THE Chemical Age

VOL. LXXIV 19 MAY 1956 No. 1923

Volume LXXIV
Number 1923

The Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE · 154 FLEET STREET · LONDON EC4

Telephone: FLEET STREET 3212 (26 *lines*) *Telegrams* ALLANGAS · FLEET · LONDON

CONTENTS . 19 MAY 1956

Editor: *E. Arnold Running* *Manager:* *H. A. Willmott*

Director: *N. B. Livingstone Wallace*

MIDLANDS OFFICE:
Daimler House, Paradise Street, Birmingham
Phone: Midland 0784/5

SCOTTISH OFFICE:
116, Hope Street, Glasgow, C.2
Phone: Central 3954/5

LEEDS OFFICE:
Martins Bank Chambers Park Row, Leeds, 1
Phone: Leeds 22601

SINGLE COPY 1/3 (BY POST 1/6) ANNUAL SUBSCRIPTION 52/6

Unexpected Results

SPEAKING at the opening of the Perkin Memorial Exhibition at the Science Museum, South Kensington, London, on 8 May, Dr. R. P. Linstead, C.B.E., F.R.S., rector of the Imperial College, said that William Perkin was one of the founders of the organic chemical industry, and it was particularly appropriate that the exhibition owed so much to the industrial firms of this country.

In considering the work of William Perkin, continued Dr. Linstead, there were two points to bear in mind. First, at the time of his discovery Perkin was 18 and his formal qualifications to carry out research were, by today's standards, not very striking; but his spiritual and mental qualifications were of the highest order. He made his discovery not under the eyes of his professor, but at home.

There was a moral; in these days of planning and organization it was extremely important that we should not plan or organize ourselves to such an extent that we left no opportunity for the free and eager spirit, the young and ardent mind to make important contributions to knowledge and to industry.

Dr. Linstead's second point dealt with the extraordinary sequence of events which followed Perkin's initial discovery. Within four months the discovery had been patented; within about a year the factory at Greenford Green was building and approximately 20 months after the discovery, commercially manufactured mauveine was in use in at least one dye. Perkin combined the fire of the discoverer with the initiative of the industrialist. And not only did he lead the way in the discovery of commercial dyestuffs, but in the 16 years during which he was in the chemical industry, he cleared up the whole business of the manufacture of coal tar intermediates.

'Perkin was a most gifted scientist and one of the very great technologists,' added Dr. Linstead. His monument is the factories of Britain in which synthetic organic chemicals are made. Not only did he discover the dye, but he discovered the idea that things could be made synthetically on an industrial scale. A century ago that was quite a new idea.

Further tributes to Perkin and to Perkin's father ('he deserves far more thanks from the world than has been given him') were paid by the Marquess of Salisbury, K.G., Lord President of the Council, at the centenary celebration banquet in London on 9 May.

Perkin was destined to join the family business of boatbuilding, remarked Lord Salisbury, but when he was 13 he made his first contacts with chemistry and he decided that he would become a chemist. Perkin senior, showing a liberal-minded-

ness not by any means universal among Victorian parents, allowed the boy to go down to the Royal College of Chemistry when he was 15. A few years later he put up nearly all the capital which he had accumulated during a lifetime of hard work to finance his son's discovery. Added Lord Salisbury, 'The father was certainly one of the main heroes of the story.'

Having started his firm and made what money was necessary, Perkin left the world of commerce when he was 36 and went back to his first love—research. He did valuable work in other spheres and left behind a dual heritage. On one side a commercial and scientific heritage, on the other a human heritage. The first is the vast industry of organic chemistry throughout the world, the second the remarkable school of scientists and technologists which has come to be known as 'Perkin's family'.

This family has continued to dominate British organic chemistry. The most outstanding member is perhaps Sir Robert Robinson, whose recently compiled geneology of the family shows that members held 21 of Britain's chairs in organic chemistry, two sons were emeritus professors and one grandson was rector of the Imperial College.

Lord Salisbury declared that the story of Perkin and his discovery taught two lessons. First, that Britain still had creative scientists; second, that the courageous and adventurous spirit which inspires the scientists must inspire the whole industrial community, masters and men. If the nation does not take advantage of the great discoveries of its scientists, other countries certainly will. Germany, for example, had grasped the importance of Perkin's discovery far more rapidly than we had, and there had been similar experiences in other spheres.

'We can no longer lie back and let others pass us by,' said Lord Salisbury. 'If this country is to maintain its standard of living it must take advantage of every new discovery, be first away in the field and—most important—keep the lead. This more than anything else is the lesson to be learned from the career of William Perkin.'

Another well-known personality who spoke at the dinner was Sir Cyril Hinshelwood, B.Sc., F.R.S., president of the Royal Society and of the centenary celebration. He drew attention to the fact that Perkin greatly enriched pure organic chemistry and, at the same time, played a major part in creating this country's chemical industry. In doing so he made a fortune and Victorian economy allowed him to keep it! He devoted it to pure science.

One of the great things he did, said Sir Cyril, was to solve many of the peculiar, subtle problems connected with transferring things from the small scale to operations on a large scale. He showed that pure and applied science went hand in hand. This was reflected in the excellent relations existing today between academic and industrial chemistry.

Referring to the 'unhappy story of Britain's loss of the dye industry,' Sir Cyril said the reason for this was that in the last century the country was misled by a rather misconceived set of educational values. Today, scientists received more sympathy and understanding, though there were quarters where things were not perhaps as they should be. Everything possible should be done to disarm the suspicions that remained.

Science was an adventure, a theme which clearly showed in the Perkin saga. If everything could be regarded as an adventure, people would not go far wrong because what ever happened they would have fun out of it. There was no doubt that the Perkin family had had fun out of all they did.

Among the many foreign guests at the dinner was Professor Burckhardt Helferich, president of the German Chemical Society. He drew attention to the fact that Perkin's discovery was an unexpected result. The danger today was that unexpected results might be overlooked. The system of organic chemistry was so well built up, supported more and more by physical laws, that it was rather difficult to find the unexpected. Students should be trained to look not only for the expected results, but for the unexpected ones.

Notes & Comments

Fuel Efficiency

ACCORDING to information published by the National Industrial Fuel Efficiency Service, a maximum of 51.5 per cent of the fuel used in some chemical works can be saved. Even more startling is a further claim that the industry as a whole can save 15 per cent. Translated into £ s. d. these percentages must certainly mean something in an industry which prides itself on efficiency in costing and production. The Fuel Efficiency Service figures have been compiled following approximately 300 surveys throughout British industry. It may well be that such sampling does not give chemicals a fully representative showing in the list. Nevertheless, the conclusions cannot be disregarded. As the Service has pointed out, there is every reason why the performance of a plant should be improved before fuel consumption and costs are at their maximum.

Brains or Brawn

IT is not surprising that this year's Mechanical Handling Exhibition at Earls Court should be devoted to automation and methods closely connected with automatic processes in industry. Automation—a grossly overworked term these days—is by no means new to the chemical industry, but a study by chemical engineers of latest developments in the field, such as have been displayed at Earls Court, must have served a useful purpose. Perhaps the most surprising thing is that managements in so many industries have not yet appreciated that speedy and economical handling of goods is vital to efficiency; there is still too much of the 'pick-and-shovel' mentality in boardrooms and on the factory floor. The sooner managements and labour realise the value of handling machinery, properly used, the better it will be for shareholders and wage earners alike. There is no particular merit in brawn when brains, and power from a motor of one kind or another, are available to take the 'humping' out of industrial processes.

Fibre News

AS a result of several months of price changes and production cuts in the US synthetic fibre industry, price reductions from 10 to more than 20 per cent have been announced for nylon filament yarns by the main producers. Dacron filament yarn prices were similarly reduced. Staple prices for both these synthetics had been cut some months before. Although this will undoubtedly reduce US internal prices for nylon and Dacron fabrics, it may not mean lower retail prices for garments, for the falls in costs of material are likely to be fully offset by rises in costs of clothes manufacture. Therefore, the tendency for demand to fall may not be removed, and further competition between producers could lead to more price cuts. From a long-term—and possibly somewhat coldly academic—viewpoint, these trends confirm the optimistic thesis for the future of synthetic fibres, that although in introduction they are usually expensive, their prices will steadily fall until they enjoy wider and wider markets of use. The process may be temporarily painful to manufacturers, but it is natural economic evolution. When total production is high enough, or higher than existing market demand even periodically, then prices must fall until some new point in the supply/demand equilibrium is reached.

Abstract News

A BRIEF report from the 129th meeting of the American Chemical Society at Dallas has given some news of the reaction of subscribers to the new 'service' terms for *Chemical Abstracts*, which came into effect last January. The $350 subscriptions are 'coming in more slowly than expected.' We can only comment that in all probability such expectations were far too great. On the other hand, personal use and educational subscriptions are better than expected, and comfort was obviously sought in this by the twofold statement that although this classification of purchase will not determine

financial success, it shows that *CA* 'will be more widely used.' However, any suggestion of the new plan's failure is blandly denied by saying that even if the high $350 subscriptions do not reach the predicted total, the position will be better than before when corporation members underwrote the deficit on *CA* production costs. All this sounds either defensive or complacent. To us the indications between the lines are that the new system of charges is already taking the shape of failure, if not yet describable as a failure.

A Good Chance

SUBSCRIPTIONS to other ACS publications were said to be 'in better shape', with most of them 'ahead of budget'. As a result of this, the overall publication programme of the ACS was estimated to have a good chance of breaking even by the end of 1956. If less exorbitant rates for corporate subscriptions to the abstracts service had been fixed, perhaps this chance would not merely have been good, but certain, or have become a chance that a margin of profit could be secured.

Anti-Corrosion

COMBINING the coating and cathodic approaches to corrosion prevention is the subject of an interesting article in *Chemical and Engineering News* (1956, **34,** 1922). It is pointed out that the protection given by organic coatings is mainly derived from their high electronic resistance and not from their prevention of moisture or oxygen penetration. However, when such coatings are broken by a severe scratch or ruptured blister, the uncovered area of metal surface immediately becomes an anode point, and all the rest of the coated surface becomes a cathode. This leads to high current density at the anode, and in turn to severe localized corrosion. Cathodic current protection to offset this type of risk is not as effective in practice as it would seem in theory. Currents of sufficient strength will often cause general deterioration of the coating or severe blistering, the latter being due to the accumulation of hydroxyl ions as hydrogen is discharged at the coating's cathode surface. *p*H values as high as 10 or 11 have been measured within coating blisters, and alkalinity of this degree is enough to destroy the bond between coating and metal surface.

Seat of the Trouble

THE seat of the trouble is the cathodic interface; if this could be shifted to the film surface, alkalinity developed there would be quickly washed away and be less likely to damage either the coating or the bond between the film and the metal. To do this, the coating must be made part of the electronic circuit; in short, it must be electrically conducting. To put this plausible argument into practice, the heavy addition of zinc dust as a pigment is recommended. Over 80 per cent of zinc dust by weight is required before resistivity is sufficiently reduced; at less than this extent of addition it seems that the zinc particles are sufficiently separated from one another for the coating to remain highly non-conductive. Extensive testing both in the laboratory and at corrosion-liable sites will be required before the value of this idea can be properly assessed. Nevertheless, it is considered hopeful that organic coating paints, heavily enriched with zinc, will, conjointly with cathodic current protection, provide a new standard of resistance to immersion types of corrosion.

First Petrochemical Unit

AUSTRALIA's first petrochemical unit is now being built at Geelong, Victoria. The project, which will cost £A2,000,000 is a joint venture of the United Carbon Co., of the US, and Shell Petroleum Co. Ltd. The unit will be adjacent to Shell's refinery at Geelong and, when completed, will produce 16,000 tons of carbon black a year from special petroleum fractions. The Geelong refinery, which has a throughput capacity of about 2,000,000 tons a year, is connected with Melbourne by a 36-mile long pipeline. The manufacture of carbon black will save Australia about £2,000,000 of foreign exchange yearly, besides making the country independent of overseas supplies of an important range of strategic industrial chemicals.

Science on Show

34 Exhibits at Royal Society Conversazione

A DEMONSTRATION of the 'ceiling temperature' effect in addition polymerization reactions was given on 10 May at a press preview of the conversazione held by The Royal Society at Burlington House, London W1. Professor Dainton and Dr. Ivin of the University of Leeds showed the effect of temperature on the reaction between sulphur dioxide and *iso*butene to produce a polysulphone.

On irradiating the reactant mixture with ultra-violet light at 0°C the polysulphone is rapidly formed as a white precipitate, but at room temperature there is no reaction, showing that the ceiling temperature lies somewhere between 0°C and room temperature. The actual temperature is found to be 4°C.

A ceiling temperature exists only when the growth reaction is exothermic. If heat is absorbed a floor temperature will exist. An example of this effect is sulphur, the monomer of which (mainly S_8) will not polymerize below 159°C.

Evolution in Process

Although the conversazione consisted of 34 stands illustrating many aspects of university and industrial research. There was also a film, 'Evolution in Process' made by Dr. H. B. D. Kettlewell of the department of zoology, University of Oxford, which showed how about 70 species of moths in this country are changing their colouring to allow for changes in the colour of tree bark caused by atmospheric pollution.

The Associated Electrical Industries exhibit demonstrated the use of semiconductors in such applications as deaf-aids, electronic computors and guided missiles. Most elements and compounds if absolutely pure would not conduct electricity. Replacement of a small fraction of the original atoms by suitable impurity atoms causes an excess or deficiency of electrons; flow of these extra electrons or deficiencies ('holes') enables the material to conduct electricity. Excess of electrons produces an n-type semiconductor, holes produce a p-type semiconductor.

Germanium and silicon are the most widely employed semiconductors. Crystals of these materials can be produced with only enough impurity (one part in 10 million) to make them semiconducting.

Models illustrating the arrangement of atoms in the vitamin B_{12} molecule were on show. Vitamin B_{12} was first isolated in the Merck Laboratories, US, and in Glaxo Laboratories in this country, in 1948, and was shown to have an empirical formula approximating to that now adopted, $C_{63}H_{88}N_{14}O_{14}PCo$. The probable chemical structure of the vitamin has been determined by a combination of traditional chemical methods and X-ray crystallographic analysis, in investigations over the last eight years by workers in this country and in America.

The vitamin molecule may be considered as divided roughly into two parts. Most of the structure of the first part was determined by chemical degradation and synthesis. The structure of the second part is largely based on X-ray analysis, through calculations of the electron density in four different crystals.

The atomic positions now deduced for vitamin B_{12} show that the molecule has a beautifully compact form, composed around the central cobalt atom, with all the chemically more reactive groups on its surface. The largest part of the computing necessary was carried out on the automatic computor SWAC in Los Angeles. The rest was done at Oxford, at the National Physical Laboratory and at Manchester.

