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CHEMICAL AGE

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METALLIC CORROSION

METALLIC CORROSION has been recognised since ancient times, but it is only in the last few decades that the cost of corrosion to industry and in particular to the chemical industry has become so widely important. In fact, metallic corrosion is costing the UK £600 million a year, and even this sum only represents probable costs of maintenance of metal installations and the cost of equipment made unserviceable by corrosion. Indirect costs of breakdowns caused by corrosion such as shutdowns, loss of product, low efficiency, explosion and contamination are incalculable.

At the beginning of this century, deterioration by corrosion was generally accepted with the attitude that damaged material could be easily replaced. But with the very considerable industrial expansion that has taken place, the cost of replacement of equipment etc., cannot be ignored. Rapid depletion of iron ores is another consideration.

It has been estimated that about 30 years ago, renewal of ferrous materials and products because of corrosion amounted annually to about two per cent of the total tonnage of such materials etc., in use. This indeed represents considerable waste since the scrap value is negligible compared with the replacement cost.

Annual British expenditure on protection of iron and steel at the end of World War Two was estimated at £200 million. The yearly bill for the whole world at that time was about £600 million. One American investigator in 1949 calculated the annual direct loss to the US of £1,500 million. This includes, however, every direct loss due either to deterioration or substitution of more expensive materials.

Capital charges, maintenance costs, sales losses and higher operating costs, and overhead costs are the four main business costs.

Under capital charges come over-design, corrosion resistant equipment and additional equipment for corrosion prevention such as cathodic protection rectifiers and dehumidifying equipment, inventory for maintenance and storage for maintenance supplies.

Choice of metals for construction of a plant is a very important factor and this is considered in detail in the first article on corrosion in chemical plant by Himsworth and Hines on page 285 of this issue. Substitution of one metal for another or alloy may save a considerable sum of money. But not all material loss by corrosion can be prevented despite careful use of metals, metal alloys or protection, for continuous and periodic upkeep is always necessary. However, modern techniques and advice from the growing number of experts on corrosion are proving of value.

The methods used in combating causes of corrosion are varied, such as the application of appropriate protective coatings, the use of corrosion inhibitors, choice of better materials for constructional purposes, atmospheric control and even improvement in the layout of the plant to avoid inter-contamination between units.

Most frequently applied for underground pipelines is cathodic protection, introduced as early as 1824 by Sir Humphry Davy. Where protective coating is used, pretreatment of the mutual surface is all important, as also

is the method of application and the nature of the coating applied.

Plastics are now playing an important role in chemical plant. Plastics ventilators and fans have been introduced recently. Polythene piping is now widely used. In use in the US are fume exhaust stacks two feet in diameter and 40 ft. high made of polyester resin reinforced with glass fibres and coated with an epoxy resin for added corrosion resistance. Such stacks are strong enough to require no support other than guy wires. Because resin/glass has excellent chemical resistance, it is being used for electroplating tanks and chemical fume ducts, while several manufacturers are experimenting with it for pipe manufacture. Other uses of plastics materials are for centrifuges, chute feeds and as pump and tank liners etc. Another recent introduction is a mobile spray fluidising unit for application of polythene, nylon and fluorocarbon films to metal parts by spray or dip coatings.

Graphite is another material much in evidence in the fight against corrosion. It is being used in piping, pumps and heat exchangers.

With the greater availability and reduction in price of titanium, zirconium and tantalum, chemical engineers are enthusiastically finding new uses for these metals in the fight against corrosion. Titanium is now being tested in heat exchangers, reactor linings, bubble caps in distillation columns and filter press parts. Tantalum has already proved of value in reactors, stills, anodising racks, and pipes and tubes, and zirconium has been successfully used to line tanks, steam-jet exhausters, exhaust fans, mechanical seals, spray nozzles, pump parts, rotary filters etc.

Corrosion studies in the UK and Europe are unfortunately lagging behind those in the US. There are quite a few US universities dealing with anti-corrosion research, independent research organisations, government laboratories and research stations and professional and scientific bodies. Of importance is the US five-year research, development and education programme on corrosion which it is hoped will save $921,900,000 annually. Corrosion engineers (most of whom are at present trained in industry) are frequently to be found in US plants, but in the UK and Europe this is not the case, although it is considered there are many capable men available.

Much investigative work in the UK on corrosion is being carried out by the Services, as, for instance, the Admiralty Laboratory, Emsworth, the Royal Aircraft Establishment at Farnborough and the Armament Research Establishment at Woolwich. A research school with an international reputation is that of Dr. U. R. Evans, while the corrosion sections of the British Non-ferrous Metals Research Association and British Iron and Steel Research Association have made valuable contributions regarding corrosion problems.

It would appear that there is considerable thoughtful study of corrosion problems, but action is lacking. The establishment of a Corrosion Research Station under the direction of a Corrosion Research Board has been proposed by Dr. W. H. J. Vernon, and would be welcomed.

University training in corrosion is definitely lacking and should be rectified. At the present time, there are too few trained corrosion workers, and technical personnel are far too theoretical in their approach to corrosion problems.

For economic reasons, corrosion can no longer be accepted as natural and the old saying ' Prevention is better than cure ' must apply.

JAPAN ACQUIRES ICI POLYESTER PATENT

UNDER a recently concluded arrangement between Imperial Chemical Industries Ltd. and two Japanese rayon manufacturers, Teikoku Rayon Co. Ltd. and Tokyo Rayon Co. Ltd., these companies have acquired patent rights for the manufacture of polyester fibre in Japan. The polyester fibre in question will be that which is known in the UK and elsewhere, except the US, under ICI's trade name ' Terylene '.

It is understood that the arrangement involves a substantial fixed payment and a continuing royalty on sales. The Japanese companies will not have the right to export polyester filament yarn, staple fibre and film to the UK or to any other country where ICI have patent rights. In the US this polyester fibre is being produced by E.I. Du Pont de Nemours Inc., under the trade name ' Dacron.' The arrangements concluded with the Japanese companies do not, however, include any restrictions regarding the export of garments of this synthetic fibre.

Some time ago, the USSR approached ICI with regard to acquiring patent rights in ICI's polyester fibre, but negotiations have not advanced.

ICI's patent rights in the UK expire in July 1958, unless an extension can be obtained on the grounds of non-use of the patent during the war years. Patents held by ICI elsewhere throughout the world expire at various times, but none prior to 1965. Licensing arrangements which ICI have made in Europe are as follows: France, one company; Germany, two companies; Holland, one company; and Italy, one company.

Apparently, the position with regard to Japan has been that, if ICI had not made arrangements with the interested Japanese firms, these could have obtained a compulsory licence to manufacture this polyester fibre in Japan. Under such an arrangement ICI would not have gained any financial interest or royalties. This situation has arisen because ICI have not ' worked ' the patent in Japan.

No very early production of the polyester fibre by the Japanese is anticipated, for although the patent rights are now available, development of these will take time. The raw materials required, naphtha, mixed xylenes and ethylene (obtained from crude oil in the UK) and ammonia, may also prove difficult to obtain in quantity.

ALUMINIUM TRIALKYLS

ANOTHER US chemical manufacturer has entered the metal alkyl field. US Industrial Chemicals is now producing trimethyl and trimethylaluminium (*Chem. & Engng. News*, 1957, **35**, 7). The other US company marketing metal alkyls is the Hercules Powder Company.

According to USI, the trimethyl compound is a promising fuel and igniter for jet engines. Other possibilities are its use as a polymerisation catalyst or a chemical intermediate. USI's subsidiary company, Metalectro Corporation, Laurel, Md., US, are producing it on a pilot scale. USI consider that the trimethylaluminium can be made in commercial quantities at a cost of $2.00 to $5.00 a pound.

Triethylaluminium is, of course, a catalyst used in the Ziegler low pressure polythene process. Price of the aluminium trialkyls has previously been quoted at up to $25 a pound (CHEMICAL AGE, 1956, **75**, 540). The low price USI quote for the trimethyl compound is of particular interest. Whether a similar price will be quoted for the triethyl compound remains to be seen.

Also of significance is the production of these metal alkyls by USI. This suggests that USI have developed a new process for production of these compounds since the known process for their manufacture is patented.

CHEMISTS IN THE SERVICE OF THE ARMED FORCES

FORMED in 1854 with a staff of one chemist, an assistant and a messenger, the Chemical Inspectorate has grown till in the second world war it employed 1,600 scientists and assistants. Originally a small testing unit of the War Office, under the direction of Sir Frederick Augustus Abel, F.R.S., it is today a large organisation of research and development chemists whose work is vital to the supply of weapons and equipment for the armed forces.

Much of the Inspectorate's work has civil uses also and it gives help in the production of new and improved materials. Its scientists played an important part in the development of atomic energy in this country..

Chemical Service in Defence of the Realm, by W. G. Norris, published by the Ministry of Supply, reviews briefly the history of the Chemical Inspectorate and then describes testing, research and development work on a wide range of products—plastics, rubbers, lubricants, paints, textiles, explosives, pyrotechnics, building materials, penicillin, packaging materials etc. together with a short chapter on analytical methods. Current specifications held by the Inspectorate number over 2,000.

Explosives were the first, and are still one of the most important, subjects controlled by the Chemical Inspectorate. Very few industrial concerns, says the book, have the necessary knowledge and equipment to manufacture explosives and fill them into the many types of ammunition and weapons used by the services. This work is largely done in Government ordnance factories. Technical problems can seldom be solved by drawing on the experience of the chemical industry in general.

Pyrotechnics

Military pyrotechnics, i.e. devices which function by producing fire and/or smoke and by emitting light, are also the responsibility of the Chemical Inspectorate. It was not until towards the end of the first world war that the unreliability of pyrotechnics forced the authorities to introduce scientific principles into their production.

Paints, varnishes and other surface coatings form a large part of the Inspectorate's work. An advisory service to many other Governments is provided and in this connection about 30 research and development projects are being carried out.

A current project is concerned with anti-corrosive priming paints based on the new high dispersion red lead, metallic lead, lead cyanamide, and calcium plumbate, formulated with linseed oil, oleo-resinous and alkyd media. Preliminary tests have shown that calcium plumbate is one of the best pigments and linseed oil is the best medium.

The first plastics to be used for military supplies were celluloid and cellulose acetate. In the 1930's phenol-formaldehyde resins began to be used for components for shells and bombs. Uses for plastics increased during the second world war and a special plastics section of the Chemical Inspectorate was formed.

Causes of corrosion of ammunition components packed in resilient hair in polyester-glass fibre laminated containers are being investigated. Major cause was acetic acid, arising from three different sources; hydrolysis of acetylated polyester resin, hydrolysis of the p.v.a. binder, present in the resilient hair, and hydrolysis of the same binder used in the glass mat.

In the presence of monomeric styrene derived from the polyester the enclosure of the component in double polythene bags was found to be ineffective. Transmission rate of water and acetic acid has been found to increase thirty-fold in the presence of styrene vapour.

Mr. E. W. S. Press, B.Sc., F.R.I.C., who has been director of chemical inspection, Ministry of Supply since 1955

(Crown copyright reserved)

Spray packaging using vinyl plastics has been studied by the Inspectorate. The process is done in four stages. A chlorinated rubber-rubber solution is sprayed over the equipment, forming a web. This is followed by a solution containing vinyl chloroacetate copolymer to form a continuous film. Next comes a bitumen coating which is spattered on. The whole system is finished with a coating of light and heat reflecting aluminium paint.

The Inspectorate has been closely interested in nylon for several years and was the first organisation to discover and report the phenomenon of embrittlement of nylon upon ageing. Viscosity measurements indicate that the effect may arise in moulding.

Discoloration and stress cracking of polythene mouldings have caused concern and current work is in hand in connection with the residual antioxidant. Samples of newer forms of polythene with improved physical characteristics are being investigated.

Rubbers are examined by the Inspectorate in conjunction with plastics inspection. Because of its wide experience in the rubber field it is able to advise other departments on new products. To save dollars, maximum possible use is made of natural rubber.

Recently a specification was developed for a proofed fabric suitable for making collapsible containers of up to 10,000 gallons capacity for aviation spirit. It consists of a nylon cloth coated inside with nitrible rubber for petrol resistance and outside with neoprene for ageing resistance.

Early in the second world war the Inspectorate organised an analytical team. Current research includes an investigation into the polarographic determination of lead. The determination of benzene in toluene is another important analysis for which it is thought that polarography might be suitable where gas chromatography was not available. The procedure planned is to nitrate the sample, separate the nitrobenzene from the nitrotoluene and determine it polarographically.

Gas chromatography has been introduced because it appears to be a suitable technique. Quantitative determinations have been carried out on mixtures of trichlorethylene and coal tar naphtha. An accuracy of the order of ± 3 per cent has been obtained.

Courses at Norwood Technical College

DETAILS are announced of two courses to be held at Norwood Technical College, Knight's Hill, West Norwood, London.

A course on chromatography will consist of three lectures on Fridays 15, 22 and 29 March from 6.15 p.m. to 9.15 p.m., and three periods of practical work illustrating the lecture topics on Saturdays 16. 23 and 30 March from 9.15 a.m. to 12.30 p.m. Principal topics will be paper and column chromatography of organic and inorganic compounds, methods based on ion exchange, and gas chromatography. Lecturers will be Tudor S. G. Jones, Ph.D., AR.I.C.; D. K. Hale, B.A., M.A.; and A. A. North, B.Sc., A.R.I.C. Fee for London students is 10s.

A course on semi-microchemical methods, consisting of 12 lectures and appropriate practical work, will be held on Saturday mornings from 9.15 a.m. to 12.30 p.m., beginning 6 April. Designed to survey the principal branches of chemistry in which small-scale methods have been successfully applied, the course is particularly suitable for teachers, industrial and research chemists.

Lectures, illustrated by demonstrations, will deal with the following topics: scope, aims and achievements of small-scale techniques, design and construction of simple apparatus; organic and inorganic preparation on a reduced scale; simple chemical microscopy and photomicrography; inorganic qualitative and volumetric analysis; organic qualitative and quantitative analysis; microtechniques for the determination of molecular weights etc. Fee for London residents is £1.

Prague Symposium

The 1957 International Symposium of Macromolecular Chemistry will be held in Prague in September. Full information can be obtained from Professor J. C. Bevington, Chemistry Department, Birmingham University.

Armour Reactor Allows 'Most Sensitive Ever' Chemical Analysis

A REACTOR, specially built for private industrial research, is being used in Chicago by 24 companies in a co-operative venture. Operated by the Armour Research Foundation of the Illinois Institute of Technology, the reactor enables US industrial firms, for the first time, to carry out reactor studies without security restrictions and military competition.

Each company contributed 20,000 dollars towards the construction and initial operation costs, which amounted to 700,000 dollars. The balance was provided by the Armour Research Foundation, a non-profit organisation.

The 24 firms now have the reactor at their disposal for three years, during which time concentrated research, aimed at applying atomic techniques to industrial programmes, will be carried out.

Their experiments at the Armour facility will exploit the radiation received from a nuclear reactor, together with the techniques associated with this radiation, in the solution of problems which industry faces every day.

The reactor is capable of operating at a power level of 50,000 watts. It produces neutrons and gamma radiation for research and development in the fields of chemistry, metallurgy, biology, food processing, electronics, textiles, oils and gases, rubber and leather, machinery, building materials, and allied industrial and scientific pursuits.

