. A good demand is reported for most of the tar products.

GLASGOW.—A rather quieter aspect prevailed during the past week in the Scottish heavy chemical market, but once again a little improvement was noted towards the end. Prices generally continue to remain steady with no important changes to be reported. The export market continues at a good level, and numerous enquiries are still being received.

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# CLASSIFIED ADVERTISEMENTS

## SITUATIONS VACANT

*The engagement of persons answering these advertisements 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 exempted from the provisions of the Notifications of Vacancies Order, 1952.*

**ANALYTICAL CHEMISTS.** required by THE POWER GAS CORPORATION LTD., Stockton-on-Tees. Applicants should be below 35 years of age and have had experience of Inorganic Analysis and preferably be of H.N.C. standard. Permanent and pensionable positions. Salary according to qualifications and experience. Application forms from STAFF PERSONNEL DEPARTMENT at the above address.

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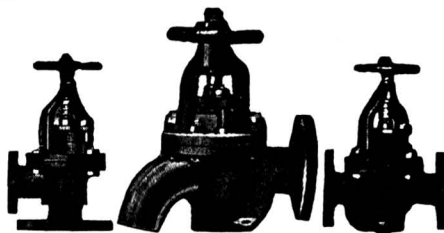
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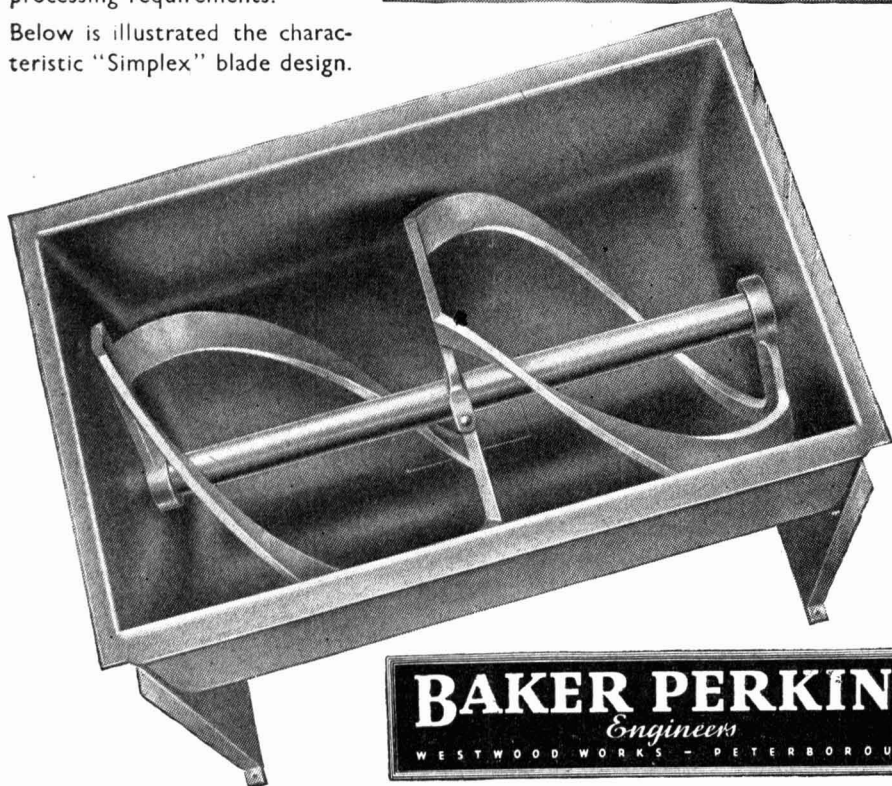
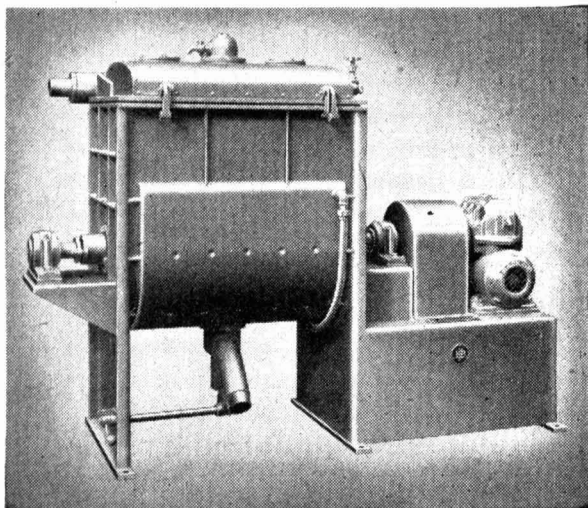
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# INDEX to advertisers in this issue