International Nickel Co. of Canada

The interim report of The International Nickel Co. of Canada Ltd., and subsidiaries for the three months ended 31 March 1956, issued by Mr. John F. Thompson, chairman of the board, and Mr. Henry S. Wingate, president, shows net earnings in terms of US currency of $26,614,000 after all charges, depreciation, depletion, taxes etc., equivalent, after preferred dividends, to $1.79 per share on the common stock. These earnings were the highest for any quarter in the company's history. In the three months ended 31 December 1955, net earnings were $23,915,000, equal to $1.61 a share on the common, and in the first quarter of 1955 net earnings were $20,678,000, or $1.38 a common share. The high price realized for copper was the principal factor contributing to the increase in earnings.

Fluorocarbons

Isceon Range Produced by ISC

THE Imperial Smelting Corporation has broken into the field of organic fluorine compounds with the production of Isceons, a range of refrigerants, aerosol propellents, fire extinguishing agents, solvents and chemical intermediates.

These materials are being manufactured by a new, continuous, vapour phase fluorination process. Imperial Smelting has also developed new analytical techniques, including methods based on vapour phase partition chromatography, to maintain the purity of the product.

Isceon chlorofluoro compounds are denoted by three numbers indicating respectively the number of carbon, chlorine and fluorine atoms in the molecule. Thus Isceon 122 is CCl_2F_2 and Isceon 224 is $CClF_2CClF_2$. Isceons 122, 131 and 122/131 are now in commercial production, and development quantities of the other Isceons are available. Plant is being erected at Imperial Smelting's Avonmouth works and it is hoped that full production will begin early next year.

Imperial Smelting's interest in fluorine chemistry started at the beginning of World War II when it was asked to make aluminium fluoride, an intermediate in the manufacture of aluminium metal. After the war the company undertook the production of anhydrous hydrofluoric acid (AHF) needed for atomic energy purposes. Further development led to the production of elemental fluorine, and inorganic fluorine compounds such as boron trifluoride and fluosulphonic acid, each one new as an industrial chemical in this country. Finally the field of organic fluorine compounds has been entered with the production of Isceons, products for which AHF is an essential raw material.

The company believes that while the United Kingdom is one of the principal markets for this type of material, there is also a relatively large export market available and this will be entered when the large scale unit is in full production.

A Liverpool firm, F. E. Callow (Engineers) Ltd., have completed arrangements for sole representation in the UK of Libra automatic mixing-by-weight machines made by the West German company, Libra Pelz & Nagel KG.

Pollution Survey Needed

FOR the first time in 37 years the North Eastern Sea Fisheries Committee, at its recent quarterly meeting in York, agreed to relax a by-law prohibiting the deposit or discharge of any solid or liquid substance detrimental to sea fish or sea fishing. Approval was given to an amendment, suggested by the Ministry of Agriculture, Fisheries & Food, which gives the committee power to say where, when and how much effluent can be discharged into the sea.

When the committee later discussed an application by a company for permission to discharge gypsum into the Humber, the clerk of the committee, Mr. T. Stephenson said it was difficult to maintain a balance between industrial interests on the one hand and the interests of inshore fishermen on the other. When informed that the last pollution survey of the Humber was seven years ago, and that another was urgently needed, the committee decided to tell the Ministry that it was opposed to any increase in the discharge of effluent into the river.

Straight Through Valve

A STRAIGHT through diaphragm valve for the control of acids, alkalis, oils, slurries, viscous substances, abrasive suspensions, food products, beverages, gases and most 'hard to handle fluids' is made by Wynn (Valves) Ltd. of Birmingham. This firm is a wholly owned subsidiary of Charles Winn & Co. Ltd., manufacturers of valves for 97 years.

Straight through flow ensures that the valves are self-draining, easy to clean out and offer minimum resistance to the passage of fluids. The diaphragm is in its normal, moulded shape when the valve is closed, so that efficient closure is not affected by diaphragm distortion. The body of the valve can easily be lined with resistant materials.

Various materials can be used for the diaphragm, including natural rubber, Neoprene, butyl, Hycar and pvc. Development work on other materials is being carried out. Available body materials include: cast iron, stainless steel, bronze, regulus metal and aluminium, while body linings are produced in lead, hard and soft rubber, nylon, Neoprene, polythene, other plastics and glass.

Richard Klinger's Expansion

Minister of Supply Opens New Wing at Sidcup

Klingerit works at Sidcup. The new wing is on the right

A NEW wing at the Sidcup, Kent, works of Richard Klinger Ltd. was inaugurated by the Minister of Supply, Mr. R. Maudling, on 8 May. Completed in about 18 months, the extension will relieve pressure on existing factory space and enable the company to increase its output of level gauges.

The company has increased its sales to dollar areas by nearly 200 per cent in the last five years and nearly quadrupled its yearly turnover since the war. Last year it produced and sold £6,692 worth of PTFE, £11,000 worth of silicone rubber, £12,000 worth of Klinger-Lastic (its own brand of synthetic rubber), £70,000 worth of level gauges, and £358,000 worth of cut jointings and gaskets. Compressed asbestos jointing has always been the firm's principal product and the output of this material in 1955 was over four times the annual tonnage for which the factory was designed.

Joints & Gaskets

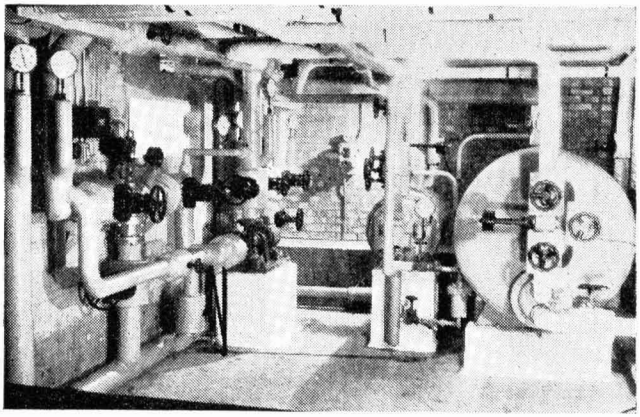
One of the main factors contributory to Klinger's expansion has been the fast-growing manufacture of Diesel engines. These require the cut joints and gaskets in which the firm specialize, and the ground floor of the new wing is being devoted to the new machine shop where all the cutting tools are made. The basement becomes the store and assembly shop for level gauges, and the upper floor houses all the production offices, including the drawing office, laboratory, and works management offices. The former offices are thus released for sales activities.

An interesting aspect of the new wing is the heating system which uses waste heat from the Diesel engines providing power for the company's electrical generators. The running cost for provision of heating and hot water is said to be only a small charge for pumping.

Cooling Water

The maximum temperature of the Diesel engine cooling water is only 140-150°F and is thus unsuitable for direct use in a radiator heating system because of the extra surface required. Cooling water at these temperatures does, however, lend itself to use with embedded floor panel heating, provided a reasonably high standard of thermal insulation is incorporated in the building structure.

In the new building block floor panel heating is only possible in the offices on the first floor, as in the machine shops floor



Heating system control room with circulating pump, motorized control valves and calorifiers

panels cannot be used because of the construction required for the machine bases and the possibility of later alterations in the layout of the shop. A radiator heating system has therefore been used in these areas. On the first floor a sinuous coil of pipe is laid horizontally on an insulating strip on the main concrete floor slab, which is covered with $\frac{1}{4}$ in. thick cork tiles. These cork tiles distribute the heat evenly over the surface of the floor.

The warm water from the Diesel engine cooling circuit is pumped through a mixing and pumping station first to the radiator circuits and the machine shops, toilets, passages etc., where its temperature is reduced in providing heat for these areas. Part of the return water from the radiator circuits is then pumped through the heating coils in the floor slab of the first floor offices. By means of a mixing arrangement, the majority of the water in these circuits is re-circulated, hot water to keep up the temperature being bled in as necessary. The return water from this circuit mixes with the rest from the radiator system and returns to the Diesel cooling water tank. An additional circuit prior to the mixing station feeds an indirect storage cylinder for the domestic hot water system. As there is always more heat available than this system can utilize, the existing evaporative spray type cooler has still to be kept working, but its load has been considerably reduced, and there is a saving of water from loss by evaporation.

Sulzer Bros. (London) Ltd., who designed and installed this plant, estimates that the additional capital cost of this system, as opposed to that of a conventional low pressure hot water radiator heating system with a steam heated calorifier, would be repaid by the savings in the cost of providing steam in about three years.

Richard Klinger Ltd. claims to make the largest PTFE sheet in this country. The company made PTFE runners for the sleighs on the Trans-Antarctic Expedition ' to reduce drag and to relieve the strain on the team of Huskies '.

Section of the machine shop in the new wing at Klingerit works

US Plant Expansion

A PROGRAMME to double electrolytic production of chlorine and caustic soda at the McIntosh, Alabama, plant of Olin Mathieson Chemical Corporation has been announced.

The expansion, which will cost $7,500,000, will increase the plant's capacity to 250 tons of chlorine and 280 tons of caustic soda per day. Construction is expected to be finished early next year. The new addition will be equipped with 124 Mathieson stationary-type mercury electrolytic cells.

Barge docking and loading facilities on the Tombigbee river adjacent to the McIntosh plant are also being built. These will be in operation this year and will permit shipments by water from the plant to river destinations, the Gulf of Mexico and beyond.

The McIntosh operation is one of three major Olin Mathieson plants producing electrolytic chlorine and caustic soda. The other two are at Saltville, Virginia, and Niagara Falls, New York. Caustic soda by the lime-soda process is also manufactured at Saltville and at Lake Charles, Louisiana. The company additionally markets chlorine and caustic soda produced at the Huntsville, Alabama, plant of National Distillers Products Corporation; caustic soda produced at the Anniston, Alabama, plant of Monsanto Chemical Company; and chlorine produced at the Arvida, Quebec, plant of Aluminium Ltd.

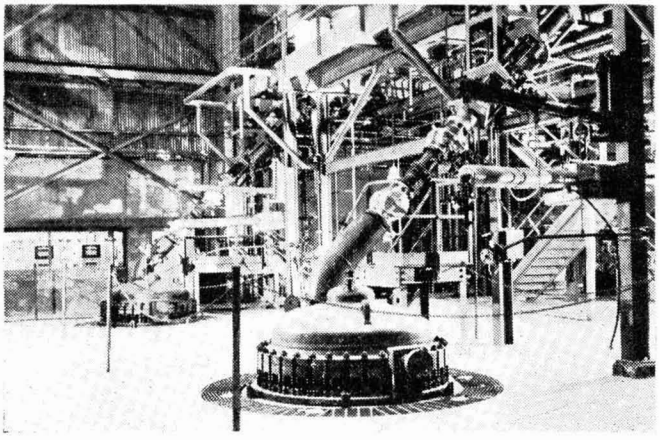
Mr. John O. Logan, vice-president and general manager, says, 'Trends in national production of chlorine and caustic soda have been steadily upward since 1939. From World War II highs of 1,300,000 tons of chlorine and 1,900,000 tons of caustic, annual production of the two chemicals increased to 3,300,000 and 3,900,000 tons respectively in 1955. Present conservative estimates are that output will climb to 4,800,000 tons of chlorine and 5,000,000 tons of caustic soda by 1965'.

Titanium Sponge Plant

THE first plant in the US for producing titanium metal sponge commercially by a method other than the magnesium-reduction process was put into operation recently at Ashtabula, Ohio, by the Electro Metallurgical Corp., a division of Union Carbide & Carbon Corp. The plant, which has a capacity of 7,500 tons of titanium metal sponge a year, employs a process in which sodium is used to reduce titanium tetrachloride.

This process has been in operation on a pilot and prototype plant scale at Electromet's metals research and development laboratories at Niagara Falls, New York, and is the result of six years of research at a cost of over $2,000,000.

Electromet has conducted research on various methods for the production of titanium for 15 years, and has been producing alloys of titanium for more than 20 years. In 1948 the output of titanium sponge in the US was three tons; by 1955 it had risen to 7,200 tons. This year it is estimated that 13,000 tons will be produced.



Part of the equipment for producing titanium sponge by a new process developed by the Electro Metallurgical Co. in operation at the newly-opened Electromet plant at Ashtabula, Ohio

Petrochemical Project

Japanese Plant Being Designed by SD

JAPAN's first major petrochemical project, a $30 million facility for the production of chemical intermediates for the manufacture of synthetic textile fibres and other important chemical products, will be built by Mitsui Petrochemical Industries Ltd. it was announced recently. The project will be financed entirely by Japanese capital.

Contracts have been signed with Scientific Design Co. Inc. (SD) New York, for the designing and engineering of plant units within the project for the manufacture of ethylene oxide, ethylene glycol and cumene, three of the key products planned by Mitsui in the initial phase of the programme. In the second phase of the project Mitsui will add facilities for the production of dimethyl terephthalate.

As outlined by SD, the processes to be employed are as follows: ethylene oxide by direct air oxidation of ethylene; cumene by alkylation of benzene with propylene; ethylene glycol by hydration of ethylene oxide.

An important share of the project's output will go to the Toyo Rayon Co. who will use the chemicals to manufacture synthetic textile fibres of the polyamide and polyester types.

The project will be located in Iwakuni City, Japan, and the scheduled completion date is November 1957.

Purchase Tax Notice

LACQUERS, varnishes, lacquer and varnish removers, and metallic powders and similar preparations for hairdressing or toilet use which have been charged with purchase tax only when identifiable by their composition or trade description as designed for hairdressing or toilet use, will in future come under the Tax Schedule.

The Commissioners of Customs, after consultation with the Toilet Preparations Federation Ltd. decided that a 90 per cent charge under groups 30(a) and 32(b) (1) of the Tax Schedule will apply to preparations of these kinds which are put up for retail sale without any specific indication of their use in polythene spray bottle, aerosols or other containers commonly used for hairdressing or toilet preparations.

These are to include glass bottles or tubes styled or labelled in a manner similar to containers of cosmetics; unless the capacity of the containers exceeds 16 fluid ounces, or the channels of distribution of the product establish that it is not marketed for hairdressing or toilet preparations.

Mataripe Expansion Contract

THE M. W. Kellogg Co. has been awarded a contract by the Brazilian firm, Petroleo Brasiliero SA (Petrobras), to participate in a major expansion of the Mataripe refining facilities in the state of Bahia. In 1950, Kellogg installed a 2,500 BPD thermal combination refinery at Mataripe, and a duplicate refinery in 1952/53.

Current plans are for increasing the capacity of these facilities from the present 5,000 barrels-per-day to 37,000 barrels-per-day. The expansion of the Mataripe facilities will include the conversion of existing thermal cracking units to other operations integrated to the plant, as well as new processing units for the production of gasoline, Diesel oil, LPG, lube oils, and waxes. Part of the off-site construction will be a marine terminal for the transport of petroleum and petroleum products.

Designed to handle all types of native Brazilian crude, including Candeis, Itaparica, Don Joao, Mata and Catu, the new expansion will result in the largest refinery installation ever constructed in South America as a single project. It will incorporate one of the world's largest wax plants, rated at 60 tons per day, and the nation's first lube oil plant with a 3,000 BPD capacity. The production of the refinery's lube oil plant is expected to answer Brazil's consumption of this oil for the next five years.