Short-lived radioisotopes, useful in industrial and scientific research but so far little used because they lose their radioactivity in transit, are available locally from the installation.

As an example of the new and powerful techniques made possible by the reactor, 'neutron activation' now permits what is probably the most sensitive method of chemical analysis known to date. By this method impurities in very rare quantities can be detected.

Another newly-developed technique is that of 'neutron diffraction.' Since the diffraction of neutrons is almost independent of atomic number, there is now available a powerful method of structure analysis which complements, and frequently exceeds, the standard X-ray diffraction techniques. This method has already proved valuable in the study of organic compounds, hydrogen and oxygen in solids, and anti-ferromagnetic materials.

Bombardment of materials by radiation produces effects in almost infinite variety. The study of such effects in glasses, plastics, organic systems, and metallic alloys can be undertaken readily with the reactor. The flux also will permit study of the influence of radiation on chemical reactions, some of which are known to accelerate under these conditions.

The reactor is a 'water boiler' type using, as fuel, enriched uranium dissolved in about four gallons of water.

Glove Box Symposium at Harwell

GLOVE BOX DESIGN and operation is the subject of a three-day symposium at the Atomic Energy Research Establishment, Harwell, from the 19 to 21 February. Among those invited to participate are research workers from Universities, representatives of interested industrial firms and delegates from overseas atomic energy organisations, in addition to staff of the UK Atomic Energy Authority.

The symposium will cover the design and operation of both shielded and unshielded glove boxes and during the conference delegates will be invited to tour typical installations in the chemical and metallurgical laboratories at Harwell.

Papers on the general design of shielded and unshielded boxes, on their installation and maintenance and on their applications to chemical, metallurgical and large scale operations will be among those to be presented.

Typical applications of these glove boxes are in the study of the chemistry and metallurgy of plutonium (unshielded boxes).

New Telephone Number

Telephone number of Electrothermal Engineering Ltd., 270 Neville Road, London E7, has been changed to Grangewood 9911.

Shell Moves House

Shell Chemical Co., Ltd., formerly at Norman House, Strand, London WC2, has moved to Marlborough House, Great Marlborough Street, London W1 (telephone: Gerrard 0666). Most of the staff moved in on Monday 11 February. Certain departments previously at 170 Piccadilly are remaining at that address. Public Relations department remains at Walter House, Bedford Street WC2.

Extensions Approved

Steetley Magnesite Co. Ltd., has had plans approved for the erection of extensions to its factory at West Hartlepool, Co. Durham The work includes extensions to the hydrotreater dust plant, the building of an electric sub-station, sea water storage tank, beach pump house and bridge, office block and other premises.

Synthetic Petrol Plan Dropped

Mr. G. S. Steel, general manager of Kepec Co. (England) Ltd., manufacturers of leather chemicals, Otley, Yorks, announced last week that the firm's plans for the production of synthetic petrol (see CHEMICAL AGE, 19 January, p. 134) have now been definitely abandoned because of difficulties in getting one of the ingredients.

Borax 1957 Research Programme on Chemistry of Boron

AN INTENSIVE programme of research is to be undertaken by Borax Consolidated Ltd., UK operating company of Borax (Holdings) Ltd. and by the US company, United States Borax and Chemical Corporation. This was stated in London last week by Mr. Desmond Abel Smith, chairman of Borax (Holdings).

The American company will undertake work on boron and potash products for industrial use and much of their efforts will be directed towards new uses in agriculture. Time will also be devoted to the development of new and improved package products, but particular stress will be laid on work in the chemistry of organic boron compounds. UK scientists will concentrate largely, but not exclusively, on the inorganic compounds of boron.

UK investigations during 1957 will cover an important part of the chemistry of boron, about which there is still much to learn. The end products are so diverse that the scope for research is immense. To take a random example, Mr. Smith said that the use of borax in anti-freeze agents would be studied, and its property as a corrosion inhibitor investigated. At the other end of the temperature scale, work is to be done on borides which can resist immense temperatures. Some borides are noted for their hardness. Much of this work is, of course, fundamental and somewhat abstruse.

The US chemists will investigate many of the interesting and highly complex systems that can be built up when boron atoms are joined to nitrogen or carbon atoms. In this boron-organic chemistry, possibilities are almost unlimited. Fuels and fire retardants, insecticides and fluids for transferring heat are some of the typical applications being developed.

In order to house the enlarged research team and provide the fullest facilities for their work, Borax Consolidated have recently acquired research laboratories at Chessington in Surrey. These will house up to 50 chemists, with room for further expansion.

Petrochemical Plants Opened at Grangemouth

TWO NEW PLANTS for the production of ethylene and ethanol have been successfully brought into commercial operation by British Hydrocarbon Chemicals Ltd., and have doubled the existing capacity for these basic chemicals.

The decision to construct these two plants was announced in June 1955 as part of the £8,000,000 expansion programme of the company's chemical works at Grangemouth, Scotland.

The two new units are operating on petroleum distillate feedstock from the Grangemouth refinery of British Petroleum.

British Hydrocarbon Chemicals is jointly owned by the British Petroleum Co. Ltd. and the Distillers Co. Ltd.

Corrosion Problems in Chemical Factories—I

Choice of Constructional Materials

By
F. R. Himsworth, Ph.D., B.Sc.,
and
J. G. Hines, Ph.D., M.A.

This is the first part of Himsworth and Hines' paper on corrosion problems in chemical factories, written specially for CHEMICAL AGE. *The authors endeavour to give guiding principles and the paper may be considered a broad outline of current practices in corrosion prevention.*

Next week, the use of non-ferrous metals and chemical methods of protection will be discussed. Other matters which will be considered later in this series will be the sphere of usefulness of non-metallic materials and plastics and rubbers; also atmospheric corrosion, plant floors, effluent drains etc.

IN A FACTORY producing chemicals, problems of corrosion are bound to arise; indeed the practicability of a chemical process often depends on the existence of materials which will withstand the corrosion, and have also the necessary mechanical properties. Where the chemicals being manufactured are acids or salts that are severely corrosive, the problem is serious; where the products are relatively non-corrosive, for example in some parts of an oil refinery, much less trouble is experienced.

This paper is based mainly on experience in large factories producing acids, inorganic salts, fertilisers etc. In such factories corrosion arises in many forms and in many situations, not only inside equipment, but also on external structures, in effluent drains, and in the ground if leakage should occur. The materials used to resist corrosion are varied; for plant items expensive metallic or non-metallic materials may be justified, whereas for structures, floors, drains etc. cheaper materials are required

Selection of materials for the construction of a plant to handle corrosive liquors involves the consideration of many factors. The material must be sufficiently resistant to the liquor under the worst likely conditions of temperature, composition, velocity. These will be on occasion more severe than during normal running, and such variations must be allowed for.

External Corrosion

A fact often overlooked is that liquid leaking from a defective joint may become more corrosive when it has become diluted or aerated by the atmosphere, and may cause external corrosion; concentrated nitric acid can be safely stored in aluminium vessels, but if a leak or spillage occurs, the acid becomes diluted, and is then very corrosive to aluminium.

Another point which often arises is that a material, though not appreciably corroded, may damage the product by introducing small amounts of impurity. Mild steel, for example, is not noticeably corroded by formalin, but causes discoloration which makes the formalin unsuitable for many puposes.

A constructional material must also have sufficient strength and rigidity at the temperature involved. It must be capable of being fabricated into the required forms by processes which are not too costly, and which do not adversely affect the corrosion resistance. The final decision must be based on costs, including the costs of the material, fabrication, maintenance, and replacement. In a small chemical plant it may often be found more profitable to use a cheap material and replace it regularly than to use a more expensive material with a longer life. In a large integrated factory, however, where maintenance work on one plant may cause loss of production from several others, it is usually found economic to employ materials having a long life in spite of higher cost.

By far the commonest materials for chemical plant construction are metals. But for many severe duties ceramic materials are used; they have much higher resistance to corrosion than even very expensive metals, but are weaker, more brittle, and not easy to fabricate. Rubbers and plastics are becoming more and more important materials of construction as experience grows; the main limitation to their use is their relatively poor temperature resistance. Timber is often overlooked, but has stood up to many years under arduous conditions in old factories.

The discussion which follows is subdivided into several sections, dealing with different aspects of corrosion problems.

Choice of Materials

Mild steel and cast iron are the cheapest metallic materials of construction and are therefore the first to be considered for any engineering project. In the chemical industry, however, their usefulness is limited by their poor resistance to corrosion in many environments, and it is usually necessary to consider the use of more expensive materials. The stainless steels and copper, nickel and aluminium alloys are the most widely used, but occasionally even more expensive metals, such as titanium, tantalum and the precious metals may be economic. Non-metallic materials are being used on an increasing scale. The primary consideration controlling the choice of material is, of course, cost, an expensive material being practicable only if the expected reduction in operating and maintenance costs are sufficient to offset the higher initial capital expenditure.

Selection of the most suitable material for a given purpose must be made on the basis of the best available information on the behaviour of possible materials under the exact conditions existing. If the plant envisaged is a duplicate or replacement for an established process, the available information may be considerable, but frequently the plant is required for a new product or process and there is only limited experience on which the choice of material can be based. As the conditions in a chemical plant are often complex, the information in the literature, text books or manufacturers' publications must be treated with caution and used only to eliminate obviously unsuitable materials. The final choice must be made on the basis of the available experience and on intelligent use of information obtained in tests designed for the purpose.

Ideal Test Conditions

Ideally, tests should be carried out under the exact conditions which will be encountered in the plant. Laboratory tests are convenient and easily controlled, but the information available is rarely sufficiently detailed to allow service conditions to be reproduced exactly. Factors such as the oxygen supply in the liquor and the concentration of impurities which will develop from the water supply or side reactions are usually unknown, and these are often as important in determining the corrosion behaviour as process variables such as temperature, pressure, concentrations of reactants, etc. Furthermore, physical factors which control special forms of corrosion like crevice attack, erosion, stress-corrosion cracking and corrosion fatigue can rarely be defined.

All these factors should be controlled if realistic information is to be obtained from laboratory tests, and, while it is possible to reproduce almost any conditions by sufficient elaboration of apparatus, it is doubtful whether, in view of the inevitable uncertainties, the expense is ever justified. Thus laboratory tests are usually carried out under controlled conditions which merely approximate to those in service, and the information they must give must be interpreted with care.

If the proposed plant is a duplicate or replacement of one already existing the position is clearer, as tests may be carried out under the conditions existing in the plant. Moreover, the behaviour of some materials in service is known and may be used to 'calibrate' laboratory tests, and 'plant liquor' is available for laboratory tests. However, the possible effects of apparently minor changes in design or operating procedure should be given careful consideration.

Alternatively, a pilot-scale plant may be available, which can be used to obtain information which is more realistic than that given by laboratory tests; it should be appreciated, however, that size effects may occur between a pilot plant and a full-scale plant.

Laboratory tests are necessarily of

short duration—say up to two months—whereas in service conditions lives of five years or more are usually required.

To obtain data quickly accelerated tests are often used, in which conditions are made more severe by, say, increasing the temperature or concentration of the corrodent. Such tests provide results quickly, but may give erroneous impressions of the behaviour of borderline materials. For example, if the temperature is increased and the temperature coefficient is abnormally large, a material may be rejected which would be quite satisfactory at the service temperature, or if the effect of temperature is small, it may be accepted unjustifiably. Thus accelerated tests provide a satisfactory guide only if some firm basis for their interpretation exists.

Whatever the test, it is essential that the maximum information be obtained, and it is wise to examine the specimens carefully for weight loss, selective attack, pitting or intergranular corrosion. If special forms of corrosion—galvanic corrosion, deposit attack, erosion or stress-corrosion cracking—are possible, it is desirable to perform tests to determine the extent of the risk.

As the information on which the choice of material is to be based is rarely complete, it is usual to apply a factor of safety to the results of corrosion tests, e.g. to accept no material which corrodes at more than 0.1 mm./yr, and to add a corrosion allowance to the thickness of material selected. Each case must be judged on its merits, and all the factors taken into consideration. While the choice of a material with inadequate corrosion resistance might be disastrous, it is important to avoid being over-cautious and to avoid corrosion by unjustifiable expense in the initial capital outlay.

Cost of Fabrication

Although possible materials which give a much longer life than mild steel or cast iron are often much more expensive on a weight for weight basis, their superior properties may make the increase in initial capital outlay less than might at first be thought. A considerable part of the initial cost of a plant is the cost of fabrication*, and so long as the expensive alloy is readily worked or welded, the cost of fabricating a given item in that alloy is little more than if mild steel were used. Further, the superior strength and/or corrosion resistance of the alloy may allow a saving in the amount of material required, by allowing thinner scantlings or a smaller corrosion allowance to be used. Again, it may be possible to increase the efficiency of the process because the expensive material allows higher temperatures, pressures, acid concentrations etc., to be maintained; if so, it may be possible to reduce the size of the plant with consequent saving in material.

The possible reductions in running costs must also be considered carefully, as even a small reduction in running costs can, over a number of years, balance a considerable increase in the initial capital outlay. The running costs may be reduced either by a reduction in the "down-time" required for maintenance—a particularly important consideration in a large integrated plant—or by an increase in the efficiency of the process.

While the use of a material which is inherently resistant to the conditions is often the most satisfactory method of avoiding corrosion troubles in the chemical industry, it may be worth considering the use of one of the methods by which the damage caused by corrosion can be minimised. These methods are, however, expensive if they are to be effective, and suffer the great disadvantage that the results of temporary or localised breakdown in the protection may be disastrous; on the other hand they can allow a material to be used in conditions where it would normally suffer severe attack.

It is not usually economic to apply protection to more expensive materials than mild or low alloy steel or cast iron, but in certain circumstances it may be necessary to use mild steel equipment protected by a thin lining of a resistant material which is expensive or in short supply, where no reasonable alternative material exists.

Construction Materials

Materials Available: In the discussion above the factors which influence the selection of the materials of construction of a projected chemical plant were considered. In the following section the various materials are surveyed briefly, and their range of usefulness indicated.

Mild Steel and Cast Iron: These are the cheapest materials available, and are readily fabricated into any kind of plant. They are therefore widely used where the conditions are only mildly corrosive, as in fresh-water cooling systems, steam lines or equipment handling many gas mixtures or organic chemicals. Because of their limited corrosion resistance they are of little use in corrosive conditions, except for batch processes where replacement is easy and any alternative material much more expensive, or in certain special environments where their corrosion resistance is adequate, e.g., in concentrated sulphuric acid. In some very severe conditions where no reasonable alternative material would last appreciably longer, a reasonable life is obtained by the use of very thick sections of these cheap materials.

Low Alloy Steels: Addition of small amounts of alloying elements does not bring about an appreciable increase in corrosion resistance compared to mild steel, and leads to increased fabrication difficulties, particularly if welding is required. Low alloy steels thus find only limited use in the chemical industry. Their superior strength is valuable in high pressure plant, and they are useful at sub-zero temperatures where mild steel is unpleasantly brittle.

