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Supply of Energy

FEW reports, and perhaps none from the same report-prolific source, have yet been more realistic than OEEC's recent *Europe's Growing Needs of Energy* (HMSO, 8s). The problem presented is the reverse face of the coin called mechanization or automation. For as man's own energy is less and less used in producing goods, so more mechanical energy is used. This process of transferring effort from man and muscles to machines and steam or electricity has been steadily expanding in the past century, and in the post-war period it has gathered pace. Additionally, most national populations are appreciably larger and demand for fuel and power *per capita* is rising with the growing use of machines for domestic work. These broadly stated factors in the energy picture are obvious enough. What has been too obvious in the past—and to the point of error—is the assumption that fuel and power supplies will always rise to meet the expanding demands. Because this happened when total demand was smaller, because coal was difficult to sell during the depression of the 1930s, these are not reasons to assume that the output of primary fuel, and the production of power, can perpetually satisfy the demands of mechanized industry and press-button households.

By no means is the OEEC report the first warning to be given. More than one eminent scientist has, in recent years, pointed out that too much attention is being devoted to raising the production of secondary goods and too little to the production of primary materials. Optimism (or, more accurately, wishful thinking) that atomic energy can fill the gap before it genuinely hurts civilization has been debunked by several atomic energy scientists. But on the whole few people are concerned about fuel and power supplies. Price increases are grumbled about, shortages of desired grades raise occasional protests, imports of coal are resented as signs of national weakness—but most people, including men of considerable responsibility, do not take these happenings as evidence of fundamental shortage, or as portents of greater shortage to come. In Britain clear thinking has been fogged by politics. The merit of the OEEC report is that it reveals the problem as a product of our times and as one that is being faced over a wide area. Set against the facts in the report, Kensington's views on the Rhondda Valley or *vice versa* are meaningless.

The starkest picture of the OEEC area energy position can be presented quite simply by the following figures, with energy sources expressed in terms of coal equivalent:

	1955	1960	1975
Primary energy consumption	730	840	1,200
Indigenous production ..	584	645	755
Gap (in million tons of coal equivalent)	146	195	445

Briefly, estimates of demand have been based upon the assumption that industrial trade and development will continue along present lines, and four separately made estimates have been averaged. Estimates of home-production of all sources of fuel or power have been based upon present rates of increase and upon the assumption that these rates will steadily persist. This is all reasonable prediction. As for the yardstick term of

'coal equivalent', this just as reasonably covers the indigenous energy resources of coal, lignite, hydro-electricity, crude oil, and natural gas. What the figures imply, however, is that the percentage of primary energy to be met by fuel imports into the area is 20 per cent for 1955, 23 per cent for 1960, but 37 per cent for 1975. How will certain European countries stand this extra strain upon their balance - of - payments position ? For imports of energy mean coal and oil, and exportable surpluses of these, inasmuch as they exist in 1975, will tend to be dollar area commodities.

Those who compiled the report drew the obvious conclusion that Europe's indigenous energy sources must be developed more fully. Contributions from natural gas and oil were assumed as still in 1975 'unlikely to be large'. Reserves of coal and lignite were assessed as capable of lasting for centuries. Water power at economic distances from industrial centres was likely to be fully developed by 1975. Therefore, the energy resources survey reached the conclusion that coal must mainly help to close the gap. Taking present UK and US estimates as a basis, it was assumed that by 1975 nuclear power could not be providing more than 8 per cent of Western Europe's total energy needs. This must be taken as a reasonable estimation, within limits of current knowledge and hopes.

Europe's coal industry, then, is still a major one and may well remain the most vital artery of her civilization. The report deplores 'the growing tendency to regard coal as a static or even a dwindling industry . . .'. Coal is essentially a long-term industry which by its nature lacks the flexibility of other industries . . .'. Its future 'depends on long-term investment and it was clear from all the evidence we heard that conditions are unfavourable to this at the moment'. On modernization and mechanization, 'the coal industry should consider whether it is investing sufficient funds in research'. The industry's man-power situation is perhaps its most critical feature. Despite many improvements for conditions of work and in play, it has been unable to hold its own in the competition for labour . . . . Better recruitment must depend upon the obvious inducements of good pay and terms of employment and improved working conditions. Another factor, perhaps less obvious, is the need to remove doubts about the future of coal. The use of foreign man-power in countries well endowed with coal and mines is referred to in the report. The fact that 65 per cent of the underground workers in Belgium's industry are foreign is mentioned, as are 'objections which have been made in certain countries to the introduction of foreign workers'.