American Scientist's Visit

Visiting Europe is Dr. Waldo L. Semon, director of polymer research at the B. F. Goodrich Co.'s research centre, Brecksville, Ohio. Accompanied by Mrs. Semon he flew into London on May 15 from Switzerland. The inventor of Koroseal (Goodrich's series of pvc resins and elastomers) Dr. Semon expects to stay in Britain for about 12 days. He will meet old friends at several rubber plants in the Midlands and tour North Wales.

A Review of Organic Phosphorus Insecticides

VI Parts—Part II : Colorimetric Methods of Analysis

by **R. G. BARRADAS, B.Sc., A.R.I.C., A.R.T.C., M.R.S.H.**
(Government Laboratory, Hong Kong)

DIETHYL *p*-nitrophenyl thiophosphate (*parathion, E 605*) has been shown to be one of the most effective insecticides for the control of parasites in vegetable growing, viniculture, forestry, and in agriculture generally. Because of the high mammalian toxicity of this compound, analytical methods for determining parathion accurately are vitally important. Methods are necessary to control the concentration of parathion in the crude commercial product, and in solutions and dusts made therefrom. It is essential to have methods available for determining the concentration of parathion in the atmosphere during its manufacture and use. It is also very desirable to know the amount of parathion present in edible crops after harvesting, if they have been treated with this insecticide, for reasons of public health and for compliance with Government regulations with respect to the use of compounds such as this.

Parathion can be hydrolysed in alkaline solutions to *p*-nitrophenol and diethyl thiophosphate. At a *p*H of approximately 8-9, *p*-nitrophenol assumes a very strong characteristic yellow colour, which has been made the basis of what is perhaps the simplest colorimetric method for the detection of parathion. Schwerd and Schmidt (**1**) made use of this simple and rapid reaction for the detection of parathion in blood.

Method of Detection

The method is as follows:—3 to 5 mls. of blood is deproteinized with an equal volume of 20 per cent trichloroacetic acid, and 4 to 3 drops of a 33 per cent solution of sodium hydroxide are added to the protein-free filtrate. A yellow colour which becomes more intense on boiling indicates the presence of more than 1 mg. of parathion per 100 mls. of blood.

Jachimowicz (**2**) made use of the same principle for the detection of parathion in poisoned bees. He prepared an acetone extract of bees suspected of having died by poisoning with parathion and evaporated it to a small volume. This was hydrolysed by the addition of 10 drops of an alcoholic solution of potassium hydroxide. The mixture was then allowed to dry off on a water-bath and perhydrol was added until no more solid or oily yellow brown particles could be seen, leaving a white or uniformly yellow dry residue. The residue was then extracted with 2 mls. of ether saturated with hydrogen chloride. A strip of filter paper was inserted into the ether extract and the solution allowed to rise by capillary action. The *p*-nitrophenol produced by the alkaline hydrolysis of parathion became concentrated in a narrow zone, which turned yellow when exposed to ammonia vapours. By this method 10 micrograms of parathion could be detected.

Parathion Residues

Buckley and Colthurst (**3**) determined the parathion residues in tomatoes by washing them off the surface of the fruit with alcohol. The plant pigments were oxidized with hydrogen peroxide, and the parathion was hydrolysed to *p*-nitrophenol, which was then determined colorimetrically. Residues on the whole fruit were extracted with hexane and the procedure repeated.

Ivanova (**4**) reported a method for determining an aqueous solution (20 ppm) of parathion at 20°C. Alkaline hydrolysis was again used and the resulting sodium *p*-nitrophenate was determined. Ivanova claimed that the absorption maxima at 430 mμ followed the Bouguer-Beer Law, and that it could be used analytically in conjunction with a calibration curve.

The colour was not very stable, but after a 20-30 minute period it gave quite useful readings. Heating increased the intensity of the colour but caused deviations from the Bouguer-Beer Law. The solutions were examined spectrophotometrically. The

Part I of this review was published in THE CHEMICAL AGE *of 21 April 1956*

standards were prepared from 1 per cent potassium ferricyanide solutions which had been compared with known specimens for establishing the calibration curve.

Mel'nikov (5) pointed out in a later paper the errors inherent in Ivanova's method. He reported that the hydrolysis by sodium hydroxide at 25°C had the rate constant 0.047, so that the hydrolysis at 20°C would require several days and not the 20 minutes suggested by Ivanova. Another serious error which invalidated this method as a means of accurate quantitative determination was that most commercial preparations of parathion contained a certain amount of free *p*-nitrophenol as an impurity.

An Elegant Method

Westenberg (6) described a very elegant method for the removal of free *p*-nitrophenol in emulsifiable parathion preparations, with the use of a strongly basic ion exchange column. A quantity of the preparation equivalent to 40 mg. of parathion was homogenized or dissolved in 96 per cent ethyl alcohol and diluted to 50 mls. To an aliquot of 12 ml., 100 ml. of water and 58 ml. of 96 per cent ethyl alcohol were added, and diluted to 200 ml. with water. The solution, in 35 per cent v/v ethyl alcohol was passed through an ion exchange column containing Deacidite-F or Amberlite IR-4B in the hydroxide form.

The first 170 ml. fraction was rejected and the next 25 ml. fraction was collected. Sodium hydroxide (0.5 g.) was added to the latter fraction, which was allowed to stand for 24 hours, and the absorbency of the solution was measured using a 4 or 5 mm. cell with a blue filter (Jena BG12). The results of the analysis were strictly dependent on the dimensions of the column and the speed of passage of the solution. Trial experiments with pure (non-emulsifying) parathion solutions were recommended to test the general efficiency of the method.

It follows from Westenberg's paper that there is an urgent need for a simple procedure for obtaining pure parathion for use as a primary standard. The hitherto accepted criterion for evaluating the purity of parathion had, as its basis, an elemental nitrogen analysis as reported by Averell and Norris (7).

Edwards and Hall (8) evolved a relatively simple procedure for purifying technical parathion by washing it by decantation with petroleum ether, then dissolving the residue in ether, extracting further impurities with sodium carbonate, evaporating the previously dried (with anhydrous sodium sulphate) ether on the steam-bath and removing the last traces of ether in a current of dried nitrogen. The yellow oily residue was crystallized at a low temperature, and recrystallized slowly from ether at a temperature of −15°C. The resultant white needles were washed with a pre-cooled mixture of petroleum ether and ether, and recrystallized a second time from ether using the above technique. The parathion thus obtained was a very pale odourless yellow liquid crystallizing into long, almost colourless needles, mp 6°C.

Despite the many refinements and improvements to the method of matching the colour of the alkaline *p*-nitrophenol, few authors have reported consistently good results. Such a method is not sufficiently sensitive for the determination of trace amounts of parathion to be found, for example, in the atmosphere and in plant tissues. Parathion can also be identified colorimetrically by the intense green blue colour (changing to ultramarine blue) it gives with a layer of concentrated sulphuric acid, even in dilutons of 1 : 1,000. This test was used by Völksen (9) for the detection of parathion in viscera and other toxicological specimens.

This test was not entirely specific and Völksen recommended the confirmation of parathion by hydrolysis of the gastric contents with aqueous sodium hydroxide solution and the identification of the *p*-nitrophenol formed, and by tests *in vivo* of the dried ether extract of the gastric contents. The biological methods of the type employed by Völksen will be described in a subsequent part of this review.

Not Sufficiently Sensitive

The above mentioned colorimetric methods are not sufficiently sensitive for the accurate quantitative determination of trace amounts of parathion. The best colorimetric methods are based on the reduction of parathion, diazotization of the amine produced and coupling with some suitable reagent.

One of the earlier reliable sensitive methods of determining the residual trace amounts of parathion was that of Averell and Norris (7). They experimented on a variety of plant materials, by extracting the plant tissues with benzene, which was then

evaporated to dryness after treatment with an adsorbent to remove plant pigments. Aqueous alcohol was used to dissolve the residue, and the nitro group was reduced to an amino group with zinc dust and hydrochloric acid. The amine was diazotized and coupled with N-(1-naphthylethylenediamine). The coloration of the azo dyestuff formed was matched with standard samples of pure parathion treated in the same manner. The authors recommended the removal of excess of nitrite with ammonium sulphamate. Blinn and Gunther (**10**) adopted the method of Averell and Norris for the determination of parathion in citrus fruit and grapes. Methyl anthranilate occurs in these fruits and when diazotized and coupled with N-(1-naphthylethylenediamine), the resultant product had absorption characteristics equivalent to parathion treated similarly. The methyl anthranilate was removed by washing the benzene strip solution with dilute hydrochloric acid. Blinn and Gunther (**11**) in another paper described a micro procedure based on the Averell and Norris method, for the microdetection of parathion in orange and lemon oils. They were able to determine the insecticide in amounts of the order of one microgram per drop of orange or lemon oil. This represented approximately 0.5 ppm of parathion in the fresh peel of the fruit.

Magenta Colour

The development of the characteristic magenta colour of the azo dye does not prove the specific presence of parathion because many other nitro compounds and amines respond similarly. Paulus, Mallach, and Janitzki (**12**) studied and modified the Averell and Norris method. They reported that 29 to 260 micrograms of parathion could be determined photometrically with an accuracy of ±18 micrograms. The method for the determination of parathion in blood was improved by correcting for the effect of interfering materials by omitting the reduction step.

In toxicological analysis the presence of haemoglobin decomposition products in stomach contents affects the determination of parathion by the azo-dyestuff method. Kaiser and Haag (**13**) suggested the removal of blood pigment, which is liable to mask the parathion dyestuff in alcoholic extracts, by extraction of the parathion with benzene in which the blood pigment is insoluble.

This technique of eliminating the interference of blood pigment in azo-formation colorimetric determinations is not new, for Francis and Spink (**14**) in 1950 recommended the benzene extraction in the determination of diaminodiphenyl sulphone (DDS) in blood. The DDS, free from blood pigment, was then diazotized and coupled with N-(sulphatoethyl)-*m*-toluidine.

In his paper on the analysis of parathion, J. C. Gage (**15**) described a method in which the compound in toluene solution was reduced to the corresponding amino compound, which was extracted into acid, diazotized, and coupled with N-(sulphatoethyl)-*m*-toluidine. This method was specific only for compounds that could be reduced to an amino compound capable of forming an azo dye.

Interfering Amines

Interfering amines were eliminated at the stage where the toluene extract was washed with acid. *p*-Nitrophenol did not interfere in the analysis, but *bis*-p-nitrophenyl-ethylthiophosphate (normally present in crude commercial parathion preparations) gave a colour. Another contaminant which interferred was the S-ethyl isomer of parathion.

In a more recent paper Gage (**16**) described a method for the analysis of a mixture of parathion, its S-ethyl isomer and *p*-nitrophenol. The mixture was reduced, and the resulting *p*-amino phenol and reduced S-ethyl isomer were successively coupled with *o*-cresol and determined colorimetrically as an indophenol dyestuff. The reduced parathion was extracted, diazotized, and coupled with N-(sulphatoethyl)-*m*-toluidine, and determined colorimetrically. In this modification to his original paper, Gage succeeded in making the analysis more selective.

Lawford and Harvey (**17**) adopted Gage's method to the determination of *p*-nitrophenol in urine and blood, which is a valuable diagnostic aid in assessing the degree of exposure to parathion. A mixture of ether, light petroleum and amyl alcohol was used to extract the *p*-nitrophenol. This solvent mixture removed more than 90 per cent of *p*-nitrophenol and none of the interfering substances. The *p*-nitrophenol was extracted by a solution of ammonia, the extract was reduced with zinc dust, and the resulting aminophenol was coupled with *o*-cresol with the development of the characteristic indophenol blue colour.

Zeumer and Fischer (**18**) recommended

coupling with α-naphthylamine instead of N-(sulphatoethyl)-*m*-toluidine or N-(1-naphthylethylenediamine). Three procedures were reported, one using an alkaline solution of α-naphthylamine and two other methods with but slight variations in quantities using a solution of α-naphthylamine in acetic acid.

0-(2-(ethylmercapto)ethyl)-0,0-diethyl thiophosphate (demeton, Systox), octamethyl pyrophosphoramide (OMPA, Schradan), *bis*-(dimethyl-amino)fluoro-phosphine oxide (Pestox 14, dimefox), and *bis*-(iso-propyl-amino)fluoro phosphine oxide (Isopestox, Pestox 15, mipafox) are four systemic organic phosphorus insecticides which have proved sufficiently promising for commercial production.

Colorimetric Analysis

A very successful and sensitive colorimetric method of analysis for Schradan was developed by Hall, Stohlman, and Schechter (**19**). It was evolved primarily for the determination of octamethyl pyrophosphoramide in the minute quantities present in plant materials as a result of spray or soil applications of the insecticide. Schradan was exhaustively extracted from the macerated plant materials by means of chloroform.

The process utilized hydrolysis of the insecticide with strong mineral acid to yield four moles of dimethylamine and two moles of phosphoric acid. The dimethylamine was then determined by forming the yellow cupric dimethyl dithiocarbamate complex which was measured colorimetrically (this coloured complex is formed by the reaction between dimethylamine and a copper reagent in an alkaline carbon disulphide and chloroform medium). This method was found to be sensitive to the determination of about 5 micrograms of octamethyl pyrophosphoramide.

It must be interpolated that since the method is based on the determination of dimethylamine, it will not distinguish between octamethyl pyrophosphoramide and chloroform-soluble metabolites containing the dimethylamino group.

David, Hartley, Heath, and Pound (**20**) also utilized the fact that Schradan was easily hydrolysed in an acid medium to dimethylamine and orthophosphate for the determination of the insecticide in plant residues. The orthophosphate ion resulting from the hydrolysis could be determined by the molybdenum blue colorimetric method proposed by Allen (**21**). Clough, Heath, and Otter (**22**) recognized the limitations of Hall's method in that certain plant species might contain appreciable quantities of dimethylamino compounds. Clough and her co-workers produced a method in which Schradan was efficiently separated from mixtures containing natural products.

The separation was performed by micro-distillation of plant residues at low pressures, after the residue had been extracted by chloroform from the bulk of the plant material, which had been previously hydrolysed at a controlled alkalinity. This ensured that the natural phosphorus compounds were hydrolysed in the alkaline solution to compounds insoluble in chloroform. The Schradan residue, after separation by the special micro-distillation technique, was determined by the well-known Berenblum and Chain (**23**) method. This procedure was also applicable to the determination of mipafox.

There has been only one colorimetric method, that advanced by Ritchie (**24**), for the determination of Demeton formulations. He modified the colorimetric method of McCarthy and Sullivan (**25**) for the determination of methionine. The method involved the addition of an aqueous sodium nitroprusside reagent to a sodium hydroxide and methyl alcohol solution of demeton, which was acidified with phosphoric acid and allowed to stand in an ice bath for five minutes, when a red colour developed. The intensity of this colour was matched in a spectrophotometer.