Chromium steels are useful in certain restricted fields, but the general corrosion resistance is not appreciably better than mild steel unless more than 12 per cent chromium is present. Three to five per cent chromium steels are used in the oil industry and in high pressure ammonia and hydrogenation plants, as they are resistant to sulphiding and to hydrogen attack—the decarburisation and fissuring which mild steel undergoes in high pressure hydrogen at 200°C or above. They are also useful in contact with gases containing carbon monoxide, which attack mild steel by forming iron carbonyl.

Stainless Steels: These may be divided into two classes, the high chromium steels and their derivatives, and the austenitic steels. Both types depend for their corrosion resistance on the presence of the surface oxide film, and if this film is not maintained—as in acid chloride solutions or under de-aerated conditions—very rapid corrosion may occur. The straight chromium steels may, in fact, corrode faster than mild steel in acid solutions. The austenitic steels are superior in this respect, and are also much easier to fabricate than the high chromium steels.

The 12-14 per cent chromium steels are valuable for resistance to scaling and sulphiding at moderately elevated temperatures, and for items such as valve seats where both hardness and corrosion resistance are essential. They are also useful for parts which are exposed to fluctuating stresses in mild corrosive environments where mild or low alloy steels would suffer rapid failures even though the normal corrosion is small. The 12-14 per cent chromium steels are also useful for the prevention of contamination of pure liquids. The hardenable 16-18 per cent chromium, 2 per cent nickel steels, which has superior corrosion resistance, finds similar applications. The remaining high chromium steels are non-hardenable, and are more correctly called chromium irons; they have better resistance to scaling, sulphiding and aqueous solutions than the 12-14 per cent chromium steels. Seventeen per cent chrome iron has excellent resistance to nitrates and many chloride solutions, as well as to oxidising and sulphiding conditions. It is difficult to fabricate, as the strength of welds is poor. Higher alloys, e.g., 27 per cent chrome iron, are valuable in special circumstances, particularly where resistance to oxidation or decarburisation is necessary; they are difficult to fabricate successfully and (like the 17 per cent chrome irons) become brittle after service at elevated temperatures, so that they are avoided if possible.

Modifications

Modifications of the high chromium irons with silicon, aluminium or titanium additions are used on the Continent. These alloys have very good resistance to many environments, particularly at elevated temperatures, but they are difficult to fabricate and tend to be very brittle at ordinary temperatures. Because of the nickel shortage they were widely used in Germany before and during the war in applications where austenitic steels are used in this country, and were successfully fabricated into many kinds of plant, so that fabrication and handling difficulties may have been over-emphasised in this country. There is no doubt, however, that austenitic steels are much more convenient, both for fabrication and in service.

Austenitic steels are among the most

(*Continued on page* 289)

* Even with relatively expensive materials like the 18/8 stainless steels the fabrication cost of a heat exchanger or pressure vessel is usually two to three times the cost of the material.

CORROSION SURVEY

CA Review of Plant, Equipment, Materials and Publications

Protection of Chemical Plant

CATHODIC protection can be applied as a protective system against corrosion wherever metal is in contact with an electrolyte. Apart from the natural application to buried pipelines, cathodic protection has its place in the chemical industry in such applications as storage tanks, condenser water boxes, insides of large diameter pipes, pasteurisers, autoclaves, heat exchangers etc. Installations have been applied to metals other than steel, aluminium, in particular, being comparatively simple to protect.

Generally applications to chemical plant are by the power-impressed system utilising graphite, aluminium or lead alloy anodes, although the use of zinc sacrificial anodes is preferred in one or two standard applications.

Cathodic Corrosion Control Ltd. claims to offer a complete cathodic protection service from preliminary advisory services right through to final installations.

Stress-Corrosion in Austenitic Steels

ITEMS of particular interest referred to in *The Nickel Bulletin* for December 1956 include abstracts dealing with stress-corrosion in austenitic steels, the resistance of high-alloy steels to corrosion by mine waters, and service experience with iron-containing cupro-nickel alloys.

Copies are available from The Mond Nickel Co. Ltd., Publicity Department, Thames House, Millbank, London SW1.

Rust Prevention Paint

COLD GALVANISING is claimed by Corrosion Ltd., 16 Gloucester Place, London W1, to be a simple and economical means of protecting iron and steel from rust. Glopane, a paint containing 95 per cent zinc, provides a coating which can be broken without allowing corrosion to spread. It is stated that condenser tubes installed at a brewery in the autumn of 1954 showed no trace of rust in the autumn of 1956.

Corrosion Ltd. also makes the Epiglo range of heavy duty paints and surface coatings for metals, concrete, wood and other materials.

Laminates as Metal Replacements

CRESYLIC-formaldehyde laminates incorporating either fabric or paper based fillers are made by IOCO Ltd., Netherton Works, Anniesland, Glasgow W3. Known as Formapex, these laminates are claimed to be resistant to organic acids and solvents, weak mineral acids other than those of an oxidising nature and to weak alkalis at normal temperatures. They will not stand exposure to strong acids and alkalis.

They can be used for metal replacements in the form of gears and other machined parts where corrosive vapours are present. Typical uses include electroplating tumbling barrels and chain and sprocket assemblies for conveying members to acids tanks.

Rubber as Anti-Corrosive Material

A RANGE of standard anti-corrosive rubber compounds, grouped under the name Cabtyrit, is made by St. Helens Cable and Rubber Co. Ltd., Slough, Bucks. Heat resisting natural rubber which is claimed to be suitable for temperatures up to 100°C is available. Where abrasive conditions are encountered an abrasion-resisting product can be supplied. Varieties of ebonite are also available for very severe corrosive conditions. A number of synthetic products are also made by St. Helens including neoprene, p.v.c. and butyl, a compound for use with dilute oxidising acids and agents and also for elevated temperatures up to 120°C.

High Strength and Chemical Resistance

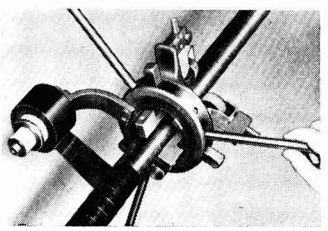
RESISTANCE to a wide range of chemicals together with a high degree of adhesion to the base metal is claimed for Vulcoferran, a form of ebonite for lining steel and cast iron surfaces, which is made by Nordac Ltd., Uxbridge, Middlesex. Concentrated acids at temperatures up to 110°C can be used in contact with Vulcoferran it is claimed. Bonding between the metal and Vulcoferran is said to be of a chemical nature and tests have shown that the adhesion is greater than the strength of the material itself.

Lead, probably one of the oldest corrosion-resistant materials, is still used in cases where higher temperatures are encountered. Nordac's chemical lead department, formerly S. Porter and Co. Ltd., supplies lead for applications where toxic contamination is not of importance.

Pipe Protection Tapes

NEWEST product of Industrial Tapes Ltd., Ofrex House, London W1, are Speedfix pipe protection tapes which are claimed to be resistant to the action of acids, alkalis, fungus and bacteria. Laboratory tests indicate that life of from 30 to 40 years underground is to be expected from these tapes.

To simplify application of the tapes pipe lagging machines are manufactured by Industrial Tapes. A 9 ft. length of pipe can be lagged in 1½ minutes using one of these machines claim the makers.

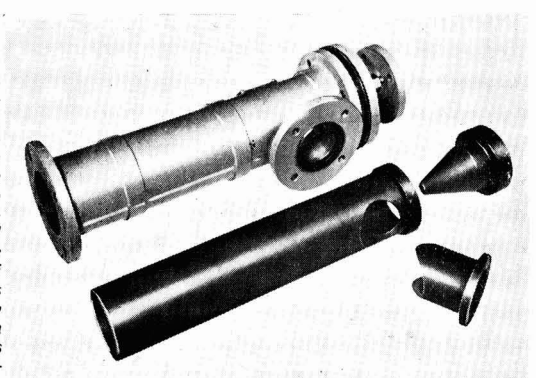


Pipe lagging machine made by Industrial Tapes Ltd. for wrapping Speedfix pipe protection tapes in any required degree of overlapping

Corrosion Resistant Alloys

PUBLICATION SP18 of Deloro Stellite Ltd., Highlands Road, Shirley, Solihull, Warwickshire, describes the uses in the chemical and petroleum industries of heat, corrosion and abrasion resistant Stellite alloys. Stellite alloys consist entirely of cobalt, chromium and tungsten combined in different proportions. It is claimed that their intrinsic hardness is little affected by heating to high temperatures. Resistance to corrosion and atmospheric oxidation is said to be high.

Also contained in this publication is a description of Deloro alloys B and C

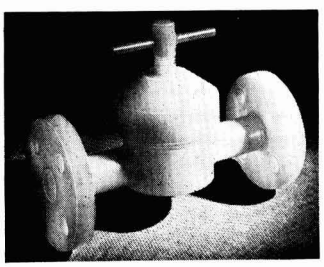


Carbon water-operated ejector for emptying tanks containing corrosive fluids such as waste pickling acids. Claimed to be corrosion resistant to all acids and alkalis and suitable for all types of dirty liquids, it is manufactured by Powell Duffryn Carbon Products Ltd., Hayes, Middlesex

which are nickel based alloys containing chromium, molybdenum and tungsten. Resistance to the common mineral acids such as hydrochloric and sulphuric is claimed for these two alloys.

Wide Range of Surface Coating Resins

MANY resins for surface coatings are made by Bakelite Ltd., 12-18 Grosvenor Gardens, London SW1. Epoxide resins, a comparatively new group of plastics materials, are claimed to form tough, stable products with good chemical resistance, particularly to alkaline solutions. They adhere to a wide range of materials, including metals, ceramics, glass and plastics.



Flow valve made from components moulded or extruded in Bakelite polythene

Bakelite Lacquer L3128, a solution of a fast baking phenolic resin, is applied by brushing, spraying, dipping etc. and stoves rapidly at normal baking temperatures. Protection of metals against chemicals, other than alkalis and strong oxidising acids, and atmospheric corrosion is claimed.

Chemical and Heat Resistant Stoving Varnish

GOOD chemical and heat resistance is claimed for Lorival R stoving varnish, manufactured by Lorival Plastics, Little Lever, near Bolton. The varnish consists essentially of Lorival R, or depolymerised liquid rubber, dissolved in suitable solvents and drying agents.

Two coatings of varnish on the metal surfaces, stoved between coats at a temperature of 180°C, produces an oxidised film which clings tenaciously to the surface. It is resistant to further oxidation or corrosion and also resists many chemicals.

The surface is claimed to be stable under a continuous operating temperature of 150-200°C.

Fume Cupboard Fans Protected by Polythene

AEROFOIL fans designed for fume cupboards are now being protected against corrosive gases by a coating of polythene. The method has been developed by Woods of Colchester Ltd.

The new fume cupboard fans, made in three sizes, 6 in., 7½ in. and 9½ in. diameter, are completely protected with polythene inside and out. The motor and casing are hermetically sealed in a covering which is resistant to practically all corrosive reagents. To ensure adhesion of the polythene to the fan the casing is made from perforated steel and is coated on both sides. Thus polythene passes through the perforations, joining the inner and outer coatings, and the metal is sheathed within a homogeneous double skin.

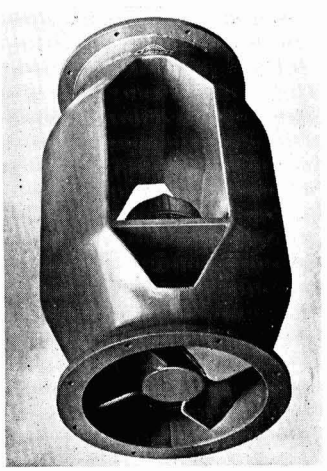
Pipe and Tanker Protection

CATHODIC protection of steel pipelines is one of the aims of the Guardion system developed by F. A. Hughes and Co. Ltd., Devonshire House, Mayfair Place, Piccadilly, London W1. The pipe is connected to a magnesium anode which is placed in the earth about eight feet from the pipe with its top level with the invert depth of the pipe. It is recommended that a plastics test point box be connected between the pipe and the anode. By this means regular current readings can be taken and the life of the anode estimated. Replacement of the anode is also simplified by this means as it can be removed without disturbing the connection to the pipe.

The Guardion system is also applied extensively to shipping, particularly tankers. This year the 250th tanker was fitted with the Guardion system.

Fume Removal Fans Made From p.v.c.

RECENT developments by Keith Blackman Ltd., Mill Mead Road, London N17, include p.v.c. fabricated centrifugal and bifurcated fans. Rigid p.v.c. sheeting up to ½ in. thick is the basic material for fan casings and impellers; plasticised p.v.c. is used for flexible inlets and outlets and foamed p.v.c. as a gasket material.



10 in. p.v.c. bifurcated fan made by Keith Blackman Ltd.

Advantages of p.v.c. as a fan material include its high resistant to chemicals apart from certain strong solvents, its cost, which is claimed to compare favourably with older materials, its light weight, and its 'deadness' in connection with sound.

Range covered by Blackman fume removal fans is from 300 to 4,100 c.f.m. at pressures up to 0.5 in. s.w.g.

Pressure Relief Valve

A RECENT development by Merrill Pumps Ltd., Cavendish Road, Sheffield 11, is a pressure relief valve for handling corrosive fluids. This incorporates an air pressure gauge and a Schrader valve connected to an air chamber surrounding the valve. When the pumping pressure exceeds the pressure in the air chamber, a flexible sleeve of some corrosion resistant material is pushed away from an isolating disc, allowing flow through the valve.

So far only 10 of these valves are in service, but, Merrill claims, they have proved satisfactory. At present only available in 1½ and 2 in. sizes, they will now be manufactured in further sizes.

Latest Electro-Plater

RECENT addition to the range of metal finishing equipment made by Electro-Chemical Engineering Co. Ltd., Sheerwater, Woking, Surrey, is the Efco-Udylite 'Little Steve' automatic plating machine. Designed for plating small and medium parts, this plant has been used for plating, anodising and other electro-chemical immersion processes on electrical parts, door furniture, plumbing fittings etc. A full copper-nickel-chrome sequence can be incorporated. Zero-mist, a chromium plating additive which is claimed to reduce losses due to spray, can be used in the installation.

Acid and Alkali Resisting Cements

ESTABLISHED in 1911, John L. Lord and Son has specialised in the manufacture of acid and alkali resisting cements, and the supply and installation of brick and tile linings for all types of storage and process vessels, as well as undertaking the laying of corrosion resisting brick and tile floors.

Originally established to meet the requirements of the paper and textile finishing trades, the field has considerably expanded and covers in addition the steel, metal finishing, galvanising, oil, chemical and many other types of industry.

The firm markets a full range of silica, resin, sulphur and latex cements, linings and floorings in brick and tile, as well as all kinds of fabrications and linings in p.v.c., rubber and stainless steel.

Stainless Steel Equipment

HEAT EXCHANGERS in stainless steel are among the equipment manufactured by The Taylor Rustless Fittings Co. Ltd., Leeds 12. A typical two pass heat exchanger with floating head is designed to

allow for expansion and contraction and to facilitate easy dismantling when the tubes need cleaning.

Of importance in the dyeing industry are stainless steel tanks which can be cleaned quickly and easily. This company also makes mixing vessels, autoclaves, jacketed vessels, heat-resisting boxes and storage tanks.