	Page		Page
Baker Perkins Ltd.	459	Mirrlees Watson Co., Ltd. (The)	420
Bowmans Chemicals Ltd.	454	Nikex	417
British Tar Products Ltd.	426	NorDac Ltd.	423
Brotherton & Co., Ltd.	422		
Classified advertisements	456, 457 & 458	Oil & Colour Chemists' Association	422
Cole and Wilson Ltd.	458		
English Glass Co., Ltd.	Cover iii	Power-Gas Corporation Ltd.	Cover iv
Ewart M.D. & Co., Ltd.	454	Price Stutfield & Co., Ltd.	Front Cover
Geigy Co., Ltd. (The)	455	Pulsometer Engineering Co., Ltd.	426
Geigy Pharmaceutical Co., Ltd.	424		
Haughton's Metallic Co., Ltd.	458	Shell Chemical Co., Ltd.	419
Imperial Chemical Industries Ltd.	421	Simm G.E. (Engineering) Ltd.	420
Kestner Evaporator and Engineering Co., Ltd.	460	Richard Simon & Sons Ltd.	Cover ii
Leigh & Sons Metal Works Ltd.	454		
Mills Packard Construction Co., Ltd.	Cover ii	United Coke and Chemicals Co., Ltd.	Cover iii
		Widnes Foundry & Engineering Co. Ltd.	418
		Worcester Royal Porcelain Co., Ltd. (The)	458

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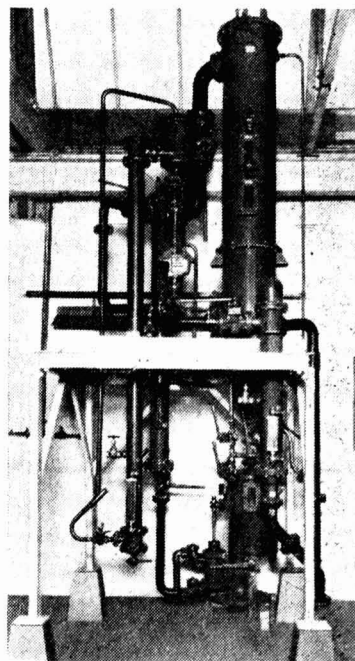
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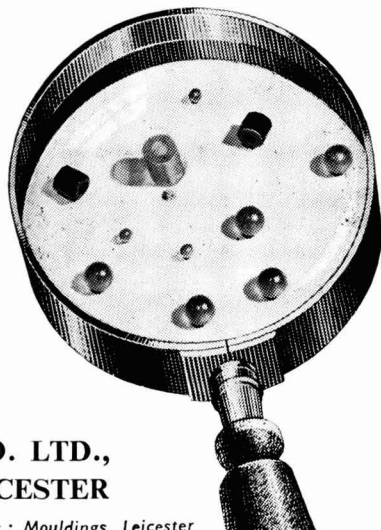
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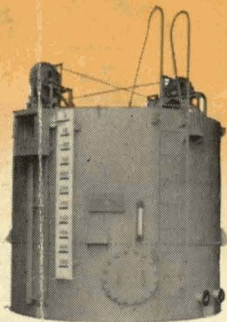
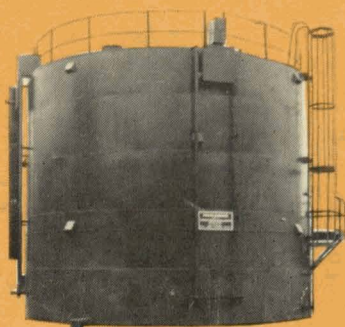
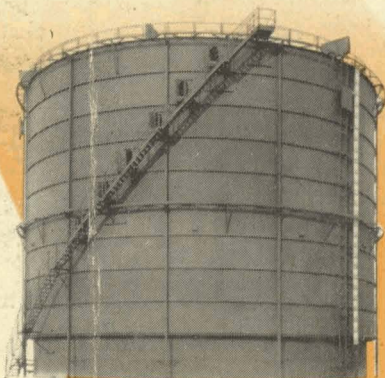
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