Dimefox or Mipafox

Generally, there are no specific methods reported for the determination of dimefox or mipafox, but these substances can be analysed by the methods available for Schradan, with some appropriate modifications. The methods described for the analysis of these systemic insecticides are tedious, time-consuming, and not very accurate. There is much research yet to be done on the development of specific methods which will eliminate these disadvantages.

Other insecticides which have been widely used in various fields are 0,0-dimethyl-0-3-chloro-4-nitrophenyl phosphate (Chlorothion) and *bis*(ethoxycarbonyl)-ethyl dimethyl thiophosphate (malathion). Kolbezen and Barkley (**26**) made minor modifications to the Averell and Norris method for determining parathion, and applied the modified

method for the determination of Chlorothion, especially for the analysis of Chlorothion residues in milk. Their results showed that concentrations of greater than one part per million in 500 ml. of milk could be determined spectrophotometrically, and that 0.02 to 0.1 parts per million could be determined by visual comparison in Nessler glasses.

A colorimetric method was developed by Norris, Vail, and Averell (27) for the determination of malathion residues on plant materials. The procedure involved the hydrolysis of the malathion (0.25 to 2.5 mg. of malathion in 100 ml. aliquots of carbon tetrachloride extracts of plant material) with sodium hydroxide in ethyl alcohol. The impurities and products of hydrolysis, other than sodium dimethyl thiophosphate, were removed by repeated extractions with carbon tetrachloride from the acidified hydrolysate. The sodium dimethyl thiophosphate was then treated with a mixture of carbon tetrachloride and an aqueous solution of copper sulphate, and the solution of the resultant yellow coloured complex was measured in a spectrophotometer at 418 mμ against pure carbon tetrachloride as a blank.

The condensation of chloral with a dialkyl hydrogen phosphite gives rise to a new series of organic phosphorus insecticides. Barthel, Giang, and Hall (28) produced a series of 0,0-dialkyl-2,2,2,-trichloro-1-hydroxy-ethylphosphonates (general formula $(RO)_2P(0)CHOHCCl_3$). The dimethyl ester has recently attracted attention as an effective insecticide against DDT-resistant house flies. The technical grade of the dimethyl ester was designated in America as Bayer L13/59.

Barthel, Giang and Hall (29) in a later paper suggested a method, based on the pyrolytic decomposition at 550°C in a micro furnace of the dialkyl-1-hydroxyphosphonates, for the determination of these compounds. The chloroform produced on pyrolysis of the insecticide was determined colorimetrically by a modification of the Fujiwara (30) pyridine-alkali test. The red colour developed by absorbing the chloroform in aqueous pyridine and warming with alkali, was measured in a colorimeter using a green filter (500 to 570 mμ). The method was sensitive to 20 micrograms of L 13/59.

REFERENCES

(1) Schwerd, W. & Schmidt, G., *Dent. med. Woshchr.*, 1952, 77, 372-3.
(2) Jachimowicz, T., *Osterr. Chem.-Ztg.*, 1954, 55, 190-1.
(3) Buckley, R., & Colthurst, J. P., *Analyst*, 1954, 79, 285-9.
(4) Ivanova, Z. V., *Gigiena i Sanit.*, 1953, No. 4, 29-34.
(5) Mel'nikov, N. N., *ibid.*, 1954, No. 6, 53.
(6) Westenberg, L., *Meded. Landb-Hoogesch., Wagoningen*, 1954, 19 (3), 554-557.
(7) Averell, P. R., & Norris, M. V., *Anal. Chem.*, 1948, 20, 753-6.
(8) Edwards, Fred. I., & Hall, S. A., *ibid.*, 1949, 21, 1567.
(9) Volksen, Wilhelm, *Deut. Apoth.-Ztg. Ver Süddent. Apoth.-Ztg.*, 1953, 93, 393-4.
(10) Blinn, R. C., & Gunther, F. A., *Anal. Chem.*, 1950, 22, 1219.
(11) *Idem., ibid.*, 1950, 22, 1450.
(12) Paulus, W., Mallach, H. J., & Janitzki, W., *Arzneimittel-Forsch.*, 1955, 5, (4), 241-244.
(13) Kaiser, K., & Haag, T., *Dtsch. Apoth.-Ztg.*, 1955, 95, (9), 211.
(14) Francis, J., & Spinks, A., *Br. J. Pharm. and Chemotherapy*, 1950, 565, 5.
(15) Gage, J. C., *Analyst*, 1950, 75, 189.
(16) *Idem, ibid.*, 1952, 77, 123.
(17) Lawford, D. J., & Harvey, D. G., *ibid.*, 1953, 78, 63.
(18) Zeumer, H., & Fischer, W., *Z. Anal. Chem.*, 1952, 135, 401-9.
(19) Hall, S. A., Stohlman, J. W., & Schechter, M. S., *Anal. Chem.*, 1951, 23, 1866.
(20) David, A., Hartley, G. S., Heath, D. F., & Pound, D. W., *J. Sci. Food Agr.*, 1951, 2, 310.
(21) Allen, R. J. L., *Biochem. J.*, 1940, 54, 858.
(22) Clough, J., Heath, D. F., & Otter, I. K. H., Fisons Pest Control Ltd., Chesterford Park Research Station, nr. Saffron Walden, Essex, England. (Private communication involving as yet unpublished material.)
(23) Berenblum, J., & Chain, E., *Biochem. J.*, 1938, 32, 295.
(24) Ritchie, G. D., 'A Colorimetric Method of Analysis of 0,0-diethyl-0-(beta-ethylmercapto) ethyl thiophosphate (Systox).' A Dissertation, Cornell University, USA, Feb. 1953.
(25) McCarthy, T. E., & Sullivan, M. X., *J. Biol. Chem.*, 1941, 141, 871.
(26) Kolbezen, M. J., & Barkley, J. H., *J. Agric. Food Chem.*, 1954, 2, (925), 1278-1280.
(27) Norris, M. V., Vail, W. A., Averell, P. R., *ibid.*, 1954, 2 (11), 570-573.
(28) Barthel, W. F., Giang, P. A., & Hall, S. A., *J. Amer. Chem. Soc.*, 1954, 76, 4186.
(29) Giang, P. A., Barthel, N. F., & Hall, S. A., *J. Agric. & Food Chem.*, 1954, 2, 25, 1281.
(30) Fujiwara, K., *Sitzber naturforsch. Ges. Rostock*, 1916, 6, 33.

Detergent Profits Drop

THERE is a deterrent to detergent profits, according to the report of Thomas Hedley & Co. for the year ended 30 June 1955. This reveals a drop in profits from £2,203,000 in the previous year to £514,000. As the manufacturers of soaps and detergents bombard newspaper, magazine, and TV viewers in an intense campaign to win the housewife's custom for their product, fierce competition is created, and must be expected.

Although Hedley's turnover volume was similar to that of the previous year the fall in profits rose mainly as a result of keener selling prices, increased general selling and manufacturing costs, and the maintenance of marketing expenditure at the high levels established in recent years.

Chrome Chemicals Plant

Plans May be Reconsidered

PLANS by the firm for a new plant to produce chromium chemicals may have to be reconsidered because of the 'credit squeeze', warns Mr. E. F. Wright, chairman of British Chrome and Chemicals (Holdings) Ltd., in his report to be presented at the annual meeting on 31 May.

'These plans must clearly be reviewed in the light of the present restrictions on credit and the issue of new capital, and your board have the matter under close examination,' he states.

No location for the plant has been decided.

The question of prices for the company's products is constantly in mind, says Mr. Wright. 'We realise full well the desirability of keeping prices down but, to put it mildly, we are not helped in doing so by increases in costs due to rises in the price of coal and transport, the recent increase in wages, and the effect of all these increases on the cost of our raw materials'.

'We are doing our best to absorb these increases, but there is obviously a limit to what we can do in this direction'.

'Meantime, demand for all our products, including fertilizers, remains high, but this is a year in which it is even more difficult than usual to prophesy, and I would prefer to make no estimate of what demand is likely to be over the rest of the year'.

'I believe, however, that taking a long view, the Government's policy is right, and that a slight recession in trade for the next six months may well prove the foundation for greater and sounder prosperity in the future'.

Referring to the decrease in the company's profits to £234,283, compared with £241,243 in 1954, Mr. Wright says the decrease is more than accounted for by the explosion at the Glasgow works in March, 1955.

Will

MR. GILBERT ROWAT-SMITH, Ph.C., M.P.S., of 19 Broadlands Road, London N6, a retired manufacturing chemist, formerly a director of L. Manetti Roberts & Co., who died on 16 February aged 85 years, left estate valued at £51,631 gross, £50,815 net. (Duty paid £18,884.)

Plastics Record Year

THE *Board of Trade Journal* for May reports that 1955 was a record year for the plastics materials industry; output reaching 324,000 tons, 16 per cent higher than in 1954. The growth of the industry can be best judged by the output in 1950 which was less than half of the 1955 output. The leading part in this rapid expansion continued to be taken by the newer thermoplastics group whose output increased by 21 per cent over 1954.

With the exception of polystyrene, the output of which fell just below the 1954 figure, all the thermoplastics materials for which separate figures are collected showed increases in 1955, with polythene and the vinyl chlorides, which make over half of the thermoplastics group, increasing by more than 20 per cent. The exports of plastics materials during the year rose to nearly 85,000 tons, compared with 73,000 tons in 1954.

Argentine Contract for UK

WHESSOE LTD., of Darlington, has received an order from the Argentine State Gas Department for two WW-D electro-detarrers for Buenos Aires. The order was gained in competition with German, French, US and UK firms.

The detarrers, which are 9 ft. in diameter, are complete with two high tension transformer-rectifier sets, each of 180mA. at 33kV. The complete plant has a capacity of 30,000 cubic metres per hour of water gas measured at STP and treated at approximately 40°C. The plant has to conform with a rigid specification drawn up by the Buenos Aires Gas Department and will be subject to a stringent guarantee test.

This order follows a previous contract from the Buenos Aires Gas Department in 1948 for two WW-D electro-detarrers for the treatment of 13,000,000 cubic feet per day of water gas.

£25,000,000 Oil Refinery for the UK

A £25,000,000 oil refinery is to be built in the UK by the California Texas Corp. (Caltex) and the Trinidad Oil Co. for their joint subsidiary, the Regent Oil Co. Although the site for the refinery has not yet been decided, it will probably be near Southampton, Hants.

Petrochemical Phthalic Anhydride

Part I — Raw Materials

by P. W. SHERWOOD

IN RAPIDLY increasing measure, phthalic acid anhydride is becoming a product of the petrochemical industries. Traditionally derived from coal tar sources (naphthalene), economic pressures of the postwar years have compelled the manufacturer of phthalic anhydride to rely more and more on petroleum-derived *o*-xylene. For the coming years, the growth outlook for phthalic anhydride continues to outpace the ability of the coke and coal tar industries to supply the raw materials need. It is therefore certain that *o*-xylene's importance will continue to grow in this role. Beyond that, efforts are being made to obtain economic recovery of naphthalene and methyl naphthalene from petroleum cuts, thereby adding to the raw materials base for phthalic anhydride.

Resins in Surface Coatings

The rapid growth of phthalic anhydride has been largely due to the spectacular growth in the use of alkyd resins in surface coatings during the past 12 years. These resins are obtained by the reaction of polyfunctional alcohols (glycerol, pentaerythritol, sorbitol) with a dibasic acid, notably phthalic, maleic, and more recently also sebacic and *iso*phthalic acids. Within the latter group, volume application puts phthalic acid anhydride definitely in first postion.

Second in importance among the outlets for phthalic anhydride is the manufacture of plasticizers of the phthalate ester type—notably dibutyl, and di-octyl phthalates. These plasticizers have important application in the manufacture of plastics materials, notably of non-rigid polyvinyl chloride, but extending also into other plastic products such as phenolics, polystyrene etc.

Some importance attaches also to the use of phthalate esters (especially dimethyl and diethyl phthalates) for insecticidal purposes.

Polyesters are a relatively new line of structural plastics. These materials have made headlines in such applications as the production of automobile bodies, various building materials, small boats etc. Market volume of the polyester resins, in the manufacture of which phthalic anhydride figures prominently, is still fairly small but this is a field in which the consensus of market forecasters looks to early significant expansion.

Various minor chemical applications, including above all the production of dyes and medicinals, round out the list of outlets for phthalic anhydride.

The present distribution pattern for this versatile chemical intermediate is typified by the domestic situation which prevailed in the US in 1954 (1):—

End Use	% of Domestic Market
Alkyd resins, modified and unmodified	52.6
Phthalate esters	36.8
Styrene, alkyd, and polyester resins	4.6
Dyes	2.4
Other uses	3.6

The significant growth rate of phthalic anhydride is seen from US production figures during the last 10 years, as released by the US Tariff Commission:

1946	112.7	million pounds
1947	137.5	,, ,,
1948	158.8	,, ,,
1949	149.7	,, ,,
1950	216.2	,, ,,
1951	248.0	,, ,,
1952	228.6	,, ,,
1953	226.6	,, ,,
1954	253.8	,, ,,
1955 (estimated)	350.0	,, ,,

Note the 38 *per cent increase of* 1955 *production over* 1954 *output.*

At present, phthalic anhydride exports are large. In 1954, 11.3 million pounds were shipped abroad and 1955 foreign sales are estimated at 19-20 million pounds. The chief markets for these shipments are British and German resin makers who accounted for some 70 per cent of all phthalic anhydride exports from the US. This situation will be changed as European phthalic

anhydride plants, now under construction, go on stream. In fact, one authority predicts that Germany, now and for many years past an exporter of naphthalene, will require naphthalene imports within five years in order to meet the needs of her own phthalic anhydride industry.

This illustrates the general efforts of these countries to raise phthalic production at least to the level of their own mushrooming demands. Western European installed capacity in 1955 has been estimated at 207 million pounds per year. Phthalic plants now under construction or authorized are expected to raise Western European capacity to 324 million pounds by 1957, compared with 376 million pounds in the US (announcement of additional expansion in the Western Hemisphere is expected shortly).

Average Yearly Growth

Long-range, an average yearly growth rate of 5 per cent in the demand for phthalic anhydride is considered conservative. This demand already poses a severe problem on raw materials position—a problem which will be intensified in the future. Thus, it must be noted that phthalic anhydride consumed only 45 per cent of the available naphthalene in 1940 (a year during which this aromatic hydrocarbon was actually a glut on the market). By 1954, phthalic anhydride actually required 82.4 per cent of the naphthalene available in the US—more than 100 per cent of domestic production. Thus, other consumers of naphthalene were constrained to draw on imported stocks for their raw material.

However, there now threatens to be a world-wide shortage of naphthalene. In a recent paper, American Cyanimid Co.'s E. C. Medcalf estimated that phthalic anhydride capacity of the Western world will be 748 million pounds per year by 1957. To satisfy this capacity alone will require 922 million pounds napthalene (plus *o*-xylene now being used.) Yet naphthalene production capacity by 1957 will be only an estimated 952 million pounds.