Polythene Agitation Coils

POLYTHENE equipment is finding increasing application where corrosion problems arise. Rediweld Ltd., 15-17 Crompton Way, Crawley, Sussex, is producing polythene agitation coils for use in plating baths. It is claimed that these coils can be used in all plating solutions at temperatures up to 65°C.

A centrifugal pump made almost entirely in polythene is supplied by Rediweld. The shaft can be made of stainless steel, bronze or other corrosion resistant metal and is integrally moulded into the impeller. The stuffing box consists of a neoprene gasket. Driven by a ¼ h.p. electric motor, the capacity of the pump is five gallons per minute.

Corrosion Resistant Seal

CRANE PACKING LTD., Slough, Bucks, has developed a mechanical seal for use where shafts are operating under corrosive conditions. Main part of the seal is a bellow made of pure Fluon (p.t.f.e.). Spring loading is provided by a Fluon sleeved spring. Successful testing of these seals is reported with 70 per cent sulphuric acid at 100°F, 90 per cent nitric acid at ambient temperatures and five per cent hydrochloric acid and two per cent sulphuric acid at 176°F.

Advantages of Glass Reinforced Plastics Discussed by A. H. Davies

DEVELOPMENT and use of glass fibre was the subject of a paper given by A. Hudson Davies, managing director of Fibreglass Ltd. on 13 February at the Royal Society of Arts, Adelphi, London WC2.

Mr. Davies began with a historical note on glass and glass fibre manufacture, glass wool production. Applications of glass wool were also considered, with glass yarn manufacture and uses. The rest of the paper was devoted to glass-reinforced plastics.

Resin/glass laminates are new structural materials which have developed rapidly in the last ten years. What is new is the polyester resin which polymerises without releasing water, so that only small moulding pressures are needed. Also new is the glass-fibre, made and presented in the forms required for moulding and for the development of strength in the laminate.

One advantage for glass reinforced plastics is that in some ways they are much more easily shaped than metals. Other advantages are the relative inertness of both resins and glass. As neither are affected by ordinary causes of deterioration such as corrosion in metals or decay in wood, maintenance is not required. They withstand temperatures of 100°C readily while special resins are used for radomes up to 200°C. At these temperatures there is little loss of strength and as far as has been observed, creep and fatigue effects are small. Newer resins, such as the epoxides are widening the range of properties.

A limitation to the usefulness of resin/glass laminates, which is passing, is cost. Seven years ago the cheapest glass-fibre reinforcement for plastics cost 15s per lb. In 1956 the cheapest price of a well-established product was 4s per lb. Resin prices have similarly decreased. In 1953, about 200 tons of glass fibre products for reinforcements were sold in the U K and for last year the figure is estimated at not less than 1,500 tons.

Moulding methods used vary from laying up glass cloth or glass fibre mat on a former and impregnating with resin by hand, vacuum or pressure and this is followed by curing, either cold or at moderate temperatures. As most resins today set by chemical change, time has to be allowed for setting.

Because resin/glass has good chemical resistance, electro-plating tanks and chemical fume ducts are being produced while several companies are interested in manufacturing pipes of resin/glass. There are at present problems about porosity to be solved, and although a four-inch diameter reinforced plastics pipe is twice as dear as a mild steel pipe, according to Mr. Davies it is 70 per cent cheaper than stainless steel.

Development needs considered by the speaker were as follows: Thermosetting resins must cure more quickly; cures at 200°F and 50 lb. pressure for three minutes are being aimed at. Resistance to fire is important and improved methods of forming metals to mouldings and mouldings to mouldings still have to be worked out. The linkage formed between the resin and glass is of fundamental importance. At the present time the surface of the fibre, and the use of coupling agents, such as silane, or chrome materials between the resin and the glass are being carefully studied.

SAC Annual Meeting

Annual general meeting of the Society for Analytical Chemistry will be held at 2.45 p.m. on Friday 1 March in the meeting room of the Royal Society, Burlington House, Piccadilly, London W1.

The meeting will be followed immediately by 'The Address of the Retiring President,' Dr. K. A. Williams.

In the evening the society will hold its biennial dinner commemorating its 83rd anniversary at Vintners' Hall, Upper Thames Street, London EC4.

Murgatroyd's Extension to Elworth Plant

WITH REFERENCE to our report on Murgatroyd's Plant Extension (CHEMICAL AGE, 1 December, page 359), Murgatroyd's Salt and Chemical Co. Ltd., Elworth, Sandbach, Cheshire, ask us to point out that, in addition to the caustic soda required by Fisons Ltd., their product is sold widely throughout the chemical industry. The pure grade of caustic soda obtained from the mercury cells enables them to enter fresh markets. This and other products are marketed by the company's sales agents, the Tennant Group, represented by the Barter Trading Corporation Ltd., 14 Waterloo Place, London SW1.

The pipeline delivers to the plant at Elworth a quarter of a million gallons of brine a day from the Middlewich brine field, not a quarter of a million tons, as stated in the original report.

New Cellulose Film Polythene-Coated

BRITISH CELLOPHANE have developed a polythene-coated cellulose film made by coating cellophane on one side with polythene. No adhesive, or other separate bonding agent is used in the manufacturing process.

It is claimed that the new film combines the well-tried and complementary properties of the polythene and cellulose. It has the basic strength of cellulose combined with the marked tear strength of polythene.

The new film is said to have excellent printing and handling properties and to be resistant to chemicals and liquids.

Corrosion Problems

(*Continued from page* 286)

important constructional materials in the chemical industry, as they combine good corrosion resistance with considerable strength at high temperatures, and are easily welded and fabricated. Those most commonly used are based on the 18/8 Cr/Ni composition, stabilised varieties being almost invariably used in corrosive conditions to avoid the danger of disintegration (weld decay) in service. The addition of 2-4 per cent molybdenum increases the resistance to many environments (except nitrates) but also leads to increasing fabrication difficulties. Addition of copper also improves the corrosion resistance, and some highly allowed steels, such as the 20/29/4/3 Cr/Ni/Mo/Cu alloy produced by several firms have good resistance to non-oxidising acids The 18/18/4/3 Cr/Ni/Mo/Cu alloy, which is probably the most corrosion resistant austenitic steel which can be easily worked, has only a limited resistance to hydrochloric acid and to sulphuric acid in the range 30-60 per cent.

Highly alloyed chromium nickel steels (e.g. 25/12 and 25/20 Cr/Ni) are valuable for high temperature service under conditions which are too severe for the simple 18/8 Cr/Ni compositions. These alloys are readily worked and do not share the disadvantages of the high chromium irons and their derivatives.

RECENT DEVELOPMENTS IN ISRAELI RESEARCH

THE most recent issues of the Bulletin of the Research Council of Israel (*Bull. Research Council of Israel.* 5A (4), July 1956. (Maths. Physics, Chemistry.) 5C (2-3) March-June 1956. Technology) indicate that in spite of Nasser and other external troubles, research is proceeding vigorously along a broad front with a balance between purely academic work, in which organic synthesis figures largely, to the severely practical. Once again the Hebrew University and the Hadassah University Hospital at Jerusalem, the Institute of Technology at Haifa, and the Weizmann Institute of Science at Rehovoth all produced their quota of scientific papers. The Ministry of Defence, and the Israel Atomic Energy Commission have also permitted the publication of a number of communications.

At the 19th meeting of the Israel Chemical Association held at Rehovoth in June of last year, over 40 papers on organic chemistry and biochemistry were submitted.

Fluorine Compounds as Synergists for DDT: E. D. Bergmann, S. Cohen and their co-workers have found that fluoroacetamides, mono-substituted at the amide nitrogen by alkyl, cycloalkyl, aryl or heterocyclic radicals were toxic to the larvae of DDT-resistant house flies, and, unless the substituent was bulky (naphthyl) or polar (alpha-pyridyl), also showed contact toxicity. Some amides, with para-substituted phenyl radicals, also showed rodenticide action.

Organic Fluorine

Considerable further work has been performed on organic fluorine compounds.

Considerable research has been attempted in the field of amino acids including poly-L-hydroxyproline and polymers of N-carbobenzoxy amino acids, with some investigations into the enzymatic decomposition as well as the synthesis of these materials.

Analytical developments: It is hardly surprising that a country which includes a large part of the Dead Sea within its borders displays an interest in the chemistry of the halogens. It has been found that hydrobromic acid can be removed from bromine by 0.25N potassium bromide solution, and D. Kaplan and I. Schnerb have worked out a quantitative method. I. Behr, using separation by an ion exchange column, and titration to an exact *p*H has developed a method for the simultaneous analysis of phosphates, sulphates and chlorides. A method has also been developed for the analysis of iodine in oil drilling brine since this is considered a valuable indication of the possible occurrence of oil.

Other analytical work of interest includes a micro- or semi-micro method for the estimation of CO_2 by absorption in a solution of benzylamine in absolute ethanol, and titrating with sodium methylate in methanol benzene using thymol blue as indicator. Double bonds can also be cleaved by a modified method which involves using lead tetra-acetate or sodium periodate with ruthenium dioxide as catalyst.

M. Lewin and his co-workers at the Institute for Fibres and Forest Products Research have examined the chemical composition of Israeli *Eucalyptus rostrata,* which has been compared with the Australian variety and other hardwoods. It is interesting to note that samples of this eucalyptus grown in the Negev under semi-desert conditions show a considerable variation in chemical composition from trees grown on the coastal plain (Hadera); the difference in annual rainfall being from 100 mm. in the Negev to 600-700 mm. in the coastal plain.

Because of significant differences in composition between Australian and Israeli *Eucalyptus rostrata,* e.g. the alkali soluble content was much lower in the latter, the Israeli eucalyptus was considered suitable as a source of paper pulp, and a thorough investigation was made by the sulphate process.The results have generally proved exceedingly satisfactory, and cooking conditions for *E. rostrata* are more favourable with regard to the cost of production than most hardwoods and softwoods used in the pulp and paper industry. The relatively high bulk makes these pulps suitable for the production of printing papers and they can be used for the production of wrapping papers with suitable mixtures of unbleached coniferous sulphate pulp. In addition, first quality printing and fine papers can be produced from the bleached pulps.

Low Quality

Practical Problems: Concrete is the main building material of Israel, but its relatively low quality compared with other technologically advanced countries has given some cause for concern. R. Shalon, of the Building Research Station of the Haifa Institute of Technology, has conducted an extensive survey into causes of the variability of locally produced concrete in a number of building projects.

Volume batching of locally produced cement caused fluctuations of ± 10 per cent in cement content with single cases varying as much as ± 24 per cent. The variation of the water content where a water meter was not used caused the water/cement ratio to vary from 0.63 to 1.34. Grading of coarse aggregate also caused wide variations.

The author considers that local specifications as to minimum cement in concrete are too stringent, and that there is a need for revision of Israeli standard specifications.

Industrial and agricultural development of Israel has necessitated much new road construction. Two main problems which face the engineers are maximum compaction of the natural soil to prevent ingress of water, and the exploitation of local materials for sub-base, base and temporary riding surface. J. L. A. Watson, chief roads engineer, Public Works Department, considers these problems and describes some natural materials: Metamorphosed basalt, calcareous sandstone and natural gravel, all of which have given satisfactory results in base construction. For some rural roads on a loess soil, a cheap form of construction has been discovered, which simply consists of shaping and giving a camber to the road, and giving several treatments using a concentrated mixed solution of calcium and magnesium chlorides.

Another useful practical examination has been a study of regenerated motor oils by A. B. Stern, who has shown that after suitable regeneration, and the use of suitable additives, crankcases oils can be re-used to give a highly satisfactory performance.

Conclusions: These Bulletins indicate that the virile spirit in research and practical development in Israel is being well maintained—indeed, says our correspondent, if its neighbours were to spend a proportionate amount compared with their national incomes or populations, most of the problems of this trouble spot would be completely solved. The Bulletin is printed in English.

Drugs and Medicines Exports Reached Records in 1956

BRITISH exports of drugs and medicines reached a new record in 1956 of £35,943,000. Of this total, antibiotics accounted for nearly £7 million and vitamins for nearly £3 million. Sulphonamide preparations (£1¼ million), aspirin and synthetic antimalarial drugs (£1 million each) and barbiturates, insulin and anti-histamine drugs (around £½ million each) also contributed significantly to the total. Proprietary medicines not covered by specific headings in the Board of Trade returns amounted to over £10 million.

Australia and India were the leading export markets for British drugs, with sales around £3 million. Next came Nigeria, Pakistan, South Africa, New Zealand, the Republic of Ireland and Burma, in that order, all taking between £1 million and £2 million. Sales to Egypt at £742,000 were nearly £400,000 down on the previous year, but there was a great improvement in sales to the US which at nearly £1 million easily surpassed last year's record of £660,000.

Instrument Factory Expands

Due to expansion of business, KDG Instruments Ltd., Manor Royal, Crawley, Sussex, is now building an extension to its new works. The factory will then cover a total area of 40,000 sq. ft.

Overseas News

US CHEMICAL INDUSTRY TO SPEND $2½M ON NEW PLANT IN 1957-58

CAPITAL spending on new chemical plant in the US during 1957 and 1958 by 327 companies is expected to total about $2,500 million. This figure is estimated by the Manufacturing Chemists' Association following a recent survey.

Last year, 354 construction projects were completed at a cost of more than $1,100 million. In addition, projects under construction total 278 and will cost an estimated $1,800 million; plans have also been made for a further 128 projects that will call for an expenditure of about $717 million. Texas, the third largest chemical producing state, had the largest number of projects with a total of 81, valued at an estimated $639,961,000.

Mr. John Hull, MCA president, says these figures indicate the confidence of the industry, the steady growth in demand for chemicals and the need for better production methods to meet mounting competition. He added that investment in organic chemicals during the three years 1956-58 would total $862 million; plus $816 million in inorganic chemicals and a further $465 million in chemically produced metals or metallic compounds, excluding aluminium, processed uranium, copper and ferro alloys. Research facilities completed in 1956 were valued at $42 million; those under construction, $37 million; and those planned, $16 million.

S. African Uranium Costs

Cost of uranium installations in South Africa to date according to the Minister for Economic Affairs, is £56.8 million. Pyrites and sulphuric acid installations have cost £8.9 million. When loans from the Combined Development Agency have been repaid, the price of uranium would probably be stabilised, the Minister told the South African senate

Producing Chemicals from Australian Sugar

Possibilities of exploiting Australia's large annual production of refined sugar (492,000 tons in 1955-56) as a source of chemical raw materials was the subject of a recent comment by Dr. H. B. Hass, of the Sugar Research Foundation Inc., New York, on his return from Australia. He said that sucrochemistry had already produced sugar ester detergents and superior drying oils for paints. In Denmark, the first commercial production of detergents from sugar beets would shortly start, while a furfural plant, mostly used for nylon, and a bagasse paper plant have come into operation.

No country is yet using sugar widely as a chemical starting material although it has been used as a raw material to support the production of yeast, alcohol, acetone and citric acid (CHEMICAL AGE, 1956, **76**, 441, 443). Sugar ester detergents are colourless, odourless, edible and completely indifferent to hardness in water.

German Refinery to Expand

It is reported that Scholven Chemie, a company which chiefly produces motor fuels and fertilisers, plans to expand its present refinery capacity from 57,000 tons a year to about 2 million tons. Construction of new installations, which is expected to take two years, is to be begun as soon as financing is secured.