The trouble is, of course, that phthalic anhydride demand and production are geared to the rapidly expanding plastics and surface coatings industries, while production of naphthlene by present methods depends on the more slowly growing coking facilities tied to the steel industry and the manufactured gas industry. The latter especially has seen no significant expansion during the postwar era, since it has been eclipsed by the rapid growth of long-distance transmission systems for natural gas in the United States and Canada, and also to some extent in Western Europe.

For the producer of coke, naphthalene (whether recovered or sold to coal tar distillers) is but one by-product. It is by no means sufficiently important to permit adjustment in his process volume. The pace is set by the requirements for coke, which represent some 75 per cent of the value of all products obtained in the course of coal distillation. And here it must be borne in mind that the volume of coke employed per ton of iron or steel produced is falling off. This is partly due to improved fuel efficiency in modern iron making processes and partly to increased use of high-grade iron ore (taconite) concentrates. These factors, coupled with the conservative rate of expansion in the steel industry as a whole, and the regression of the manufactured gas industry, have been responsible for the fact that coking capacity in the US has increased a mere five per cent since 1948.

Alternate Sources

This is, therefore, not the source to which the phthalic anhydride producer may look for the incremental raw material that he will need in the future. There are available to him two alternate sources: coal hydrogenation and petroleum-derived hydrocarbons.

Coal hydrogenation has, of course, been used in central Europe for the production of synthetic gasoline, especially during World War II and the years immediately preceding it. Since then it has been much bruited about as a source of aromatic chemicals, but its importance to the phthalic anhydride producer is more potential than actual. A semi-commercial plant has been operated for some years by Carbide & Carbon Chemicals Co. On a smaller scale, work has been carried out by Koppers Co. and by Dow Chemical Co. (A coal hydrogenation project operated for some time by the US Bureau of Mines was concerned chiefly with the production of synthetic liquid fuel rather than of chemicals.)

Coal hydrogenation projects are remarkable for their large yield of higher tar acids as well as of other coal tar chemicals such as aniline. Their interest to the phthalic anhydride producer rests in their ability to yield three to eight times as much

naphthalene per pound of coal as is obtained in coking or carbonization processes.

Attempts have been made to use higher tar-derived aromatics (e.g., phenanthrene and alkylated naphthalenes) as raw materials for phthalic anhydride manufacture. Such conversion is readily attainable in the laboratory. But on a commercial scale several drawbacks militate against such stocks. Particularly disadvantageous is the large amount of by-product heat evolved in the course of oxidizing these hydrocarbons to phthalic anhydride. This heat makes control of the reaction difficult and adds substantially to the cost of constructing and operating the reaction equipment. The problem is difficult enough with naphthalene as raw material. It is much more severe as additional carbon atoms are present in the feed material since such surplus atoms are subject to complete combustion to carbon dioxide and water.

Situation Summarized

The situation may therefore be summarized as follows: coking facilities cannot and will not grow fast enough; coal hydrogenation is too costly and too dependent on markets for other chemicals; and higher aromatics are technically not suitable enough to offer much hope for future complete coverage of raw materials for phthalic anhydride production.

Once again, it will be the petroleum industry which will be called upon to break the bottleneck. The petroleum industry is in a peculiarly fortunate position to meet this new demand of the future.

One approach is the recovery of naphthalene, or even more plentiful methyl naphthalene, from the higher fractions of heavy reformate. However, this approach offers only limited incentive at presently prevailing naphthalene prices.

More attractive, and already commercially important, is the isolation of *o*-xylene from the xylenes fraction of reformate. The separation from the other two xylenes and ethyl benzene is possible by close fractionation.

o-Xylene has definite attractions over naphthalene as raw material for phthalic anhydride: it is converted with lower heat of reaction, and it is liquid at ordinary temperatures. Against this stands the lower yield which is obtainable from *o*-xylene. Economically, the situation is such that use of *o*-xylene for phthalic anhydride manufacture becomes attractive only if outlets of value exist for by-product C_8-aromatics. An important market is developing for *p*-xylene in the manufacture of terephthalic acid, intermediate for synthetic fibres (Dacron, Terylene etc.). *m*-Xylene can be oxidized to *iso*phthalic acid, but this compound has as yet only a limited market. Intensive market development work during the past few years has led to the limited adoption of *iso*phthalic-based alkyd resins and of *iso*-phthalate esters for plasticizers. These uses compete in part with the established outlets for phthalic anhydride, but special product characteristics also promise to extend the field. Ethyl benzene is the intermediate in styrene production. One plant, now under construction, plans to use by-product ethyl benzene in this synthesis.

Long Range Outlets

Long-range chemical outlets for the by-products of *o*-xylene recovery will probably be inadequate. However, these aromatics may be blended into high-octane motor fuel where their good rating commands a premium price. The outlet is not, of course, as attractive as chemical upgrading.

Today, only one producer (Oronite Chemical Co.) uses *o*-xylene as sole raw material for phthalic anhydride synthesis. Its feedstock is obtained from the nearby Richmond refinery of its parent, Standard Oil Company of California. Some other manufacturers (among them American Cyanamid) are set up to use *o*-xylene as emergency feed during times when naphthalene supply is short or its price is high enough to make full or partial replacement by *o*-xylene attractive. Reports have it that a new entrant into the field (Hatro Chemical Co.) may build an *o*-xylene-based phthalic anhydride plant which will, uniquely for this new material, use the fluid-bed catalytic process.

(To be continued)

REFERENCES.

(1) *Chemical and Engineering News*, 1956, 20 February, 856.

(2) Sherwood, P. W., *Pet. Ref.* 1953, 32 (4) 156.

MR. R. A. PITTMAN, B.Com., A.C.I.S., has been appointed secretary of the British Engineers' Association. For the past eight years, Mr. Pittman has been head of the economic research division of the association.

Brake on Automation

DSIR's Exhaustive Report

THE most powerful brake on the rate of introducing automation is likely to be the shortage of technical and scientific manpower, according to a report published this week by the DSIR ('Automation' price 6s). This is a general problem raised by all scientific and technical development affecting industry. Government plans for increasing the supply of these skilled people have recently been outlined, and the report hints that a big effort is needed if the rate of progress is not to be slower than is desirable for our economy.

The object of the report is to put automation in perspective and to discuss its probable future impact on industry. It makes a special point of saying that no one yet knows enough about automation to be dogmatic and that much research and exchange of information is required.

Further Mechanization

Some technical trends can be foreseen fairly clearly, says the report. The production, handling and assembly of components will be further mechanized and transfer-machines will be more widely used in the mass production of engineering components. Automatic control processes, already far advanced in industries like petroleum and chemicals, will continue to make progress. The report points out that the benefits will not be confined to large firms, though they are as a rule favourably placed. Many small firms may find their factories suited to automatic processes on both economic and technical grounds.

Progress with automation will also depend on how readily individual firms can raise capital for development. The transition to automation will be greatly eased if due attention is given to the needs, feelings and problems of the workers concerned, and if the trade unions are consulted in advance of each step. At present, the report adds, interest tends to be focused on the possibility of automation causing unemployment. But this is unlikely to be a serious problem if its introduction is not too rapid, if firms keep redundancies to a minimum by adhering to good managerial practice, and if a state of full employment continues so that redundant workers can be quickly re-absorbed. It is important that firms should plan their manpower requirements well ahead.

New Carboy Truck

A CARBOY truck has been developed from the 'Safe Way' carboy tilter by Powell & Co. It is a combined lifter, transporter and tilter, and its novel features are that the sliding clamp does not touch the iron skip, there is no metal ring surrounding the neck of the bottle, and there is no chain or bar across the front of the carboy.

The full carboy is placed in the cradle of the truck at ground level and is lifted to the transporting position by an easy arm and foot operation. A lever-operated 'stop' can be put out of operation when lifting or lowering the carboy. The truck is available with 14 in. dia. wheels, either all-steel or rubber cushion tyred.

The new carboy truck developed by Powell & Co.

Moscow Nuclear Physics Conference

Two Harwell physicists are included among a number of British scientists invited to the Conference on High Energy Nuclear Physics which opened in Moscow on 14 May. Dr. T. G. Pickavance and Dr. T. H. R. Skyrme, who are both specialists in research associated with high energy machines at AERE, Harwell, will be in Russia for about two weeks.

Uncommon Tanning Agents

Effect of Unusual Metals Described to SLTC

A MEETING of the Northampton Group of the Society of Leather Trades Chemists was held on Friday, 11 May at the Northampton College of Technology under the chairmanship of Mr. J. S. Mudd, when a paper was read by Professor D. Burton, M.B.E., D.Sc., F.R.I.C., on 'The Criteria of Tanning Ability and Some Uncommon Tannages'.

The future would bring many new tanning materials, and the problem of judging their tanning ability would arise. Theoretically the criteria of tanning ability could be stated as:—

(1) Resistance to putrefactive and other micro-organisms. Proteolytic enzymes, such as trypsin, hydrolysed some leathers but not others.

(2) Stability to heat. In this connection Chater and Briggs developed the shrinkage temperature technique. Standard figures for the T_S of leather were still required. Under the electron microscope the first indications of degradation generally occurred at temperatures below the T_S.

(3) Stability to water. The nitrogen content of the water extract was a measure of the stability of the tanned collagen.

(4) Effect on the physical properties of hides and skins. These are primarily determined by sound unit fibrils and retention of the fibre structure without too much removal of mucoid matter. In practice, the following must also be considered: (i) colour, (ii) weight-giving properties, (iii) area yield and (iv) stability to atmospheric conditions, light and various chemicals.

Tanning Abilities

The tanning abilities of the elements in relation to their positions in the periodic table have been investigated by Dr. H. P. Chakravorty using the T_S and the formation of leather-like products as criteria. In general the *p*H of maximal metal fixation is closely related to the *p*H at which the hydroxide or basic salt is precipitated and the maximum T_S is given by pelt tanned at this *p*H value.

The salts of copper, silver, magnesium, zinc, cadmium, yttrium, lanthanum, cerium, neodymium, tin, lead and manganese have no tanning ability. The salts of beryllium, titanium and thorium are worth further investigation. The effects of acetic acid, sodium acetate and sodium hydroxide on the tanning ability of mercuric acetate were described. A basified solution of mercuric acid gives a T_S of 91°C, but its commercial possibilities either alone or in a combination tannage are limited by its cost, poisonous character, and liability to blacken in air.

Chlorine rapidly combines with bated pelt to the extent at least six per cent on the dry weight. Small quantities reduce its T_S to values of 34°C and below. It becomes swollen and horny when dried. Its use in soak liquors is dangerous especially at temperatures above 15°C. Sodium hypochlorite causes drawn grain with bated pelt. Bromine increases the T_S of bated pelt from 61°C to 64.5°C. Iodine gives a maximum T_S of 62.5°C. The halogens combine to a smaller extent with deaminized hide powder than with untreated hide powder showing that the reaction is with the amino group.

Titanium I Leaflet

A LEAFLET reporting the findings of research carried out by the British Oxygen Co. in the welding of titanium alloys has just been published. Entitled *Titanium 1*, the four-page leaflet can be obtained from the Sales Technical Service Department of the company at North Circular Road, Cricklewood, London NW2.

The report states that many of the normal methods of joining metals can be applied to titanium, although its special chemical and metallurgical characteristics sometimes require modified techniques. The Argonarc process was ideal for the fusion welding of titanium because atmospheric contamination could be prevented by the Argon gas shield provided by the torch. The leaflet lists nine recommendations for the production of sound ductile welds.

Radiation Sterilization

Work at DSIR Low Temperature Station

THE research group formed late last year at the Low Temperature Research Station, DSIR, is working on an extended programme of research into the uses of ionizing radiations for preserving foods. High voltage electron generators and *gamma* ray sources in several other laboratories are being made available for this work and are already in use. The work will be greatly increased in scope by use of two X-ray generators which have just been installed in an annexe to the food laboratory. These are of high output (90 kV, 75 mA) and will be employed mainly for explanatory studies. Smaller scale work has been carried on at the station for several years and has shown that many important problems remain to be solved in spite of promising results. Interest in the subject is increasing and the new programme has been planned to provide further basic information.

Help from Industry

The group working on irradiation of foods is led by Dr. R. S. Hannan and now totals six scientific workers. The Metal Box Co. Ltd., and the British Food Manufacturing Industries Research Association have seconded members of their staff to work with Dr. Hannan. Metropolitan Vickers Electrical Co. Ltd. has made a Research Fellowship available. This is held by Dr. Margaret J. Thornley who is in charge of the microbiological aspects of the work. Dr. B. Coleby, Broodbank Fellow of the University of Cambridge, is initiating radiation chemical studies, particularly in the relatively unexplored field of irradiation of fats.

First aim of the research group will be to survey the possibilities of treating common foods with all the various possible types of radiation. Most attention is being given initially to the treatment of poultry, meat and fish products, but studies on other foodstuffs such as potatoes (for prevention of sprouting) are being carried out on a smaller scale. It is emphasized that work on the application of the ionizing radiations specifically to foods is still in an early experimental stage and caution is advised in speculating on the future of the method. There is no doubt that food can be sterilized by treatment with large doses of radiation and that irradiation could be carried out on a commercial scale. In this respect British electron generators which have been available commercially for some years are among the most advanced in the world, while large radioactive sources will become available within a few years as a by-product of the operation of the Nuclear Power Programme.

Canadian Chemical Output

CANADIAN production of chemicals was valued at $279,846,000 in 1954, an increase of 9 per cent over the preceding year's $255,582,000.

Factory selling value of organic chemicals rose to $72,936,000 from $61,539,000 in 1953, synthetic resins to $36,647,000 from $26,251,000, compressed and liquefied gases to $33,723,000 from $31,130,000, acids to $19,174,000 from $14,651,000, calcium compounds to $16,469,000 from $16,032,000 and other chemicals to $24,847,000 from $24,483,000. Value of fertilizer chemicals fell to $45,386,000 from $50,682,000, and sodium compounds to $30,664,000 from $30,814,000.

Shipments of the acids, alkalis and salts industry had a factory selling value of $142,006,611, an increase of 11.6 per cent over the preceding year's $127,299,437. The 43 plants in the industry employed 8,408 persons against 8,278.

'Vest-Pocket' Laboratory

NOW on permanent exhibition at the Science Museum, South Kensington, London, is a 'vest-pocket' laboratory of the type which is displacing the retort as the symbol of the chemist. Technically known as a semi-micro set, the vp laboratory was evolved by Dr. J. T. Stock, associate professor in chemistry in the University of Connecticut, and Mr. M. A. Fill of the Norwood Technical College, London.

The assembly, which was designed for use as a demonstration unit at the Norwood Technical College, is equally effective as a mobile laboratory for work in the field, and can be employed for the determination of insecticides in orchards, hop gardens and farms, and for anti-gas work in the event of a war. The set makes use of 61 components from the range of interchangeable laboratory glassware made by Quickfit & Quartz.

HOME

Kent's Works Holidays

The factories of George Kent Ltd. at Luton, London, and Resolven, South Wales, will be closed for the annual works holiday from Friday evening, 20 July to Tuesday morning, 7 August. Offices at all factories, however, will remain open.