Marked Increase in Japan's Synthetic Fibre Production

Japan's synthetic fibre production (vinylon, nylon and vinyliden) in October of last year showed a marked increase at 6,211 thousand lb. over production in September (5,650 thousand lb.).

In order to meet an expected shortage, it is understood that the Japanese Ministry of International Trade and Industry have decided to import high tenacity rayon from the US. Reason for the step is said to be due to the present boom in the motor industry which is overtaxing domestic production of high-tenacity rayon.

According to a recent Japanese Ministry survey demand during the first quarter is estimated at 6.8 million lb. Production for this period is set at 5.6 million lb. Requests to import about 1 million lb. are said to have been made.

Cuban Imports of Sulphite Pulp

Paste or dry pulp of bleached sulphite may now be imported in Cuba duty free as a raw material in the manufacture of synthetic yarn.

Sulphonated Oils Duty

Nicaragua has lowered the import duty on sulphonated oils from .10 cordobas per gross kilo, plus 10 per cent *ad valorem* to .05 plus 10 per cent.

New Consulting Corporation Formed in New York

Calkin & Bayley, Inc., a new firm of industrial consultants with offices at 50 East 41st. Street, New York, will specialise in marketing and economic research, product and market development, process development and design, business and plant surveys, analysis and testing. Among industries to be served are chemical, gas, petroleum and plastics. Mr. John B. Calkin, president, was associated with Foster D. Snell, Inc., Mr. George T. Bayley, executive vice-president, has been associated with Stauffer Chemical Corporation and F. W. Berk Inc.; Dr. Robert Frank, vice-president, has served with Fertiliser Sales Ltd., London, American Cyanamid Co. and Chemical Construction Corporation; Dr. John L. Parsons, vice-president, is a recognised authority in the pulp and paper industry.

Uranium and Thorium—Reserves in France

Uranium reserves of Metropolitan France are officially estimated at between 50,000 and 100,000 tons. Some 10,000 tons have been proved by direct working. Uranium reserves in French North African superphosphate ores are not included in these figures.

France also has thorium reserves in Madagascar in 1,000 tons of uranothorianite. It has been proved that this contains, 60 per cent to 70 per cent of thorium and 10 to 20 per cent of uranium.

Present French prices quoted for uranium concentrates are Frs. 12,000 (approximately £12) per kilogram. However, this price is expected to be reduced shortly to Frs. 10,000 per kilogram.

Bauxite Deposit to be Developed in Australia

A large bauxite deposit on the west coast of Cape York Peninsula, Australia, is to be developed by a new company representing Consolidated Zinc Pty. Ltd. and Commonwealth Aluminium Co. The deposit is said to contain hundreds of millions of tons of bauxite of a grade suitable for the production of alumina.

Fertiliser Plant for Iraq

Iraq's Development Board have invited various consultants from Britain, France, the US, Germany, Italy and Switzerland to quote for the design and construction of a fertiliser plant at Basra, Iraq, having an initial capacity of 250,000 tons of ammonium sulphate. Cost of the plant is estimated at over ID 7 million.

Timber Preservation Plants

Hickson and Welch are spending £A250,000 in Australia in erecting vacuum pressure timber preservation plants. At Melbourne a plant will be built to handle five million feet of timber a year. Another plant costing £A85,000 will be erected in Victoria for preserving transmission poles.

Furfural Content of Indian Gums

In a note to the *J. Sci. indust, Res.* (1956, 15A, 571) K. G. Mathur and S. C. Banrejee of the National Chemical Laboratory of India, Poona, give details of their determinations of the furfural content of some Indian gums.

Vegetable gums are rich in pentosans,

which, on hydrolysis and subsequent elimination of water yield furfural. The yield of furfural from eight Indian gums was as follows:

Gum	Furfural content (on dry basis) %
Gum Arabic (*Acacia arabica*)	20.1
Ghalty or Ghati (*Anogeissus latifolia*)	28.2
Karaya (*Sterculia urens*)	12.3
Siris (*Albizzia lebbek*)	16.5
Cashew (*Anacardium occidentale*)	4.2
Mango (*Mangifera indica*)	1.8
Bijasal (*Petrocarpus marcipium*)	nil
Palas (*Butea monosperma*)	nil

The gums were distilled with 12 per cent hydrochloric acid and the distillate collected at the rate of 3 mil./min. Furfural was estimated in the distillate as phloroglucide. Crude gum was used in all cases except in the case of gum arabic which was a purified sample.

Ghati gum is shown by the results obtained to be a richer source of furfural than corncobs or oat hulls which are commonly used in the production of furfural. The yields from corncobs and oat hulls are 23 and 22 per cent respectively, as compared with 28.2 per cent from ghati gum.

German Polythene Productions; BASF Subsidiary Expanded

It has already been reported that Lupolen H (polythene) production is to be expanded (CHEMICAL AGE, 1957, **77**, 130) by Rheinische Olefinwerke GmbH, Wisseling, subsidiary of the Badische Anilin und Soda-Fabrik AG., Ludwigshaven, and Deutsche Shell AG., Hamburg. For the expanded production of Lupolen, ethylene will be manufactured in a plant to be specially constructed in the Rheinische Olefinwerke. A process based on gasoline which has been operating successfully in a number of countries will be used.

Intensive research is being conducted into whether and to what extent the Rheinische Olefinwerke can produce further ethylene polymerisation products closely related to Lupolen H or which could extend the scope of application of the polythenes.

It has also been announced that all grades of Lupolen manufactured by Rheinische Olefinwerke will in future be exclusively distributed by Badische Anilin und Soda-Fabrik AG. When the expansion plans are completed more than 500 workers and staff will be employed at Rheinische Olefinwerke.

High Pressure Hydrogenation Plant in Madrid

In addition to a low-temperature carbonising plant, the Empresa Nacional Calno Sotela, Madrid, has started operating a high-pressure hydrogenation plant working by the Badische Anilin und Soda-Fabrik TTH process. The plant is situated in Puertollano in the Province of Ciudad Real, an area rich in shale oil. The plant is stated to have an annual capacity for processing 140,000 metric tons of shale tar from the low-temperature carbonisation or from similar raw materials. A single-stage hydrogenation with fixed catalyser supplies fuels, in particular, good diesel oil, lubricants and high quality paraffin wax.

The hydrogenation plant as well as that for the production of hydrogen from bituminous coal, also of local occurrence, were planned and supplied by BASF. The liquid finish products, the quality of which has fulfilled all expectations, are obtained in the high yield of 97 per cent by weight of the shale oil.

Sulphur Beds Discovered in Sicily

Prospecting for sulphur carried out in Sicily by Ente Zolfi Italiani is reported to have given good results. In all, 38 sulphur-bearing areas have been ascertained and detailed and precise surveys of five of them have already been carried out. Sulphur beds of industrial consistency have been found at S. Rosalia Sinatra, Quattrofinaite, S. Gaetano Lavanche and Bubbonia. Small sulphur beds were found at Palma Montechiaro and in the Contrada Gessi while fine potassium beds have been discovered at Racalmuto and Cannarella-Salinella.

South Rhodesian Lithium as a Rocket Fuel

Production of lithium in Southern Rhodesia in 1956 reached an estimated total of nearly 97,000 tons, worth about £400,000, compared with 82,166 tons in 1955 and 179 tons in 1950. This included all forms of the ore—amblygonite concentrates, petalite and lepidolite. Uses include the fuelling of guided missiles.

New Water Soluble Resin

In the Overseas News section of CHEMICAL AGE, 2 February, page 206-207, we published a description of a new water-soluble synthetic resin dimethyl hydantoin formaldehyde (DMFH), developed by Glyco Products Co. Inc., of New York. The word 'Glaxo' which appeared in the heading should, of course, read 'Glyco'.

Tunisian Fertiliser Quota

Tunisian Customs duties on a quota of 1,000 tons of certain nitrogenous chemical fertilisers have been suspended up to 30 June. Text of the official notice, in French, may be seen at the Board of Trade Export Services Branch, Room 625, Lacon House, Theobalds Road, London WC1.

Three New Products Introduced by Celanese Chemicals Division

Three new organic chemicals are included in the 1957 Celanese Product Index, issued by the Chemical Division of Celanese Corporation of America, 180 Madison Avenue, New York 16. The first, trimethylolpropane, is designed for use in the manufacture of alkyd-based baking enamels and is said to provide better adhesion, colour retention and hardness. In polyurethanes it is claimed to provide a greater mixing ease in compounding polyesters and pre-polymers with disocyanates.

Vinyl propionate is a new vinyl monomer capable of incorporating increased plasticity and flexibility in emulsion systems, copolymer resins, adhesives and certain coatings. Cellulube 300, 550 and 1,000 are a series of functional fluids developed to combine superior fire-resistance with controlled lubricating qualities for industrial hydraulic and lubricant applications.

Detergents Protect Wool during Carbonising Treatment

Damage to wool in carbonising (a treatment used to remove burrs and other vegetable matter from wool) can be avoided by a new process developed in the CSIRO Wool Textile Research Laboratory, Melbourne.

Acid used to remove contaminating material also attacks the wool fibres to some extent at the same time. The laboratory's new process involves the addition of a wetting agent to the sulphuric acid baths.

All types of wetting agent offer some protection to the wool and the amount of agent required depends on the efficiency of the scouring. The most satisfactory material tested has been a non-ionic wetting agent, Lissapol NX, and with an efficient scour 0.03 per cent added to the acid bath is sufficient. Additions of 1 lb. of Lissapol NX for each 200 lb. of greasy wool would be usual.

New Plants for Holland

Raw materials for the Dutch market should increase in 1957 according to *Baird-facts*, published by the Baird Chemical Corp., New York. First plants to make soda ash, polythene, epichlorhydrin, synthetic glycerine, cellophane type viscose film, sodium hydrosulphite, colloidal graphite and cobalt molybdenum catalysts will go into operation this year. Eventually Holland will make titanium dioxide and more petrochemicals.

Israeli Bromine Plant in Operation

At S'dom, Israel, the new bromine plant is now in production. The present capacity of the plant is 1,000 tons a year. Two smaller plants are to be added which will bring the total annual production to over 2,000 tons.

Texaco's Petrochemical Plans

As part of its expansion of petrochemical manufacturing and sales activities, the Texas Company is at present constructing an ammonia and nitrogen solutions plant at Lockport, Illinois, to serve fertiliser manufacturers and ammonia users.

Norwegian Industry to Promote Nuclear Company

Forty-three Norwegian firms, including banks and shipping companies, have been asked to join a new company A/S

Noratom, to promote the industrial use of nuclear energy. The company will undertake market analyses with the aim of supplying the atomic energy market and allied market as soon as possible.

Formation of a Scandinavian Institute for the study of nuclear physics and of a Scandinavian centre for atomic research and the use of nuclear power for peaceful purposes will be on the agenda of the forthcoming meeting of the Northern Council in Helsinki.

Vanadium in Finland

Production has started at the new vanadium factory of the Otmanaki mine, Finland. This mine relies on comparatively rich magnetite-ilmenite ore deposits found in the centre of Finland. The vanadium is contained in the magnetite concentrate, assaying 0.5 per cent vanadium.

US/Guatemala Atomic Agreement

Under a recent agreement, the US are to provide for the supply to Guatemala of enriched uranium and plans and specifications for the construction of an experimental reactor. Peaceful uses of the atom will be investigated.

Brazilian Polythene and Petrochemical Developments

Union Carbide do Brazil SA (a US subsidiary) have announced the establishment at Cubado of the first polythene plant in South America, which will be in operation by 1958. Negotiations between the director of the privately-owned Uniao petroleum refinery at Capuava, State of São Paulo, Brazil, and W. R. Grace Co. of the US have been concluded, covering the purchase of equipment worth US $50 million for a petrochemical plant.

Uranium's Main US Market will be Industry

According to a US Atomic Energy Commission official, the US is no longer concerned over the possibility of a uranium shortage during the US Government's military and power development programme for the next two years. The director of the AEC, raw materials division, said that the uranium industry should now study the potential commercial market and look to that market for its main support after 1966. It is considered that atomic power for industrial use might become an important market factor much sooner than has been generally expected.

Isotopes of Einsteinium Created

Two teams of scientists at the University of California have created five new isotopes of the artificial element, einsteinium, element 99, named after Albert Einstein.

The new isotopes were made by bombarding the man-made elements berkelium and californium (elements 97 and 98) with alpha particles (nuclei of helium atoms) and deuterons (nuclei of heavy hydrogen), creating isotopes of einsteinium of atomic mass 248, 249, 250, 251 and 252.

These new materials are not expected to have any immediate practical applications.

Their discovery, however, is of considerable importance for the future application of atomic energy.

A report of this work appears in the *Physical Review* by Drs. A. Chetham-Strode and L. W. Holm who produced einsteinium −248 and Drs. Bernard G. Harvey, Alfred Chetham-Strode, Jr., Albert Gluorso, Gregory C. Choppin and Stanley G. Thompson, who synthesised the four others.

Oxygen for Candian Steel

Linde Air Products Co., a division of Union Carbide, is to build a large oxygen plant on its property at Sault Ste. Marie, Ontario, to supply the Algoma Steel Corp.'s expanding steel producing operations. The plant, together with Linde's general expansion programme, will cost over $3 million and will be capable of producing 150 tons of 99.5 per cent pure oxygen daily.

Venezuelan Chlorine/ Caustic Soda Plant

It has been announced by Petroquimica Nacional that its new chlorine and caustic soda plants will be opened this month. This will be earlier than expected, and is thought to be a token opening. However, the Venezuelan Petrochemical Institute claimed in November last to have produced already and sold 700 tons of chlorine at Bs. 500 per ton, a price that is 30 per cent below the world market price.

May Buy US Reactor

The South Australian Government proposes to seek a loan from the Export-Import bank for the purchase of an American atomic reactor. Sir Thomas Playford, premier of South Australia, has submitted a series of questions to be sent to the American Atomic Energy Commission seeking details of possible aid.

NZ Ironsand Deposits

There are very substantial ironsand deposits on the West Coast of the North Island of New Zealand. Mr. W. R. B. Martin who is conducting research on ironsand at Victoria University College, is at present engaged in trying to find a satisfactory method of extracting titanium from ironsand. If he succeeds, titanium could form a valuable by-product, among others, to steel.

Canadian Magnesium

Magnesium ingot (99.8 per cent) sold by Magnesium Co., of Canada, fully owned subsidiary of Aluminium Ltd., Montreal, to Canadian customers, has been reduced in price. Base price, of 10,000-lb. lots is now 33.5 cents per lb., f.o.b., Arvida, Quebec, works. Previously the price was 35.25 cents per lb.

British Standards

Testing Vulcanised Rubber

Two new British Standards publications mark a further stage in the revision and publication in separate parts of BS 903, Method of Testing Vulcanised Rubber. Parts D1 and D2 specify methods for the determination of plastic yield of ebonite, part D1 dealing with plastic yield temperature and D2 with plastic yield at a specified temperature. Parts E1 to E6 cover methods of testing cellular ebonite and comprise the following: E1, apparent density; E2, plastic yield temperature; E3 plastic yield at a specified temperature; E4 tensile strength; E5 compression strength; E6 impact strength.

Copies are obtainable from the BSI Sales Branch, 2 Park Street, London W1: Parts D1 and D2, 2s 6d and Parts E1 to E6, 5s.