Harvesting Ship Acquired

Alginate Industries Ltd. has acquired the vessel *Chondrus* from the Institute of Seaweed Research. The *Chondrus*, now lying at Kirkwall, Orkney, will be used for harvesting seaweed off the island of Westray from June to September. If the amount collected justifies it, a factory will be built on the island.

Shell's Growth Since 1946

Reviewing the development of the Shell Transport & Development Co. Ltd. in the last 10 years, the company's survey of activities for 1955 states that sales of oil and chemical products amounted to 92,000,000 tons in 1955, compared with 37,000,000 tons in 1946.

Research Fund Grants

The Research Fund of The Chemical Society which provides grants for the assistance of research in all branches of chemistry donates about £700 per annum for this purpose. Applications for grants will be considered in November and should be submitted on the appropriate form not later than Thursday, 15 November. Applications from Fellows will receive prior consideration. Application forms, together with the regulations governing the award of grants, may be obtained from the General Secretary, The Chemical Society, Burlington House, Piccadilly, London W1.

Richardson Scales

Sales of Richardson scales in the United Kingdom, the Commonwealth and the sterling area, are to be handled by the Richardson Scale Co. Ltd., 40-42 George Street, Nottingham. The company will make all types of Richardson automatic bagging, weighing, proportioning, feeding and other equipment, except 'Select-O-Weigh' systems. These fully automatic control systems will still be handled by Henry Simon Ltd., Stockport.

Centenary Lecture

Professor G. T. Seaborg, of the University of California, will present the Centenary Lecture entitled 'Present Status of the Transuranium Elements' at The Chemical Society at Burlington House, Piccadilly, London W1, at 7.30 p.m. on 7 June.

Fielden's Scottish Agents

Fielden Electronics Ltd., industrial instrumentation specialists of Wythenshawe, Manchester, have appointed A. R. Bolton Ltd., 72 Haymarket Terrace, Edinburgh (Tel.: Edinburgh 62446), to be their sole Scottish agents.

UK Agents Appointed

Leonard Smith (Engineers) Ltd., of Abford House, Wilton Road, London SW1, have been appointed UK agents for Anhydro A/S of Copenhagen, manufacturers of spray driers, flash drying plant and air heaters, plant complementary to the evaporating plant designed by Leonard Smith.

Factory Opening Date

Hess Products Ltd., of Leeds, will open a new chemical plant at Littleborough, near Rochdale, Lancashire, on 19 June for the production of Armour chemicals under license.

Professor R. Smoluchowski Lecture

Professor R. Smoluchowski, of the Carnegie Institute of Technology, Pittsburgh, at present visiting professor of physics at The Sorbonne, Paris, will lecture on 'Some Recent Studies of Irradiation Effects in Metals & Other Solids' under the auspices of the Metal Physics Committee at the Weir Hall of the Institution of Naval Architects, 10 Upper Belgrave Street, London SW1, at 6.30 p.m. on 13 June. Tickets of admission are not required.

Superphosphate Conference *in Private*

More than 180 delegates representing 21 countries took part in a series of discussions on the progress of superphosphate production and its agricultural applications throughout the world at the International Superphosphate Manufacturers' Associations four-day conference which ended on Thursday, 17 May at the Park Lane Hotel, London. All discussions were private, and no press communiqué will be issued.

• OVERSEAS •

To Increase Barium Oxide Output

The Westvaco Mineral Products Division of Food Machinery & Chemical Corp. of the US is to increase, by 30 per cent, its output of barium oxide.

Chilean Copper

Chilean copper production from 1 January to 30 April totalled 133,033 tons, compared with 139,649 tons in the same period last year.

Investigating Alpine Rock

It is reported that Italy's largest chemical company, the Italian General Petroleum Corp. has applied for concessions at Tres, in the Alps, where investigations are being carried out on small flows of bitumen to establish whether the alpine rock contains hydrocarbon deposits.

Symposium President

Mr. C. W. Humphreys, manager of the Shell Chemical Corp., of New York, presided over a symposium, 'Foreign Chemical Developments & Their Effect on the US Chemical Industry' at the American Institute of Chemical Engineers national meeting in New Orleans earlier this month. Among the speakers were Mr. J.. C. H. Stearns, vice-president of Dow Export Co. and Mr. A. H. Schutte, vice-president, The Lummus Co.

SA Uranium Industry Earns £350,000,000

Mr. J. Reid, secretary of the South African Atomic Energy Board, said that when the present 10 year contract with the Combined Development Agency of Britain and the US ends, the South African uranium industry will have earned £350,000,000. Recent agreements have been made with 27 mines for the production of uranium, and 20 are already producing.

Du Pont's New Laboratories

A $2,800,000 product development and technical service elastomers laboratory was officially opened by E.I. du Pont de Nemours & Co. at Wilmington on 19 April. The laboratory will enable du Pont's elastomers division to broaden its sales-service work. Designed primarily to provide technical service on neoprene, Hypalon synthetic rubber, Hylene organic *iso*cyanates, and rubber chemicals, it can duplicate on a pilot plant scale many operations in rubber manufacture.

US Army Seeks Research Workers

A newly-formed US Army research and development liaison group began work in Frankfurt on 15 May to gather Western European scientific and technical staff to do research for the Army.

Concessions in Libya

The Ohio Oil Co. has formed a wholly-owned subsidiary, the Oasis Oil Co. of Libya, which will operate some 35,000,000 acres of oil and gas exploration concessions in Libya, North Africa.

Five Killed at Explosives Factory

It is reported from Lisbon that five persons were killed in the recent explosions which wrecked part of the explosives factory at Santa Marta de Corroios on the bank of the river Tagus. The explosions occurred when a mixture of gelatine and nitrate was being loaded on to a tractor. In 1948 27 people lost their lives at the same factory.

1707 Catalyst in Quantity Production

Quantity production of 1707 Catalyst has begun at the Newark, California, plant of Food Machinery & Chemical's Westvaco Mineral Products Division. 1707 Catalyst, used in the manufacture of butadiene and styrene, is a metal oxide type of dehydrogenation catalyst containing a high proportion of magnesia.

Hydrogen Peroxide Plant for Canada

An $8,000,000 plant for the production of hydrogen peroxide, by a process new in Canada, is to be built by Du Pont of Canada at Maitland, Ontario. Engineering design is reported to be under way. The new process, developed in the US by E.I. du Pont de Nemours & Co., involves manufacture by a series of chemical reactions rather than the older and more costly electrolytic method.

By-Product Sulphuric Acid

Production of by-product sulphuric acid at US copper and zinc plants in 1955 was 1,112,100 short tons, compared with 886,000 tons in 1954, or an increase of 26 per cent over 1954. The acid quoted is only that produced from the sulphur content of the sulphide ores. Output at copper plants increased 20 per cent in 1955 and that at zinc plants rose 28 per cent.

· PERSONAL ·

The Cutlery Research Council, in agreement with the British Iron & Steel Research Association, has appointed its research superintendent, Mr. C. N. Kington, to be director of research. Mr. KINGTON, who is group manager of the BISRA Sheffield laboratories, has hitherto been seconded to the Cutlery Research Council in a part-time capacity. He will continue in that capacity as the director of research.

MR. R. J. GILL, who has been in charge of the cement laboratory of Solway Chemicals Ltd., Whitehaven, for about two years, has been appointed chief chemist with Taylor Woodrow Construction Co. Ltd. He was formerly with the Rugby Portland Cement Co. Ltd.

Former head of Twickenham (Middlesex) CID, Chief Detective Inspector WILLIAM ELLIOTT, has been appointed security officer at the works of Johnsons of Hendon Ltd., London NW4. Mr. Elliott, who served 25 years with the Metropolitan Police until his retirement recently, had been engaged on a number of murder investigations. In August 1955 he went to Scotland Yard to work with the murder and vice squad. He is a native of Durham and lives at East Twickenham.

MR. C. R. B. WILLIAMSON, who two years ago left Benger Laboratories Ltd. to become marketing manager and subsequently publicity manager of Pfizer Ltd., is to rejoin Bengers as home sales controller. He takes up his new appointment in June and will be responsible for the home sales of all the company's prescription and consumer products.

The following elections were made at the annual general meeting of the British Chemical Plant Manufacturers' Association on 8 May:—*chairman*: MR. G. N. HODSON, Hathernware Ltd.; *vice-chairmen*: MR. H. W. FENDER, Prodorite Ltd.; MR. I. M. O. HUTCHISON, Henry Balfour & Co. Ltd.; MR. R. W. RUTHERFORD, Power-Gas Corporation Ltd.; *hon. treasurer*: MR. P. W. SELIGMAN, The A.P.V. Co. Ltd.; *council*: MR. J. BISHOP, Nordac Ltd.; MR. J. C. HAITHWAITE, John Thompson (Dudley) Ltd.; MR. I. M. O. HUTCHISON, Henry Balfour & Co. Ltd.; MR. B. H. TURPIN, Q.V.F. Ltd.; MR. M. WYNDHAM, Bennett, Sons & Shears Ltd.

MR. P. J. C. BOVILL, who has been assistant managing director of Newton, Chambers & Co. Ltd., since 1954, has been appointed managing director in succession to SIR HAROLD WEST who has retired. Mr. Bovill, who joined the company in 1922 has, with the exception of a brief period with the United Steel Companies Ltd., been continuously concerned with the development of Thorncliffe. Sir Harold West, aged 60, joined the company in 1919 after service in the 1914-1918 war. He was knighted in 1948.

DR. R. A. WILKINS, vice-president of the research and development department of Revere Copper & Brass Inc., of Rome, New York, has been elected a Fellow of the Institute of Metals in recognition of his outstanding services to the Institute. He is the first resident outside the British Isles to be elected to the Fellowship.

The Lord President of the Council announces that SIR HUGH BEAVER is resigning from the chairmanship of the Advisory Council of the Department of Scientific & Industrial Research. He will continue to serve as a member of the council. SIR HARRY JEPHCOTT has accepted the invitation of the Lord President to become chairman.

Obituary

DR. H. B. W. MORGAN, M.D., Ch.B., D.P.H., medical adviser and consultant specialist on industrial diseases to the Trades Union Congress, died at his home in London on 7 May, aged 70.

MR. G. G. STACK, Dunlop's general sales manager in Calcutta, died suddenly while home on leave. He was 46, and had been with Dunlop since he was 19. Mr. Stack went to India in 1939 and from 1941 to 1946 was a lieutenant in the Indian Army.

Olin Mathieson Sales Up

DOMESTIC and Canadian sales of Olin Mathieson Chemical Corporation, of New York, for the first quarter of 1956, ending 31 March, were $144,340,677, or approximately 12 per cent more than the $128,697,280 in the same quarter of 1955.

Earnings in the first three months of the year rose to $10,080,099 from $8,943,237 in the same period of last year, an increase of 13 per cent.

Based on these figures, earnings were equal to 76 cents per share of common stock outstanding compared to 72 cents on the number of common shares outstanding at the same time in 1955.

No part of the profit resulting from the previously announced sale for $33,000,000 of timberlands in Arkansas, Louisiana, and East Texas has been reflected so far and will be reported before the end of the year.

At the annual meeting on 24 April, 19 directors were elected to the board of the corporation, and the shareholders ratified a company pension plan and approved modifications in the stock option plan.

Shell Research Centre Extended

EXTENSIONS to Woodstock Agricultural Research Centre of Shell Research Ltd., near Sittingbourne, Kent, were opened on Monday 14 May by Sir William Slater, executive secretary of the Agricultural Research Council.

About 8,500 square feet have been added to the floor space and the total cost, excluding equipment, was £150,000.

Woodstock is now the headquarters of all Royal Dutch-Shell group agricultural research in Europe. Previously it was divided between Woodstock and Amsterdam. The consolidated laboratories have three main functions; basic research to discover new agricultural chemicals, development and testing of these new products and the solution of specific problems which arise from experience in the use of new products.

US Barytes

The Bureau of Mines, US Department of the Interior, reports that the production of barytes from domestic mines in 1954 totalled 947,000 tons, and that consumption during the year was a record at 1,215,678 short tons.

Freon as Film Cleaner

EFFECTIVE, rapid and safe cleaning of motion picture and other photographic films is possible by the use of Freon-113 refrigerant it is claimed by du Pont.

Used generally as a cooling agent in industrial refrigerators and air conditioners, this liquid has proved itself a better and quicker-drying cleaner than most other types of solvents. Tests reported by the Motion Picture Research Council, Inc., show Freon-113 to be 'much less toxic, better in some cleaning operations, and equivalent to all others tested' in motion picture studio work.

Freon-113, one of the dozen or so refrigerants and aerosol propellents created by the du Pont company's organic chemicals department, speeds up film cleaning from 10 to 20 per cent in machine processes. Adaptable to film cleaning in machines and by hand, it dissolves gums and oils which can blur the image projected on the screen, but because of its chemical stability it does not affect the coating of emulsion on black-and-white or colour film.

Course at Harwell

THE Atomic Energy Research Establishment invites applications from physicists and electronic engineers holding a degree or the equivalent qualifications to attend the 11th specialized course on the design, use and maintenance of electronic instruments used in nuclear physics, radio chemistry, and in work with radioisotopes, to be held at Harwell from 11 to 15 June.

Fee for the course is 15 guineas and accommodation can be arranged locally for approximately four guineas. Application forms are available from DAO, Electronics Division, AERE, Harwell, Berks, and should be returned by 25 May.

US Carbon Black

Daily average production of carbon blacks in the US in March was 11 per cent higher than in March 1955, according to the Bureau of Mines, US Department of the Interior. Shipments were nine per cent less than a year ago. Stocks during March amounted to 247,425,000 lb. compared with 236,119,000 lb. the previous month.

Law & Company News

Commercial Intelligence

Increases of Capital

TAYLOR REESON LABORATORIES LTD., 23-8 Penn Street, London N1, increased by £100,000, in £1 shares, beyond the registered capital of £10,000.

HARSHAW CHEMICALS LTD., 18 Austin Friars, London EC, increased by £9,900, in £1 ordinary shares, beyond the registered capital of £100.

MINING & CHEMICAL PRODUCTS LTD., Cecil Chambers, Strand, London WC2, increased by £100,000, in £1 shares, beyond the registered capital of £100,000.

FISHBURN PRINTING INK CO. LTD., Cassiobury Mills, St. Albans Road, Watford, increased by £120,000 in 160,000 'A' ordinary and 80,000 'B' ordinary shares of 10s beyond the registered capital of £30,000.

Changes of Name

INDUSTRIAL FOAM PRODUCTS LTD., of Harbour Road, Lydney, Gloucestershire, to CELLOFOAM LTD.

SLEEPAX LTD. 274 Gresham House, Old Broad Street, London EC2, changed to Gresham Chemicals Ltd. on 26 March 1956.

New Registrations

Plastic Constructions (Installations) Ltd.