Revision of Sulphur BS.

Part 3 of British Standard 903, Methods for the Determination of Sulphur (reference CW.9214) is in the course of revision. Comments on the new draft, which can be obtained from the BSI at 2 Park Street, London W1, must be lodged by the end of February.

Work on a new BS for pyridine has been started.

AGM Date Announced

THE ANNUAL general meeting of the Parliamentary and Scientific Committee will be held at 11.30 a.m. on Wednesday, 27 February, 1957 in the River Room at the Savoy Hotel, Strand, London WC2.

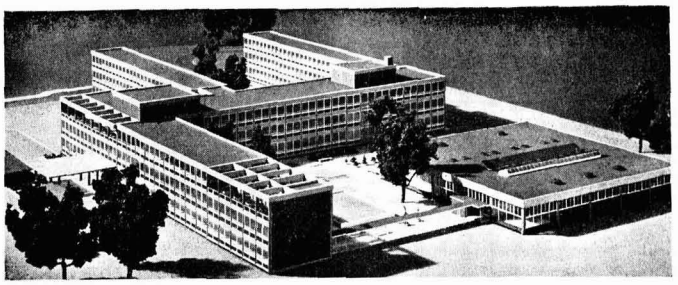
Export Enquiries for Laboratory Equipment

Through the India Supply Mission, 2536 Massachusetts Avenue, NW, Washington 8, DC, the Indian Government is seeking supplies of a wide range of laboratory and scientific equipment. Purchases will be financed by the International Co-operation Administration (ICA). Fuller details may be obtained from Room 728, BoT Export Services Branch, Lacon House, Theobalds Road, London WC1 (ref. ESB.3755/57/ICA and ESB.3857/57/ICA).

Laboratory apparatus is also sought by the Provincial Administration, Cape of Good Hope, South Africa. Closing date for tenders is 15 March. Fuller details from Room 805, BoT Export Services Branch (ref. ESB.3719/57).

Fertiliser Analysis Methods

Recent advances in the analysis of fertilisers was the subject of a paper given by Mr. H. N. Wilson (ICI Ltd., Billingham) at the annual meeting of the North of England Section, Society for Analytical Chemistry. Mr. Wilson reviewed methods of analysis for nitrogen, phosphate and potash, stressing recent developments. He did not confine himself to statutory methods, but included references to colorimetric or physical methods which, in his experience, had proved valuable.



Detailed model of the new Runcorn office for ICI General Chemicals Division

NEW RUNCORN OFFICES FOR ICI GENERAL CHEMICALS DIVISION

THIS MODEL of the new buildings at Runcorn planned for certain departments of ICI General Chemicals Division shows how lay-out of the office accommodation comprises four distinct wings. Each is specially designed for its particular function and is related to the others and to a canteen building.

Office buildings are three storeys high and the canteen one storey, but differences occur in the three-storey heights by means of recessed roof terraces and lift towers that enhance the silhouette.

The administration building, with its main entrance, faces towards Heath Road South. At right angles to this is a service wing to which are connected two identical drawing office wings around a garden court. On the opposite side of the service wing, the canteen with the administration block forms the second garden court.

Officials of Runcorn Urban District Council have given considerable help to the ICI staff in preliminary planning. Mr. F. Gibberd is architect for the scheme. It is hoped that building will start in the spring or early summer of this year.

FOR YOUR DIARY

MONDAY 18 FEBRUARY

RIC—Dartford: North-West Kent College of Technology, Miskin Road, 7.30 p.m. 'Immunisation with Toxoids and Vaccines' by Dr. H. J. Parish

CS—Leeds: Chemistry Lecture Theatre, University, 6.30 p.m. 'Silicones and their Industrial Applications' by R. Nattrass.

CS—Durham: Lecture Room 239, University Science Laboratories, South Road, 5.15 p.m. 'The Study of Fast Reactions' by R. P. Bell.

CS—Leicester: University College, 4.30 p.m. 'Metal Atoms in Aromatic Systems' by Dr. J. Chatt.

CS—Dundee: Chemistry Department, Queen's College, 5 p.m. 'The Photochemical Primary Process' by Professor W. A. Noyes.

CS—Cardiff: Chemistry Department, University College, 5.30 p.m. 'Recent Advances in Acetylene Chemistry' by Professor R. A. Raphael.

TUESDAY 19 FEBRUARY

SCI (Chemical Engineering Group)—Birmingham: The Midlands Institute, Paradise Street, 5.30 p.m. Joint meeting with Institution of Chemical Engineers. 'Some Aspects of Atomic Energy' by C. M. Nicholls.

CS—Nottingham: Chemistry Department, The University, 4.45 p.m. 'Organometallic Co-ordination Compounds' by Professor G. E. Coates.

WEDNESDAY 20 FEBRUARY

SCI (Corrosion Group)—London: 14 Belgrave Square SW1, 6.30 p.m. 'Theory and Practice in Potential Measurements for Cathodic Protection' by P. W. Heselgrave.

Royal Society of Arts—London: John Adam Street, Adelphi WC2, 2.30 p.m. 'Modern Detergents' by F. Courtney Harwood.

N. of England Inst. of Mining & Mechanical Engineers—Newcastle: Old Assembly Rooms, Westgate Road, 7.30 p.m. Annual dinner and dance.

THURSDAY 21 FEBRUARY

Royal Society—London: Burlington House W1, 10.30 a.m. Discussion on 'Work-Hardening and Fatigue of Metals' opened by Professor N. F. Mott.

I.Chem.E.—London: Royal Institution, Albemarle Street W1, 5.30 p.m. Meeting held in conjunction with The British Nuclear Energy Conference. 'The Processing of Nuclear Reactor Fuels' by R. Spence and C. M. Nicholls.

SCI (Microbiology Group)—London: 14 Belgrave Square SW1, 2.15 p.m. Symposium on 'Continuous Fermentations'.

CS—Aberdeen: Marischal College, 7.30 p.m. 'The Use of Photography in Scientific Investigations' by Dr. J. F. Padday.

CS—Bristol: Chemistry Department, University, 1.15 p.m. 'The Chemistry of Actinomycin' by Professor A. W. Johnson.

CS—Hull: Organic Lecture Theatre, University, 6 p.m. 'Polyesters and their Uses' by Dr. H. Gudgeon.

CS—Belfast: Queen's University, 7.15 p.m. 'The Study of Very Rapid Reactions by the Methods of Flash Photolysis' by Professor R. G. W. Norrish.

CS—Bangor: Department of Chemistry, University College of North Wales, 5.45 p.m. 'Some Aspects of the Structural Chemistry of Proteins and Nucleic Acids' by Professor H. D. Springall.

FRIDAY 22 FEBRUARY

CS—Cambridge: University Chemical Laboratory, Pembroke Street, 8.30 p.m. 'Some Recent Studies in Relation to Biosynthesis' by Professor A. J. Birch.

CS—Newcastle-upon-Tyne: Chemistry Building, King's College, 5.30 p.m. 'The Biological Synthesis of Oligosaccharides' by Professor M. Stacey.

SAC (Scottish Section)—Glasgow: Central Hotel, 7.15 p.m. 'Some Recent Developments in Analytical Chemistry' by Dr. R. Belcher.

SAC (Western Section)—Bristol: College of Technology, Ashley Down, 6.30 p.m. 'The Oxygen Demand of Trade Effluents with respect to River Pollution' by C. J. Regan.

SATURDAY 23 FEBRUARY

I.Chem.E. — Manchester: Reynolds Hall, College of Technology, 2 p.m. Symposium on 'Modern Developments in the Use of Plastics in the Chemical Industry'.

Progress Report on Calder Hall

MAKING a progress report on the Calder Hall nuclear power station in London last week, Sir Christopher Hinton said that the whole of the 'A' station was now operating. Reactor No. 2 had begun to supply electricity to the national grid system, and this had increased the total generating capacity of the plant from 46,000 kW to 92,000 kW installed.

'Our experience in operating the station for eight months has been very favourable," declared Sir Christopher. 'It has gone into operation more smoothly and with far less trouble than is normally experienced in starting up a conventional chemical manufacturing plant. The nuclear behaviour has been good—the critical size was less than our calculation predicted. This is of importance in connection with the design of reactors of the Calder Hall type for industrial use.'

The only unexpected difficulty, said Sir Christopher, was that the leakage of carbon dioxide from the system was larger than was anticipated. Pointing out that the leakage involved no hazard, he added that it was taking place at points such as the glands of valve spindles and was progressively being remedied by conventional engineering methods.

'Generally the performance of the fuel elements has been better than was anticipated,' said Sir Christopher.

Technical Publicity Talk

For the first time since the war members of the London Section, Institution of the Rubber Industry, heard a paper at their February meeting on a subject other than rubber science. On this occasion, Mr. G. C. Graver gave a talk on Publicity for technical products. An aspect of his talk that caused some surprise was the amount of money necessarily spent in this field of activity—in many cases more than on research itself.

Chemist's Bookshelf

ORGANIC THEORY AND PRACTICE

ORGANIC CHEMISTRY. Vol. II. Stereochemistry and the Chemistry of Natural Products. By *I. L. Finar*. Longmans, Green and Co., London. 1956. Pp. 733. 40s.

It is fair to say that the first volume of Finar's *Organic Chemistry* met with very widespread approval as a text-book which set out the fundamentals of the science clearly, accurately and in accordance with modern concepts. The appearance of a second volume dealing mainly with natural products was therefore awaited with considerable interest. Unfortunately in the case of this reviewer, the high hopes engendered by Volume I are not fully realised by Volume II. Admittedly in a general text-book it is easy to pick on some pet subject which has been treated cavalierly. However, it is difficult to find an excuse for the very sparse treatment of conformational analysis which removes the whole rationale of the discussion on steroid stereochemistry. There are also several slips which may prove confusing to students e.g., erroneous stereochemistry information and fission of an epoxide (p. 212); 'carbanion' instead of 'carbonium ion' (pp.306, 307); description of guaiol and vetivone as azulenes; use of the untenable hypothesis of 3d orbitals of carbon in transition states (p. 79).

In spite of these points this is a useful book and its low price makes a further appeal. In future editions, however, I hope that more even treatment of the subject matter will raise it to that high level of excellence one has come to expect from the author. K. RAPHAEL.

EXPERIMENTS IN ORGANIC CHEMISTRY. By *Louis F. Fieser*. D. C. Heath and Co., Boston, Mass., US, and George G. Harrap and Co. Ltd., London. 1956. Pp. 360. 36s.

One of the most refreshing aspects of Professor Fieser's text-books on organic chemistry is the sense of enjoyment of the subject he manages to communicate. A good example is this third edition of his well-known practical manual which has been revised and extended to bring in a wide variety of modern techniques and reactions; eye appeal is provided by an impressionist cover and an attractive series of colour photographs. A novel and practical lay-out involves the use of wide margins which enable comments and diagrams to be directly juxtaposed to the relevant portion of the text. As usual descriptions of procedures are logical and complete down to the last detail, a feature much appreciated by inexperienced students. Finally the useful list of interesting reagents has been considerably amplified. This book can be profitably used by all engaged in practical organic chemistry, from the tyro student to the experienced research worker. K. RAPHAEL.

Metallurgy—Science or Art?

ALLOY SERIES IN PHYSICAL METALLURGY. By *Morton C. Smith*. Harper and Brothers, New York. 1956. Pp. ix + 338. 50s.

One of the most noticeable changes that has taken place concerning metallurgy during the last 20 years or so, is the change in the definition of the subject. The view is more and more frequently expressed that metallurgy is science and not just art. The book under review could be regarded as an attempt to prove this point. How far then has metallurgy become a science of metals rather than an art of metal applications?

The science aspects of metallurgy are based mainly on certain fields of physics, chemistry and thermodynamics. These fields are then extended to deal with some specific behaviour and properties of metals and alloys. The author of this book too, recognises this fact. For example, in the introductory chapters he emphasises that the equilibrium diagrams which are most versatile tools of a metallurgist, could be best understood when treated from the point of view of the phase rule. But, unfortunately, not all the behaviour or properties of alloys in which metallurgists are interested could be equally well treated on the bases of one or other rules or laws of pure sciences.

It is this point which divides this book into two parts: more successful chapters based on the science aspects of metallurgy and less happy and frequently erroneous treatment in chapters dealing with properties and behaviour of alloys. It is true that some of these properties have so far eluded a scientific interpretation. But it is obvious also that the author is neither up to date nor accurate, for example, when dealing with properties of steels or cast irons. Science has progressed in these fields too, much further than the author is prepared to recognise.

To sum up, this book gives a very good background to the meaning and uses of equilibrium diagrams of alloy systems. It will serve a useful purpose as a textbook in this direction. It is unfortunate that the purely metallurgical chapters of the book dealing with the applications of equilibrium diagrams fall short of the required standard of a textbook. Similarly, the reproduction of microscopic illustrations is well below the accepted level of clarity.

V. KONDIC

A Textbook for Students and Teachers

CHAIN REACTIONS. By *F. S. Dainton*. Methuen & Co., Ltd., London. 1956. Pp. xv + 183. 15s.

For some time now there has been a pressing need for a short volume on chain reactions suitable for use by both teachers and students of physical chemistry. There have been many publications in this field and it has not been easy for those without direct interest in this topic to grasp the main developments except by making an intensive study of the original work which has appeared. Professor Dainton is extremely well qualified for the task of writing this book and has succeeded in producing a volume which is both compact and authoritative.

After a brief account of reactions which do not involve chains, a chapter is devoted to describing the special features of chain reactions and the main types of experimental methods used. The third chapter gives an account of the nature of the chemical reactions which may occur in the initiation, propagation, branching and termination of chains. The next two chapters cover the main points in the mathematical treatment of this type of reaction.

Up-to-date Accounts

Several specific chain reactions which lead to explosion are described in chapter vi, and a valuable and welcome feature of the book is the up-to-date account of such reactions as the combustion of hydrogen, the oxidation of carbon monoxide and the oxidation of phosphorus vapour. The final chapter deals with polymerisation.

Thus, although the book is not large, it is most comprehensive, and packed with valuable material. This compression of the subject matter means that it may prove a slightly difficult book for students to read unless they are attempting to gain a specialised knowledge in this field. Much information is given in the figures but, in some cases, such as V.7, they would be easier to follow with more extensive captions.

The volume is well-documented with references which are listed at the end of the chapters, and a good subject index in included. There is no doubt that this will prove a most valuable book for all who wish to make themselves familiar with this important field of physical chemistry. C. KEMBALL.

Role of Hydrogen Ions

HYDROGEN IONS. By *H. T. S. Britton*. 4th Edition. Vol. II. Chapman and Hall, London. 1956. Pp. xix + 489. 75s.

Volume I of this work deals mainly with the theory and methods of hydrogen ion concentration measurement. The present volume proceeds to an examination of the rôle of hydrogen ions in pure and applied chemistry, with particular reference to processes of great industrial importance. The author is a recognised

authority on this subject and the appearance of a fourth edition, after 14 years, is most welcome. It has been carefully revised and enlarged, and includes an important new chapter on the potentiometric determination of acids and bases in non-aqueous media.

On the whole, the individual subjects are presented in a rigorous and lucid fashion, and are well documented with illustrations and references to the original literature. The usefulness of the book is enhanced by the high quality of the indexes. The price seems a little high.

H. MACKLE.

Fundamental Importance

EXPERIMENTAL THERMOCHEMISTRY. Edited by *F. D. Rossini*. Interscience Publishers Inc., New York. 1956. Pp. xv + 326 $7.80.

The ultimate aim of thermochemistry is to provide experimental data from which may be deduced the heat of every possible chemical reaction. It is thus an experimental field of the most fundamental importance, and one which has developed rapidly during the past 30 years. It is not surprising, therefore, that there has emerged in recent times an ever-growing need for a book which would present to the scientific world a perspective of the present state of the subject.

At its meeting in Amsterdam in 1949, the Commission on Thermochemistry set itself the task of providing such a book. The volume under review is the outcome of the efforts of the Commission and its expert advisers, under the distinguished editorship of Professor F. D. Rossini. It is, without question, as excellent, comprehensive and authoritative a work as the following citation of contents and authors would lead one to expect:

Comprehensive List

General principles of modern thermochemistry; units of energy and fundamental constants; assignment of uncertainties to thermochemical data; calibration of calorimeters for reactions in a flame at constant pressure (Rossini): Calibration of calorimeters for reactions in a bomb at constant volume (Coops, Jessup, Van Nes); Standard states and corrections for combustions in a bomb at constant volume (Hubbard, Scott and Waddington). Combustion in a bomb of compounds containing carbon, hydrogen, oxygen, nitrogen (Prosen); Combustion in a bomb of organic sulphur compounds (Waddington, Sunner, Hubbard); Combustion in a bomb of organic chlorine compounds (Smith and Hubbard); Combustion in a bomb of organic bromine compounds (Smith and Bjellerup); Combustion in a bomb of organic iodine Compounds (Smith); Thermochemistry of reactions other than combustion (Skinner); Microcalorimetry of slow phenomena (Calvet); Physicochemistry standards for thermochemistry (Waddington).

The book is well produced, has good author and subject indexes, and the price is reasonable.

H. MACKLE

US Minerals

PRODUCTION OF BENTONITE WAS RECORD IN 1955

THE quantity of bentonite produced in the US in 1955 exceeded the previous record year of 1952 by 12 per cent. The tonnage increased by 6 per cent and the value by 17 per cent over 1954.

Foundry and petroleum industries consumed 89 per cent of the total tonnage—rotary-drilling mud accounted for 40 per cent (595,471 short tons); foundry-sand bond 28 per cent (419,152 short tons); filtering and decolorising oils and other filtering and clarifying, 21 per cent (309,315 short tons); and the remainder, 156,267 short tons or 11 per cent of the national output, went for a variety of uses. Compared with 1954, the tonnage of bentonite used for foundry-sand bond increased 42 per cent; rotary-drilling mud, 9 per cent; filtering and decolorising oils, 5 per cent. The only major use that showed a decline in tonnage consumed, compared with 1954, was chemicals.

Thirteen States reported bentonite production in 1955, compared with eleven States in 1954. The State showing the largest production of bentonite in 1955, in percentage of United States total, was: Wyoming, 56 per cent (58 per cent in 1954 and 53 per cent in 1953).

Average value per short ton, as reported by the producers to the Bureau of Mines in 1955, was $11.63, compared with $11.52 in 1954, $12.74 in 1953, $11.22 in 1952, and $10.67 in 1951.

Iodine Consumption

Consumption of crude iodine in the US during 1955 totalled 1,376,204 lb., 2 per cent more than in 1954, according to reports submitted to the Bureau of Mines, US Department of the Interior.

Domestic production of iodine continued to be confined to California where Dow Chemical Co. and Deepwater Chemical Co. recovered iodine from oil well waters. Statistics on domestic production are not available as these would disclose individual company figures, the Bureau of Mines states.

Crude iodine imported for consumption in the US was 945,985 lb. in 1954 and 1,231,994 in 1955. Chile and Japan were the two main suppliers.

Clay Output up in 1955

Clay production increased 13 per cent in 1955, according to reports of producers to the Bureau of Mines, US Department of the Interior. The following large uses of clay registered increases: Lightweight aggregate, 100 per cent; refractories, 34 per cent; pottery and stoneware, 25 per cent; paper filler, 25 per cent; paper coating, 4 per cent; high-grade tile, 14 per cent; heavy clay products, 9 per cent; rotary-drilling mud, 8 per cent. Some uses that showed decreases were: Filtering and decolorising oils (raw and activated earths), 6 per cent; other filtering and clarifying, 10 per cent; and filler (other than paper), 23 per cent.

Domestic kaolin sold or used by producers in 1955 increased 16 per cent in tonnage compared with 1954, and reached a record level of over 2 million short tons. Major uses of kaolin in 1955 remained about the same as for the past several years; with the paper, refractories, rubber, and pottery industries the principal consumers. Paper consumed 1,118,117 short tons or 52 per cent of the total kaolin output in 1955 (546,436 short tons for filler and 571,681 short tons for coating); refractories used 303,587 short tons or 14 per cent; rubber used 257,223 short tons or 12 per cent; and pottery used 142,823 short tons or 7 per cent. The remainder (15 per cent) was consumed for a wide variety of purposes.

Two per cent Increase in Fullers' Earth Output

Production of Fuller's earth decreased 2 per cent in 1955 compared with 1954, according to reports of producers to the Bureau of Mines, US Department of the Interior.

Fuller's earth consumed in mineral-oil refining in 1955 totalled 55,251 short tons or 15 per cent of the total output, compared with 23 per cent in 1954. Absorbent uses accounted for 136,664 short tons or 37 per cent of the total, compared with 31 per cent in 1954; rotary-drilling mud, 47,231 short tons or 13 per cent compared with 11 per cent in 1954; vegetable oil, 4,129 short tons or 1 per cent compared with 5 per cent in 1954. The remainder was used in other filtering and clarifying, binders, and other unspecified uses.

Average value per short ton in 1955 was $20.61 compared with $18.23 in 1954.

UK-US Agreement on Hydrogen Power

BOTH CLASSIFIED (secret) and unclassified information on research in the field of controlled thermonuclear reaction is to be exchanged by the UK and US Governments. An agreement to this effect was announced in London on 6 February.

A joint conference, organised by the US Atomic Energy Commission will be held in Berkeley, Ca., starting on 20 February. It is expected that UK representatives will discuss their work with reactions involving the fusing of tritium with deuterium atoms and the fusing of deuterium atoms. Immense temperatures in the range of 10 million to 30 million degrees C are needed to effect fusion for yielding power.

People in the NEWS

● MR. EDWARD A. O'NEAL, JR., was appointed chairman of Chemstrand Ltd. and SIR MILES THOMAS was appointed a director on 8 February. Other members of the board are Mr. Arvon L. Davies, managing, Mr. R. J. Breyfogle and Mr. R. C. G. Clarke.

Mr. O'Neal, who has just completed a visit to the site in Coleraine, Northern Ireland, where Chemstrand are erecting a £3½ million factory for the manufacture of their acrylic fibre, Acrilan, is president of the parent company, the Chemstrand Corporation of Decatur, Alabama. Sir Miles Thomas is chairman of Monsanto Chemicals Ltd.

Before returning to the US, Mr. O'Neal expressed satisfaction with the progress made at Coleraine. Construction is ahead of schedule and target date for initial production is the end of next year.

● MR. A. N. LEATHER was elected chairman of the North of England Section, Society for Analytical Chemistry, at the annual meeting held recently in Manchester under the chairmanship of Mr. J. R. Walmsley. DR. J. R. EDISBURY was elected vice-chairman and MR. A. C. WIGGINS (J. Lyons and Co. Ltd., Laurel Road, Liverpool 7) was appointed hon. secretary and treasurer.

● MR. WILLIAM G. COPELAND has been appointed general manager of the Texas Company's Refining Department. Manager of the Refining Department's Operations Division since January 1956, he succeeds MR. THEODORE A. MANGELSDORF, who recently was elected a vice president. MR. DOUGLAS P. BAILEY, assistant works manager of the company's Port Arthur, Texas, refinery since 1945, succeeds Mr. Copeland as manager of operations in the New York office.

● The election of MR. E. H. KIDGER as managing director of Menley and James (Australia) Ltd., and A. J. White (Australia) Ltd., and of MR. S. C. FENWICK and MR. R. K. WYBURN to the boards of those two companies is announced by the board of A. J. White Ltd., 120 Coldharbour Lane, London SE5.

● MR. G. WILSON has retired, for reasons of health, as a director of Turner and Newall.

● MR. J. W. BABBS has been appointed technical development manager and MR. A. B. KOZLOWSKI chief development chemist of the new technical development department recently inaugurated by Expandite Ltd.

● North Thames Gas Board has changed the titles of two sales managers. MR. H. J. CARTER is now sales manager (tar products) and MR. C. J. JOHNSON is now sales manager (chemical products).

● MR. H. D. CUMMINS and MR. D. O. HALLETT have been appointed sales director and technical director of a new company, Stainless Steel Plant Ltd., Walden Estate, Cocker Street Works, Blackpool. Mr. Cummins and Mr. Hallett formerly represented T. Guisti and Son Ltd., London. The new company will specialise in the fabrication of stainless steel plant for the chemical and pharmaceutical, food, brewery and allied industries.

● MR. JOHN P. HOLMES, vice president of Celanese Corporation of America, has been assigned to direct the company's foreign operations. In addition to his position as vice president and a director of the parent company, Mr. Holmes has been appointed president of three subsidiaries, Celanese International Corporation, Amcel Co. Inc., and Pan Amcel Co. Inc., the latter two of which are trading corporations.

● AIR COMMODORE J. A. HAWKINGS has been appointed controller of a new research and development division established by the Pyrene Co. Ltd., Brentford. This new division is intended to facilitate the development and introduction of new products and the improvement of existing ones. Air Commodore Hawkings was director of RAF Fighter Research and Development when he retired last year after 31 years' service with the RAF.

● MR. TROY B. HUNT has been appointed plant manager of Olin Revere Metals Corporation's reduction plant at Omal, Ohio. Mr. Hunt had been with Olin Mathieson Chemical Corporation prior to his new assignment. He had been in charge of designing the reduction plant.

● In agreement with the Foreign Office, the DSIR has appointed BRIGADIER C.F.C. SPEDDING to succeed MR. K. H. LAUDER as Scientific Attaché at HM Embassy in Bonn.

● DR. ALAN H. RATCLIFFE, M.A., B.Sc., D.Phil (Oxon) has been appointed head of the development operations in the UK to Smith Kline and French, pharmaceutical manufacturers, London, SE5. Dr. Ratcliffe is a natural science scholar of Brasenose College, Oxford, where he gained an honours degree in Physiology. During war service with the RAF he was technical head of the flight section of the Combined Research Group in Washington, DC. Before joining Smith Kline and French as research liaison officer in 1954, Dr. Ratcliffe was lecturer in experimental methods for the Department of Surgery, Manchester University.

● A fall in Bombay earlier this week which resulted in a broken leg may cause SIR ALEXANDER FLECK, chairman of Imperial Chemical Industries Ltd., to cancel the rest of his tour of the Far East. It is expected that Sir Alexander will be in hospital for about a fortnight.

● MR. CARL R. ROWE has been appointed plant manager of Olin Mathieson Chemical Corporation's rolling mill at Omal, Ohio.

● At the annual general meeting of the Midlands Section of the Society for Analytical Chemistry on 24 January, the following officers were elected: *chairman*: DR. R. BELCHER; *vice-chairman*: DR. S. H. JENKINS; *honorary secretary*: MR. G. W. CHERRY, 48 George Frederick Road, Sutton Coldfield, Warwickshire; *honorary treasurer*: MR. F. C. J. POULTON.

● MR. G. S. J. WHITE, division director in charge of technical service of ICI Ltd., Dyestuffs Division and a visiting director of the ICI Leathercloth Division, has been elected a vice-president of the Textile Institute. Vice president of the Society of Dyers and Colourists, and vice chairman of the council, Mr. White was awarded the SDC gold meral in 1955. He is chairman of the joint Textile Institute-SDC committee dealing with the Annual Review of Textile Progress.

● MR. G. A. EMERY, senior export entomologist of the Murphy Chemical Co. is visiting the Nairobi, Kenya, factory and laboratories of the associate company, Murphy Chemicals (East Africa).

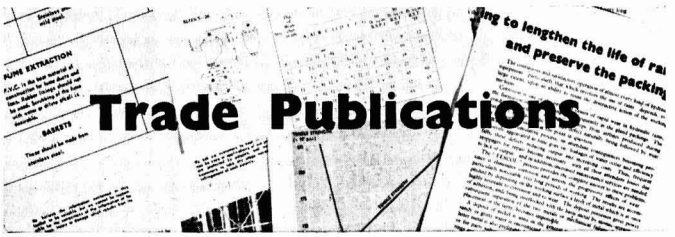
● Chairman and managing director of Evode Ltd., Stafford, DR. H. SIMON, has been appointed managing director of Vik Supplies, the Lotus subsidiary which supplies materials and equipment to the shoe industry. Vik has acquired the Lotus chemical division and is integrating with the Evode laboratories to give greater research and production facilities.

Obituary

PROFESSOR WALTHER BOTHE, Nobel Prizewinner for physics in 1954 and one of the world's leading scientists in the field of nuclear physics, died in Heidelberg on 8 February, at the age of 66.

Will

MRS. JESSIE GERTRUDE BOAKE, of Highstanding, Albion Hill, Loughton, Essex, widow of Arthur Boake, of A. Boake, Roberts and Co. Ltd., who died on 14 November last, left £134,951 net.



Solartron's Automation Policy in 1957

Electronics, the spearhead of automation, is the subject of the illustrated annual review of the activities of the Solartron Electronic Group Ltd., Thames Ditton, during 1956. The company's contributions in the field of Servo systems, the basis of automation equipment, are described. New projects and equipment by the group are also detailed. Policy in 1957, which allows for a trebling of exports, will be to provide simple units of automation equipment for use by plant engineers and works engineers in the step by step introduction of automation techniques in their plants.

High Temperature Water Circulating Pumps

A new publication, No. 1506, issued by Rhodes, Brydon and Youatt Ltd., Gorsey Mount Street, Stockport, deals with their latest '350' series vertical high temperature water circulating pumps. The brochure fully describes the pumps and includes a duty selection chart. The series is designed for pressures up to 350 p.s.i.

Rubber in Heavy Engineering

Last September, S. W. March, M.I. Loco. E., presented a paper on 'The Use of Rubber in Heavy Engineering' at a conference on 'Rubber in Engineering' organised by the Natural Rubber Development Board. This paper has now been published as an illustrated booklet by the Andre Rubber Co. Ltd., Kingston By-pass, Surbiton, Surrey. A general outline of the use of rubber in heavy engineering including buildings is given under the following four sections: Ships and jetties; general engineering (including building) couplings; and railway engineering.

New Isotope Catalogue From Harwell

A fourth edition has been published of the catalogue of isotopes on sale from the Isotope Division, AERE, Harwell. The principal section of the catalogue consists of a table giving the properties and availability of individual pile-produced radioisotopes. Both this section and one on cyclotron-produced and stable isotopes have been expanded, to cover those materials which have become available since earlier editions.