Private company (565,663). Capital £1,000 in £1 shares. To carry on the business of constructors and fabricators of chemical and any other plant from plastics etc. Subscribers (each with one share): John Pollard, and Muriel W. Williams. The first directors are to be appointed by the subscribers. Registered office: 4 Broad Street Place, London EC2.

Biorex (Marketing) Ltd.

Private company (565,849). Capital £20,000 in 5,000 deferred founders and 15,000 'A' ordinary shares of £1. To carry on the business of manufacturers, exporters, importers of and dealers in chemicals, gases, drugs, medicines etc. Subscribers (each with one 'A' ordinary share): Betley Berger and Mary L. Banister. Directors: Dr. S. Gottfried, Miss L. Baxendale, B.Sc., Dr. B. Stross, M.Sc., M.B., Ch.B., M.P., and H. Davies, M.P. Reg. office: 47/51 Exmouth Market, London EC1.

N. Kroll Ltd.

Private company. (565,424). Capital £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in chemicals, gases, drugs etc. Directors: Norman Kroll and Alfred Melzack. Registered office: 38 Seeley Drive, Dulwich, London SE21.

Waller Adhesives Ltd.

Private company (16,045). Registered in Dublin. Capital £10,000 in £1 shares. To carry on business as manufacturers of, dealers in and distributors of all kinds of formaldehyde glues etc. Directors: Charles B. Waller, Almeria, Putland Road, Bray; Robert A. McCabe, Sandra, Stillorgan, Co. Dublin, and E. H. Waller and H. A. Collinson.

H. I. Powell Ltd.

Private company (565,863). Capital £2,000 in £1 shares (100 founders and 1,900 ordinary). To carry on the business of manufacturers of and dealers in chemicals, gases, drugs, medicines etc. Directors: Harold I. Powell (permanent chairman) and Mrs. Edith A. Powell, both of Quisisana, Herne Lane, Rustington, Sussex; and Eric P. Sorrell. Reg. office: 9 Broadmark Parade, Rustington, Sussex.

Toxane Ltd.

Private company (565,138). Capital £1,050 in 4,000 'A' shares of 5s and 1,000 'B' shares of 1s each. To carry on the business of chemical manufacturers. Directors: Jack Altman and Sidney Morris of 24/7 High Holborn, London WC1. Secretary, K. A. Beaney, 8 Lonsdale Avenue, London Road, Romford, Essex.

Evomastics Ltd.

Private company (564,871). Capital £100 in £1 shares. To carry on the business of manufacturers of and dealers in abrasives, adhesives, bricks, cartons, cements, containers, dyes, enamels, fats, fillers, glass, glues, lubricants, oils, paints, pigments, plastics, polishes, pottery, tiles, varnishes, waxes etc. Directors: Herman Simon, managing director of Evode Ltd., English Waxes Ltd. and Evode Industries Ltd. (Eire); James F.

Bostock, chairman and managing director of Lotus Ltd.; managing director of Lotus & Delta Ltd., director of other companies; Godfrey S. Bostock, chairman and managing director of Vik Supplies Ltd., vice-chairman and managing director of Lotus Ltd. Reg. office: 1 Glover Street, Stafford.

Kenton Laboratories (Sales) Ltd.

Private company (565,863). Capital £2,000 Directors: John K. Cooper, director of Kenton Laboratories Ltd. etc, and Edwin W. Chick, director of Ellis & Co. (Cutlery Sales) Ltd. etc., and Simon S. Darvas. Reg. office: 9 & 10 Marble Arch, London W1.

Levy West Laboratories Ltd.

Private company (565,503). Capital £10,000 in £1 shares. To carry on the business of manufacturers of and dealers in luminescent paints, powders and materials, X-ray screens, X-ray and television apparatus and equipment, chemicals, gases, drugs etc. Directors: Richard A. Bennett-Levy, and Antony J. West. Solicitors: Walters & Hart, 18 Mansfield Street, London W1.

Gravity Rand Ltd.

Private company. (565,421). Capital £100 in £1 shares. To carry on the business of consultants in all branches of engineering, physics, chemistry and metallurgy, to carry out research and developments in all aspects of gravity etc. Directors: Richard G. Worcester, director of Aviation Studies (International) Ltd., and John C. Longhurst, director of Aviation Studies (International) Ltd. Registered office: 29/31 Cheval Place, London SW7.

Company News

Evans Medical Supplies Ltd.

Although the company's earnings from manufacturing and trading operations showed a decline of five per cent, a lower provision for taxation together with variations in sundry debits and credits resulted in an increase in net profit at £142,148, compared with £135,983 for the previous year. It is proposed that an unchanged final dividend of 5d per 5s stock unit be paid.

Glaxo Laboratories Ltd.

The directors announce that in the half-year to 31 December 1955, the group turnover (excluding sales by South American subsidiaries which are not consolidated) increased by 20 per cent, compared with the corresponding period in the previous year. After providing for depreciation and deducting minority interests, but before tax, the consolidated net profit is estimated to be £1,365,000 for the six months.

Simon-Carves Ltd.

Consolidated profit of the company before taxation for the year ended 31 December 1955, totalled £1,386,477, compared with £942,160 in 1954. The final proposed dividend is 17½ per cent. Subject to Treasury consent, the directors propose that the authorized capital of the company should be increased to £2,000,000 by the creation of 2,000,000 ordinary shares of 5s. each to be issued as fully paid to persons registered at the close of business on 15 June 1956, in the proportion of one new share for every two shares held.

Celanese Corporation of America

The Celanese Corp. of America and its domestic subsidiaries report a net income of $3,461,766 after charges and taxes for the three months ended 31 March 1956. The earnings, equivalent to 39 cents a common share, compare with last year's first quarter earnings of $3,911,314, equivalent to 47 cents a common share. Included in the 1955 first quarter was a non-recurring profit item of $802,900, before taxes, from sales of investments. Net sales for this year's first quarter totalled $48,477,887 compared with $45,851,680 net sales for the comparable 1955 period. Income before provision for federal taxes during the first three months of 1956 was $7,136,766, compared with a pre-tax income of $6,911,314 during the first quarter of last year.

Coates Brothers & Co. Ltd.

Although the company had a record year in the volume of turnover and profits earned, the rate of increase in group profit was lower than the increase in turnover due to higher costs and narrowing price margins. During the year under review the company's factories in the UK worked at near capacity and the sales of the printing ink companies expanded. Under an arrangement with the T. F. Washburn Co., of the US, the company is now manufacturing thixotropic alkyd resins under licence. These materials are the basis of the so-called jelly paints which are now appearing on the English market. All overseas companies of the

[*continued on page 1144*

Company News

continued from page 1142

group operated at a profit during the year, particularly the New Zealand Co. In April 1955 a small branch factory was opened at Christchurch, and this is now established. In Australia a new factory was opened at Auburn, and the trade of the Melbourne branch factory has increased to a point where the directors have considered it necessary to build further accommodation. The directors propose a final dividend of 16 per cent.

Clover Paint & Composition Co.

The company is to raise its annual dividend from 20 per cent to 30 per cent with a final recommendation of 20 per cent for 1955. A 10 per cent interim, as before, is declared on account of the current year. After tax of £55,307 (£29.904), the group net profit expanded from £20,135 to £43,749.

Titanie Ltd.

Titanie Ltd., manufacturers of cellulose and synthetic lacquers, made a net profit before taxation, in 1955 of £83,001, compared with £74,706 in the previous year. The directors proposed to place a further £10,000 to general reserve and to pay a final dividend of 20 per cent, plus 10 per cent cash bonus, making a final dividend of 35 per cent, plus 10 per cent bonus for the year.

Market Reports

LONDON.—A steady buying interest has been reported for industrial chemicals both on home and export account. With the exception of the fluctuations in the metal compounds, prices generally are firm at late rates. Among the soda products, hyposulphite of soda and chlorate of soda are moving steadily into consumption. Borax, boric acid and formaldehyde continue in good request. There has been no change in the position of the coal-tar products. Creosote oil, cresylic acid and phenol are in brisk demand, and there has been a fair call for refined tar and pitch.

MANCHESTER.—Steady to firm price conditions rule in virtually all sections of the Manchester market for heavy chemicals. Except in odd spots, notably in the metal compounds, no easing seems to be looked for. There is a fairly good call from the textile trades for bleaching, dyeing and finishing chemicals. Other industrial consumers are taking steady deliveries under contracts. Fresh enquiry on both home and shipping accounts during the week has been on a fair scale. Although approaching the tail-end of the season the movement of sulphate of ammonia and the compound fertilizers continues on steady lines. A good demand for most of the by-products is a feature of the market.

GLASGOW.—Business during the past week in the Scottish heavy chemical market has been firmly maintained both in regard to spot and contract deliveries, prices on the whole being little changed, although it is noted that copper sulphate has again shown a fall in price. With regard to fertilizers, the demand here is on the increase as the season advances. A fair volume of enquiries has been received for export, and in general, the market continues steady.

Next Week's Events

WEDNESDAY 23 MAY

Society for Analytical Chemistry

London: Meeting Room of The Chemical Society, Burlington House, Piccadilly W1, 6.30 p.m. 'Some New Factors in Pectin Gel Strength' by Mamie Olliver, M.Sc., F.R.I.C; P. Wade, M.Sc., Ph.D., D.I.C., A.R.I.C. & Kathleen P. Dent, A.R.I.C.; and 'The Binding of Ions & Detergents to Pectin, Protein & Other Colloid Systems' by B. A. Pethica, B.Sc., Ph.D., A.R.I.C.

THURSDAY 24 MAY

The Fertiliser Society

Fernhurst: Tour of the research station of Plant Protection Ltd., near Haslemere, Surrey, and the presentation of a paper, 'Use of Fertilizers for Glasshouse Crops' by Professor Hugh Nicol, Ph.D., F.R.I.C., F.R.S.E., head of the chemistry department of the West of Scotland Agricultural College.

FRIDAY 25 MAY

Society for Analytical Chemistry

Bradford Technical College, 6.30 p.m. A meeting on 'Microvolumetric Analysis'. 'Apparatus & Technique" by D. W. Wilson, M.Sc., F.R.I.C.; 'Primary Standards' by R. Belcher, B.Sc., Ph.D., F.R.I.C., F.Inst.F.; 'End-Point Location' by E. Bishop, B.Sc, A.R.T.C., A.R.I.C.

Society of Cosmetic Chemists

London: Bonnington Hotel, Southampton Row WC1, 7 p.m. Annual general meeting and an address by the president, R. T. Dobson, entitled, 'Development of a New Product'.

CLASSIFIED ADVERTISEMENTS

A vacancy occurs for an **INDUSTRIAL CHEMIST** on the editorial staff of a leading Chemical Journal in London. Extremely interesting work and although previous editorial experience is not necessary, ability to write lucidly is essential.

Applications, which will be treated in strictest confidence, should give full details of experience and salary required and should be addressed to **THE MANAGING DIRECTOR, BOX NO. C.A. 3470, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4**

CHEMIST or **PHYSICIST** required at **MINISTRY OF SUPPLY RESEARCH** and **DEVELOPMENT ESTABLISHMENT,** near **SEVENOAKS, KENT** for research on initiation of explosive systems and in application to Service stores. Candidates should possess 1st or 2nd class honours degree or equivalent qualification. Knowledge of modern laboratory instrumentation techniques desirable and experience in handling explosives an advantage. Appointment according to age, experience etc. as Senior Scientific Officer (min. age 26 with at least 3 years post graduate research experience) or Scientific Officer (min. age 21). Salary within ranges, S.S.O. £1,095—£1,250: S.O. £514—£933 (Superannuable). Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1., quoting F.307/6A

FEDERATION OF NIGERIA

Assistant Government Chemist.

QUALIFICATIONS

Fellowship and Associateship of R.I.C.S. (Branch E) or an Honours degree in chemistry of a British University.

DUTIES

General analytical, including bacteriological and chemical analysis and forensic work.

TERMS OF APPOINTMENT

On permanent and pensionable terms with emoluments in the scale £1,086-£1,680 p.a. or on contract with emoluments in the scale £1,290-£1,656 p.a. plus gratuity. Outfit allowance. Free passages officer and wife. Allowances and passage concessions for children. Furnished quarters at rental. Free medical attention. Income tax at local rates.

Apply to Director of Recruitment, Colonial Office, London, S.W.1. State age, qualifications and experience, quote BCD.97/14/01.

MANAGEMENT OPPORTUNITY IN THE CHEMICAL AND PLASTICS INDUSTRY

AN ASSISTANT PRODUCTION MANAGER is required by a large and established company manufacturing resins and moulding powders for the Plastics Industry.

Applicants should be qualified Chemists or Chemical Engineers with about ten years' experience in the production side of the Chemical or Plastics Industry.

The positions are tenable at a modern factory sited in a pleasant semi-rural area. Good employment conditions, welfare scheme, non-contributory pension scheme, etc.

Applications, which will be treated as confidential, should be addressed to:

BOX No. C.A. 3472,
THE CHEMICAL AGE,
154, FLEET STREET, LONDON, E.C.4,
quoting Ref. R.144.

Atomic Energy Research Establishment,
HARWELL
has vacancies for
ASSISTANT EXPERIMENTAL OFFICERS
in its Engineering Services Division.

(i) To carry out the more precise analytical work needed for the chemical service to new water moderated reactors, and to supervise less qualified staff.

(ii) To operate a chemical service for novel experiments connected with the development of new reactors.

G.E.C. Advanced level in two science subjects, or equivalent qualifications essential. Experience of industrial water treatment techniques an advantage. For (i) experience in the estimation of trace elements is desirable.
SALARY: £330 (at age 18)—£718 per annum (male).
Contributory pension scheme: five day week; excellent working conditions and generous leave allowances.
Note: Married officers living outside the Establishment's transport area will be eligible for housing under Authority arrangements or, alternatively, substantial assistance towards legal expenses incurred in house purchase, will be available.
Send **POST CARD** for application form which must be returned by 29th May 1956 to Establishment Officer, A.E.R.E., Harwell, Didcot, Berks., quoting reference 552/38

OPPORTUNITIES FOR CHEMISTS AND CHEMICAL ENGINEERS

CHEMISTS AND CHEMICAL ENGINEERS are required for the Technical Department of a large company manufacturing resins and moulding powders.

Applicants should have a good academic training and be able to apply this knowledge to the problems arising in the operation and development of chemical plant. The work is varied and will appeal to men who wish to extend their experience without specialising in a narrow field, and will involve experimental investigations leading to the design and subsequent commissioning of new or modified process equipment.

The factory is modern, offering good employment conditions, welfare and pension schemes. Applications, in confidence, and quoting Ref. R.153, to:

BOX No. C.A. 3471,
THE CHEMICAL AGE,
154, FLEET STREET, LONDON, E.C.4.