The remainder of the catalogue includes a description of the specialised services which the Isotope Division is able to provide on request; details of facilities offered by the technological irradiation group for high-intensity ionising irradiation of materials; information on radioactive standards prepared at Harwell; and tables of beta and gamma energies against half-lives. Copies may be obtained from the Isotope Division.

A separate catalogue covering naturally radioactive materials, long-lived fission products, labelled compounds and other materials requiring processing or synthesis is obtainable from the Radiochemical Centre, Amersham, Buckinghamshire.

Treatment of Aluminium Surfaces

Treatment of aluminium or aluminium alloys to provide a surface which will take organic finishes may be undertaken by using Pylumin, claims a leaflet published by the Pyrene Co., metal finishing division, Great West Road, Brentford, Middlesex. Parts to be treated are immersed in Pylumin solution maintained at 210-212°F for three to 15 minutes followed by thorough rinsing and drying. The work is then ready for the application of the finishing medium. The Pylumin finish itself is corrosion resistant and may be used alone where abrasion risks are small.

Laboratory Glassware

Price list and supplement No. 1 (dated February) for their catalogue No. 7, have been issued by H. J. Elliott Ltd., E-Mil works, Treforest Industrial Estate, Pontypridd, Glam. Listed are new apparatus, reduced prices and alterations to BSS.

Steroid Anaesthetic

A 34-page brochure on Viadril, the first synthetic steroid anaesthetic, developed by Pfizer research laboratories, is available from the public relations officer, Pfizer Ltd., Folkestone, Kent.

Continuous Centrifugal Filtration

Bird solid bowl centrifugal filters, made under exclusive licence in England by Vickerys Ltd., 4 Lambeth Palace Road, London SE1, are the subject of a new brochure available from the firm. Production in a range of sizes means that a single installation is nearly always possible. Little or no attention is needed apart from occasional oiling and greasing and there are no cloths to blind. Cake moisture is said to be slightly lower than that obtained with the vacuum filter.

The Bird centrifuge also has a wide range of applications in the chemical industry as a classifier, working in the extreme fine size range, size cuts being made in some cases at less than 1 micron.

Pressure Gauges for Chemical Works

Pressure gauges with plastics cases in 4 in. and 6 in. diameters and for work at various pressures in chemical factories where brass or steel cases might be affected by corrosion are described in a leaflet issued by Tomey Industries Ltd., Catherine Street, Aston, Birmingham 6. Available for steam, air, gas, water or fluid pressure, these Eureka gauges are made for any graduations up to 800 lb. per sq. in.

Gas Storage for the Chemical Industry

Gas storage in the gas, chemical, petroleum and iron and steel industries is the subject of a new brochure published by Ashmore, Benson, Pease and Co., Stockton-on-Tees. The booklet deals mainly with water sealed gasholders, but notes are included on Wiggins dry seal gasholders which are being used for hydrogen, nitrogen, carbon monoxide, carbon dioxide, oxygen, argon, helium, sulphur dioxide, methane, tetrafluoroethylene, dimethyl ether, blue water gas, anhydrous ammonia, sewage gas and coke oven gas.

Ajax Alarm Equipment

Latest brochure of F. Bamford and Co. Ltd., Ajax Works, John Street, Stockport, features Ajax alarm equipment. A range of flow indicators are illustrated including both electric and non-electric. Non-electric model has plastics windows for visual examination of the flow. The Ajax wall panel gives warning of failures or fluctuations in either liquid circuits or storage tanks, while Ajax temperature and pressure stats enable the temperature or pressure of the contents of a pipe to be kept constant.

Torsion Balances

Sensitive direct-reading torsion balances are described in a technical leaflet issued by White Electrical Instrument Co. Ltd., 10 Amwell Street, Rosebery Avenue, London WC1. Models featured are those in most popular demand.

New Entries in BDH Catalogue

Five entries are included in the latest list of additions to the catalogue published by British Drug Houses, Poole, Dorset. They are: 1:2-Benzanthracene, bromo-cyclopentane, o-cresolphthalein complexone, 6-phosphogluconic acid barium salt, and 1:2:4:5-tetramethyl benzene. This leaflet also describes two Lovibond Comparator discs produced by The Tintometer Ltd. in collaboration with the Pest Infestation Laboratory. Special impregnated cobalt cyanate paper prepared by BDH is used in these papers which cover a relative humidity from 100 to 60 per cent in steps of five per cent.

Commercial News

British Boiler Accessories Acquired by T. H. & J. Daniels

T. H. & J. Daniels, chemical engineers, Stroud, Glos, have acquired the whole of the issued share capital of British Boiler Accessories Ltd., manufacturers of steam storage plant, water dejectors and other boiler equipment. The products of this company will be complementary to those of Prat-Daniel (Stanmore) Ltd., a subsidiary of T. H. & J. Daniels which specialises in grit and dust collecting plant and fume extraction equipment. British Boiler Accessories will continue their close association with Schiff & Stern Ltd., a company that sells similar equipment on the Continent.

Isdale and McCullum

Isdale and McCullum Ltd., old established soap manufacturers of Paisley are to go into voluntary liquidation. The decision stems from the intensified competition in the soap and detergent field. Existing orders will be completed and stocks cleared, before the firm finally closes down but the present anticipation is that the liquidation will not be unduly extended.

G. and J. Thomson

G. & J. Thomson Ltd., Colvend Street, Bridgeton, Glasgow, have acquired the undertaking and assets of Sadler and Company (Glasgow) Ltd., also of Colvend Street. Sadler and Company are a subsidiary of Isdale and McCullum, and are concerned with the manufacture of soap for industrial purposes.

Power-Gas Corporation

Group trading profit and other income of the Power-Gas Corporation Ltd. for the year ended 30 September was £859,714 (against £827,933). Group net profit totalled £299,321 (against £344,119). Dividend on ordinary is maintained at 14 per cent. General reserve accounts for £127,454 (against £137,000) and £41,127 (against £40,460) is carried forward. Annual meeting will be held at 21 Tothill Street, London, SW on 21 March.

G. A. Platon Ltd.

G. A. Platon Ltd., 323A Whitehorse Road, Croydon, is the name of a company formed to provide a technical sales service to all industries concerned with the handling of fluids. G. A. Platon are stockholders of plant items such as flowmeters, flow-controllers, pumps etc., and give an advisory service on the development and introduction of new devices, particularly for automatic control. Directors are G. A. Platon, former technical sales manager of Rotameter Manufacturing Co. Ltd.; Mr. F. J. Minett, managing director of M. & S. Engineering (Croydon) Ltd., an associated company, and Dr. J. W. Mitchell, who is associated with the plastics industry and is a chemical engineer with experience of nuclear engineering problems.

NEW COMPANIES

NORE PHARMACEUTICALS LTD. Capital £1,000. Manufacturers of and dealers in chemical, pharmaceutical, medical and industrial compounds and preparations etc. Registered office: 42 Welbeck Street, London W1.

L. EDWARDS (CHEMISTS) LTD. Capital £7,000. Consulting, analytical, manufacturing, pharmaceutical and general chemists etc. Directors: Herman D. Edwards and Lilian Edwards. Registered office: 105 Dale Street, Milnrow, Lancs.

PRIOR KING LTD. Capital £8,000. Consulting, analytical, manufacturing, pharmaceutical and general chemists etc. Directors: S. H. Prior King and I. D. Prior King. Registered office: Room 406, 320 High Holborn, London WC1.

MORTGAGES AND CHARGES

GREENWOOD RAWLINGS AND CO. LTD. Rayleigh, plastics manufacturers etc. 14 January, £6,155 charge, to Mrs. J. Greenwood, Stock (Essex); charged on specified properties at Brook Road, Rayleigh.

POLYMER CONSULTANTS LTD. London EC, study of polymerisation chemistry. 11 January, series of £4,500 debentures, plus premium of 10 per cent on repayment, present issue £2,500; general charge.

SATISFACTIONS

GERALD CARTER AND CO. LTD. Welwyn Garden City, paint manufacturers etc. Satisfaction 16 January, of charge registered 18 January 1954.

LEDA CHEMICALS LTD. London W. Satisfactions 3 January of mortgage and charge registered 26 July 1948 and of an assignment registered 1 April 1953.

LONDON GAZETTE

Voluntary Winding Up

[*A resolution for the voluntary winding-up of a company does not necessarily imply liabilities. Frequently it is for purposes of internal reconstruction and notice is purely formal.*]

BATH FERTILIZERS LTD. By reason of its liabilities. Mr. G. C. Ehlers, 28 Baldwin Street, Bristol 1, appointed liquidator, 21 January.

GIBSON BROTHERS (HULL) LTD., paint, colour, varnish and grease manufacturers and merchants, registered office, Marfleet Avenue, Kingston-upon-Hull. By special resolution, 28 January. W. B. Hall, National Provincial Chambers, Silver Street, Kingston-upon-Hull, appointed liquidator.

RAWSON CHEMICALS LTD., pharmaceutical manufacturers, registered office, East Hamm, Essex. By special resolution. J. T. Yates, 19 Great Winchester Street, London EC2, and G. L. A. Davis, Farleigh House, Lawrence Lane, Cheapside, London EC2, appointed joint liquidators, 24 January.

ROBERT EMERY LTD., colour manufacturers, registered office, Waterloo Colour Works, Cobridge, Stoke-on-Trent. By reason of its liabilities. P. J. Snow, 17 Albion Street, Hanley appointed liquidator, 1 February.

Market Reports

Price Reduction For Copper Sulphate

LONDON Active trading conditions continue in most sections of the market with a steady flow of new enquiry both on home account and for shipment. Good quantities are being absorbed against contracts by the chief consuming industries, although the fuel oil shortage is not without its effect in some directions.

As a result of the lower metal price, sulphate of copper is now quoted at £91 10s. per ton less 2 per cent f.o.b. Liverpool. Otherwise prices, in the main, are unchanged or moving within narrow limits.

Firm conditions prevail in coal-tar products. Creosote oil, cresylic acid and pitch are all in active request, and there is a persistent demand for benzol and xylol.

MANCHESTER Apart from sulphate of copper, which has been reduced by £3 a ton, there have been few important price changes on the Manchester chemical market, the undertone generally being firm. Contract deliveries of the alkalis and other leading heavy products are well maintained and fresh enquiries on both home and export account are circulating freely. A gradual improvement in demand for a number of fertiliser materials continues. Creosote oil and most other tar products find a ready outlet.

GLASGOW From the Scottish heavy chemical market the general trend of activities reported last week has continued and covered most sections of industry. Orders placed have been mostly against current requirements with a fair percentage for forward delivery. In spite of fuel shortages, deliveries are being reasonably well maintained. On the whole, prices have remained fairly firm.

Boron as Chemical Fuel

High energy fuels, sometimes referred to as chemical fuels, are of interest to Borax (Holdings) Ltd. because they can be based on boron. Stating this in London, last week, Mr. D. A. Smith, chairman, added, 'It is possible that in the future some may be used to boost the performance of civil aircraft.'

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents),' which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London, WC2, price 2s 6d including postage; annual subscription £6 6s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period. Dates on which these applications will be open to inspection are given in 'Official Journal (Patents)'.

ACCEPTANCES

770 229 Rapid determination of micro-organisms in filtered beers, malt liquor, etc. Filtrox-Werk AG.

770 478 Polycyclic ketones. Institut Francais du Petrole, des Carburants et Lubrifiants.

770 344 Heterocyclic compounds. Allen & Hanburys Ltd.

770 481 Epoxidised compounds. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.

770 565 Distarch phosphate and products containing same. Corn Products Refining Co.

770 480 Luminescent materials. British Thomson-Houston Co. Ltd. (General Electric Co.).

770 233 Therapeutic compositions. Allen & Hanburys Ltd.

770 633 Production of foamed products. Farbenfabriken Bayer AG.

770 570 Anthraquinone compounds. Ciba Ltd.

770 483 Copper chloride sweetening processes for petroleum fractions. Esso Research & Engineering Co.

770 237 Producing cellular structure in vinyl ester resin. Elastomer Chemical Corp.

770 705 Extruders for plastic material. United States Rubber Co.

770 572 Low freezing liquid. Atlas Powder Co.

770 706 Devices for filling liquids into containers. Beul, M. L.

770 707 Aluminium trialkyls and alkyl aluminium hydrides. Ziegler, K.

770 574 Colouring compositions containing dyes of the triarylmethane series. Du Pont de Nemours, E. I., & Co.

770 359 Dyeing of wool with complex heavy metal compounds of dyestuffs. [Addition to 766 492.] Geigy, J. R., AG.

770 486 Anti-foaming compositions. Midland Silicones Ltd.

770 488 Hardenable epoxide resin compositions. Chemische Werke Albert.

770 361 3-Amino-4-butoxy-benzoates. Abbott Labs.

770 708 Fabric-bonded resin-impregnated carbonaceous pipe. Union Carbide & Carbon Corp.

770 575 Peptides. UCLAF.

770 576 Materials having coated polythene surface. Celanese Corp. of America.

770 420 Heterocyclic phosphorus-containing monofluorides. Union Carbide & Carbon Corp.

770 579 Fuel composition for four-stroke engines. British Petroleum Co. Ltd.

770 368 Cracking equipment for heavy liquid compounds of high distilling point. Mora, F. M.

770 239 Volatile hydrocarbon fuels. National Benzole Co. Ltd.

770 493 Two-stage carbon dioxide removal. Chemical Construction Corp.

770 581 Heterocyclic alcohol diammonio esters. Cutter Labs.

770 418 Stable aqueous penicillin preparation. [Addition to 770 417.] Smith Kline & French International Co.

770 494 Ultraviolet radiation absorbing compounds and photographic elements containing such. [Addition to 748 190.] Kodak Ltd.

770 370 5-Hydroxy-tryptamine and intermediates. Francesco Vismara Soc. per Azioni, and Justoni, R.

770 585 Substituted aliphatic acids and esters thereof. Rohm & Haas Co.

770 498 α-Acylamino-β-amino-propionitrophenones and derivatives. Farmaceutici Italia Soc. Anon.

770 717 Esterified formaldehyde polymers. Du Pont de Nemours, E. I., & Co.

770 376 Ethinyl carbinol derivatives. Pfizer, C., & Co. Inc.

770 500 Improving water-resistant properties of plastic-bound fibrous materials. Aktiebolaget Statens Skogsindustrier.

770 247 Hydroxy-alkyl-bis(3-cyclohexylpropyl) amines. Sterling Drug Inc.

770 248 Preparation of bacitracin. Pfizer, C., & Co. Inc.

770 381 Aldol condensation of acrolein dimer. Union Carbide & Carbon Corp.

770 592 Imidazoline and pyrimidine derivatives. Pfizer, C., & Co. Inc.

770 251 Organosiloxanes. Midland Silicones Ltd.

770 593 Chlorinated hydroxyindanes. Sterling Drug Inc.

770 594 Use of nuclear fission in synthesising organic compounds. Hercules Powder Co.

770 728 1-Benzamido-1-phenyl-3-piperidinopropane. [Addition to 739 741.] Lilly, E., & Co.

770 507 Ethylene polymerisation. Esso Research & Engineering Co.

770 729 Rust inhibiting compositions and concentrates containing thioether carboxylic acids. Esso Research & Engineering Co.

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