PRINCIPAL SCIENTIFIC OFFICER and **SENIOR EXPERIMENTAL OFFICER** required by **MINISTRY OF FUEL AND POWER, LONDON,** in connection with development of windmills, hydraulic transport of coal, atmospheric pollution, industrial drying processes, oil burning, heat pumps, development of low grade fuels. Qualifications: P.S.O. 2nd Class Hons. degree in Physics or Engineering. S.E.O. Pass degree in Physics or Engineering. Experience of engineering development, particularly mechanical engineering; knowledge of application of thermodynamics to engineering problems; interest in fuel technology. Salary within ranges:—P.S.O. (min. age 31) £1,415—£1,755 (M), £1,318—£1,625 (W). S.E.O. (min. age 35) £1,285—£1,501 (M), £1,184—£1,369 (W). Forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting A 180/6A.

WORKS MANAGER

EXPANDING Company in Lancashire, manufacturing important organic chemicals, requires a Chemist or a Chemical Engineer (35-45), with works experience, to be assistant to the Works Manager, prior to taking over this position, if satisfactory, within a short period.

The Company has adequate finances, and only men of undoubted ability and enterprise, and having the willingness to shoulder responsibility, need apply.

Replies to the Chairman, Box No. C.A. 3474' will be treated in complete confidence, and must give full qualifications, experience, details of present position and salary.

CHEMIST required at **MINISTRY OF SUPPLY** Research and Development Establishment near Sevenoaks, Kent, for physico-chemical methods of analysis, including infra-red spectro-photometry. Qualifications: Higher School Certificate (Science) or equivalent, but H.N.C., A.R.I.C., or pass degree in Chemistry an advantage. Experience of electronics desirable. Salary within range: Experimental Officer (min. age 26), £781-£968. Forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting F964/5A. Closing date, 16 June, 1956.

NORTH THAMES GAS BOARD
invites applications from
CHEMISTS
who have obtained a First- or Second-Class Honours Degree, for vacancies at its Chemical By-Products Works, Beckton, East Ham, E.6, for research on problems in connection with coal tar distillation, and the manufacture of phenols, naphthalene and bases.

Preference will be given to those who have had some post-graduate experience in research, particularly in subjects related to those mentioned above.

These are permanent appointments and offer good prospects of advancement.

Successful candidates will be required to join the Staff Pension Scheme. Starting salaries will be according to age and qualifications.

Applications, giving age and full details of training and qualifications, should be addressed to the
STAFF CONTROLLER,
NORTH THAMES GAS BOARD,
30, KENSINGTON CHURCH STREET, W.8,
to reach him by not later than fourteen days after the publication of this advertisement, quoting Reference 666/288.

JUNIOR ASSISTANT required for work in Research Chemical Laboratory. Experience with Portland cement products, concrete, fibrous boards, etc., an advantage. Five-day week, canteen, transport facilities. Pension Scheme. Apply, stating age, experience and salary required, to **PERSONNEL DEPARTMENT, THE UNIVERSAL ASBESTOS MANUFACTURING COMPANY, LIMITED, TOLPITS, WATFORD.**

WILTON ICI WORKS

Applications are invited from

GRADUATE CHEMISTS

or

CHEMICAL ENGINEERS

with a good Honours Degree, for employment in the planning and operation of the services and facilities required by a large integrated chemical factory.

Wilton Works is expanding fast, and new plants are being designed, constructed and brought into operation each year. It is situated at the foot of the Cleveland Hills and close to the North Yorkshire coast. There is a wide range of recreational facilities in the district, and among the many provided by the Company are golf, tennis and squash racquets.

The appointments are permanent and carry an attractive salary. There are contributory pension and profit-sharing schemes. Assistance can be given towards purchasing a house, and a contribution is made to the removal expenses of married men.

Applicants without industrial experience will receive consideration, as training facilities exist.

Apply for an application form to the Staff Manager, Imperial Chemical Industries Limited, Wilton Works, Middlesbrough, Yorkshire, quoting advertisement reference ICI/X/304/c

Situations Vacant—*Continued*

CHEMIST. Wanted, experienced colour chemist with knowledge of aniline and gravure inks and solvent recovery. Superannuation Scheme in operation. Apply, stating previous experience and salary required etc. to: **FISHER'S FOILS LIMITED, EXHIBITION GROUNDS. WEMBLEY, MIDDLESEX.**

FOR SALE

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

FOR protection against Acids and Alkalis you must wear overalls made from Terylene and Courlene. They will last long and clean easily. Send for samples of materials and prices of Laboratory Coats, Boiler Suits, etc., from the actual manufacturers, **M. LEY, 4, SHAFTESBURY AVENUE, KENTON, MIDDLESEX** (Wor 1518).

FOR SALE—60 tons Wool Wax. Low price accepted. Can be inspected. Sample free. **H. M. KERSHAW, OXENHOPE, KEIGHLEY.**

MORTON, SON AND WARD, LIMITED,

STAINLESS STEEL VESSELS

VESSELS of all shapes and sizes, jacketed or unjacketed —with stainless steel mixing gear to requirements; also stainless steel storage tanks and vacuum vessels.

"MORWARD" "U"-shaped TROUGH MIXERS — up to 2 tons in stainless steel, with agitators, scroll or paddle type, jacketed or unjacketed.

Stainless Steel **TROUGHS, TANKS** and **CYLINDERS** made to requirements.

These items can also be fabricated in mild steel.

JACKETED PANS

100g., 150g., and 200g., new in mild steel, for 100 lb. p.s.i. w.p.—with or without mixing gear.

3 cwt. **TROUGH MIXERS** by **CHALMERS** and **GARDNER** —stainless steel lined troughs.

50g., 75g. and 100 g. heavy duty **MIXERS** by **FALLOWS** and **BATES.** Agitators driven through bevel gears from fast and loose pulley.

200g. cast-iron **JACKETED MIXING VESSEL** with nickel-chrome impellor type agitator driven through bevel gears from fast and loose pulley.

BROADBENT HYDRO EXTRACTORS

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

PUMPS

Selection of new MONO and second-hand Pumps in stock—2 in. to 5 in.

Inquiries Invited.

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

600

CHEMICAL PLANT

PATENT TUBULAR DRIER by R. Simon, approx. 14 ft. by 6 ft. by 6 ft. cast iron construction. Revolving reel Agitator of solid drawn steel tubes, suitable 60/80 lb. sq. in. W.P. motorized 12½ h.p. 415/3/50. Separate belt drive to No. 4 Sturtevant extractor Fan, Feed hopper included.

OVEN by Laboratory Thermal Equipment. Thermostatic control at 105 C. Fitted two shelves 18 in. by 19½ in. with racks available for 5 shelves. Loading 2,250 watts for operation on 100/110/1/50. With transformer.

Horizontal steam jacketed **DISINFECTOR** by Aveling Barford. 4 ft. diam. by 7 ft. Swing door each end. Fitted full length wheeled basket. Jacket pressure 30 lb. Chamber pressure 15 lb.

6 Unused self balancing **HYDRO EXTRACTORS** by Bradford. 26 in. diam. galvanized basket. Fitted spring op. self releasing brake, galvanized hinged lid guard. Motorized.

2 **FILTER PRESSES,** plate and frame type, ca. with 51 frames forming cakes 29 in. sq. by 2 in. Individual plate discharge. Plates have ribbed surfaces.

Plate and frame **CAST IRON FILTER PRESS** by Johnson. 12 frames for cakes 17¾ in. sq., by ⅝ in. Pyramid surfaces. Bottom side feed 2 in. Hand closing. With Ram Pump 3¾ in. bore by 4½ in. stroke.

GEORGE COHEN SONS & CO. LTD.
WOOD LANE, LONDON, W.12.
Tel.: Shepherds Bush 2070 and
STANNINGLEY, NR. LEEDS
Tel.: Pudsey 2241

MIXERS—1 Baker Hand-tilted Trough, 16 in. by 24 in. by 20 in. Fast and loose pulleys and clutch. "Z" blades.

1 Ditto Power-tilted Trough, 30 in. by 20 in. by 24 in. Pulley drive and clutch. Four "L" blades.

THOMPSON & SON (MILLWALL), LTD.,
LONDON, E.14.
TEL.: EAST 1844.

PHONE 98 STAINES

MONEL METAL JACKETED PAN—45 in. by 19 in. deep.

STAINLESS STEEL JACKETED MIXERS—39 in. by 32 in. and 40 in. by 24 in.

STAINLESS STEEL PANS—2 ft. 6 in. by 2 ft. 4 in. (Two).

850 and 625 gallon **GLASS-LINED CYLINDRICAL ENCLOSED TANKS.**

(Unused) **PORTABLE STIRRERS**—440/3/50, ½ h.p.

JACKETED CYLINDRICAL OVENS—8 ft. by 5 ft., 7 ft. by 5 ft., 7 ft. 6 in. by 3 ft., 7 ft. by 3 ft., and 6 ft. by 4 ft.

20 & 30 gallon Electrically heated **PANS,** also Welded, Cast-iron and Copper **JACKETED PANS, MIXERS, PUMPS, STILLS, HYDROS, CONDENSERS,** etc.

HARRY H. GARDAM & CO., LTD.

STAINLESS STEEL 200 and 100 gallon Stirring Vats. Water Jacketed.
CHANGE-CAN or Pony Mixer 25 gallons. A.C. Motor.
JACKETED Enclosed M/S Mixing Pans 20" × 28" deep.
MORTON 2-speed 20 gallon 'Z' Blade Tilting Mixer.
WILKINSON Ointment Mill.
VERTICAL Sterilizer 18" × 36".
REVOLVING DRUM 6' dia. × 2' 4".
100 gallon **HORIZONTAL PASTE MIXER.**
WINKWORTH MACHINERY LTD., 65 High Street, Staines. Tel.: 1010.

FOR SALE—1,500 tons Crude Hot-pressed Naphthalene, 78/78.9 C. Low price. **BOX No. C.A. 3473, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

TEFLON Joints, Rods, Strips, etc., and the Latest: **PLUGS** made of **TEFLON**, 8-58 mm. diameter. Valves entirely **TEFLON** lined. **MACHINERY (CONTINENTAL) LIMITED**, 175, Brompton Road, London, S.W.3. Tel.: **KENSINGTON** 6228.

TWO Torrance 6' **EDGE RUNNER MILLS** & one 5' by Cox.
GARDNER MIXER, trough 17' × 8' × 8'
Two **GARDNER SIFTER/MIXERS** size "H" and one "G"
FILTER PRESSES, C.I. and Wood.
Two Scott **S.E. EVAPORATORS** with Pumps & Motors.
MIRACLE MILLS, sizes 1, 2 and 4W.
No. 1 motorised **KEK** Mill, pin disc type.
RICHARD SIZER, LTD., HULL.
Tel. **HULL CENTRAL** 31743

2in/1½ in. PULSOMETER CENTRIFUGAL PUMPS, 40 g.p.m. 50 feet head, 1,800 r.p.m., vee pulley, aluminium body, gunmetal impellor, stainless steel shaft unused £17 10 0 each.
DEPTEX 1 COMPTON ROAD COLCHESTER

WORK WANTED & OFFERED

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

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

PULVERISING of every description of chemical and other materials for the trade with improved mills wharfage, and storage facilities. **THOS. HILL-JONES LTD., "INVICTA" WORKS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON." TELEPHONE 3285 EAST.**

WANTED

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

AUCTIONEERS, VALUERS, Etc.

EDWARD RUSHTON, SON AND KENYON (Established 1855).

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

Telephone 1937 (2 lines) Central Manchester.

SALE BY TENDER

THE Board of Trade has for disposal about 490 long tons **AUSTRALIAN RUTILE SAND** (minimum 95% TiO_2) packed in bags, lying in store in North Wales.

Full particulars and forms of tender (returnable by 5, June, 1956) may be obtained on application to the Board of Trade, C. & G. 8 (B), Room 317, Lacon House, Theobalds Road, London, W.C.1. (Telephone: Chancery 4411, Ext. 329/330).

HYDROGEN PEROXIDE
Concentrated Qualities Dyestuffs & Chemicals
COLE & WILSON, LTD.
24, Greenhead Road, HUDDERSFIELD
Phone: Huddersfield 1993. Grams: 'Colour' Huddersfield

KEEBUSH

Keebush is an acid-resisting constructional material used for the construction of tanks, pumps, pipes, valves, fans, etc. It is completely inert to most commercial acids; is unaffected by temperatures up to 130°C; possesses a relatively high mechanical strength, and is unaffected by thermal shock. It is being used in most industries where acids are also being used. Write for particulars to—

KESTNER'S
5 Grosvenor Gardens, London, S.W.1

The
CHEMICAL AGE
YEAR BOOK
1957 Edition

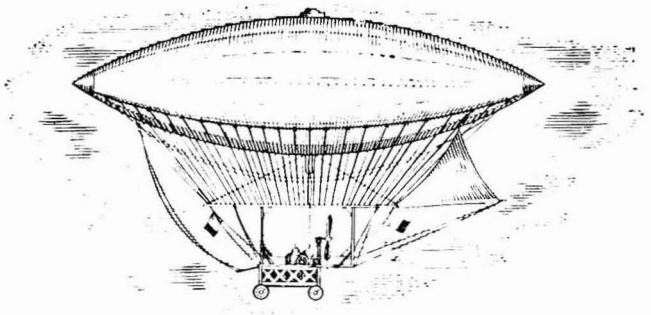
. . . . . a unique publication; the ***only*** *one of its kind*

Now in course of preparation

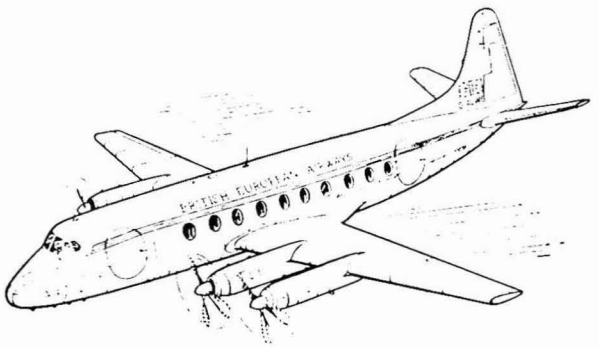
Have you reserved your space?

If not please write for particulars now

INDEX to advertisers in this issue



The span of a century has seen the development from the gas driven balloon to the Turbo-Jet. In this period also The Morgan Crucible Company has grown to a unique position; a position in which the products, parts and pieces they develop and manufacture are essential, either directly or indirectly, to every industry throughout the world. Their products may have helped the early aeronautical designers, certainly today's aircraft industry recognises the value of their aid—and the future will not ask in vain from the technologists and craftsmen who will use the knowledge and skill accumulated in these past 100 years.



CENTENARY **1856-1956**

carbon and graphite—electrical, chemical and mechanical; crucibles, furnaces, refractories; radio parts, and sintered metal products.

THE MORGAN CRUCIBLE COMPANY LTD., BATTERSEA CHURCH ROAD, LONDON, S.W.11 BATT: 8822
M.C.C. 115/A

Printed in Great Britain by THE PRESS AT COOMBELANDS LTD., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154 Fleet Street, E.C.4, 19 May, 1956. Registered at the General Post Office. Entered as Second Class Matter at the New York U.S.A., Post Office.