Could oil bridge the gap if coal fails to do so? Evidence had to be gathered from oil companies, since the OEEC area's own oil production even now amounts to only 10 per cent of need. The companies' views were that ample world reserves existed to meet Europe's maximum needs in 1975, but heavy self-financing investment by the oil industry would be required. To make this possible, earnings from oil sales in Europe would have to be maintained at a reasonable level, i.e., without restrictions such as price controls or fiscal devices to reduce profits. The report seems—and this word is appropriate for no clearer verdict is given—to give imported oil a steadily expanding future as one of Europe's energy sources, but with an undefined share.

What is said of Britain in the appendix section on member-countries' energy supply positions provides a fitting conclusion. 'Despite substantial coal reserves . . . the UK is faced with a critical shortage of coal. This is largely because of the very low level of investment in the industry between 1913 and 1947. Only one-fifth of the output at nationalization came from mines that had been sunk in the preceding 30 years. . . . In recent years a substantial increase has taken place in investment, but because new mines and major reconstructions take many years to complete, the fruits of this investment are necessarily delayed'. It might be far better for the future of Britain's coal industry's if this view had more general acceptance—yet only recently a powerful section of the Government called for reduced capital expenditure by the NCB, and for Parliamentary control over such expenditure.

Notes & Comments

Flame Proof

BURNING accidents and their prevention have been surveyed by those indefatigable workers, Dr. Leonard Colebrook and his wife, Mrs. Vera Colebrook, and Doctors J. P. Bull and D. M. Jackson, in the *British Medical Journal* of 16 June. That part of their paper which deals with ways of minimizing the risk of clothing burns deserves close study by all who are engaged in research on textile processes. Hitherto there have been a number of fairly serious difficulties in connection with producing and marketing, at a reasonable price, textiles which can be described as flame-proof. Now, however, processes have been developed which offer considerable possibilities in this direction. Furthermore, a recently introduced test for flammability is applicable to the grading of most clothing materials. Dr. Colebrook and his co-workers say that with the adoption of a standard test, the flammability grading of all fabrics should be required, and this grade should be indicated by an appropriate mark when the fabrics are offered for sale. In addition, they consider a test for undue flammability should be undertaken as standard practice in the experimental stages of all future new materials. If any such materials are found to be exceptionally hazardous they should not be mass-produced in this condition. The use of flammable finishes on threads which are by nature flame-resistant should be avoided. Where chemicals known to be dangerous are employed in flame-proofing procedures, Colebrook and partners say that the possible hazard to the wearer of the garment should be borne in mind, and recognized tests for toxicity should be carried out before the material is put on the market. Their final recommendations, though not directly connected with processing are nonetheless important. These are: As soon as satisfactory flame-proofed clothing materials become generally available, every effort should be made to encourage their use in place of unproofed fabrics of the same kind. Should it become evident that the higher cost of the safe materials is putting them out of the reach of many parents and old-age pensioners, then the case for a Government subsidy (designed to reduce the retail cost) should be pressed. This is indeed a challenge. It should not be beyond the skill of scientists to evolve flame-proofing processes which meet all requirements, yet add little to the cost of the finished material. Neither should it be beyond the ingenuity of commerce to make such material available to the public on the widest possible scale.

Selling to Sweden

ATTRACTIONS of the Swedish export market have been stressed in the *Board of Trade Journal*. Swedish prosperity has been quietly and steadily maintained throughout the post-war period—crises or drastic measures to avert them do not seem to have invaded the Swedish economic pattern. Recently, measures of an anti-inflationary type have been taken—h.p. terms tightened, interest rates raised, etc. This may have moderated Sweden's general expansion, but nevertheless the market is still enlarging. And Sweden is a country of low tariffs with virtual freedom from import quotas and exchange restrictions on import transactions. Countries belonging to OEEC or the dollar area will in practice find no impediments to export business with Sweden. British sales to Sweden have been declining in recent years. In 1950 our share of that country's import trade was 19.8 per cent, by 1955 this had fallen to 13.7 per cent. Yet in this period Sweden's total import trade had risen by 70 per cent (by value). Obviously we have been slipping back and other countries have been getting more orders, notably Western Germany. One reason for this is plainly stated by the Swedes themselves: 'UK sales and technical personnel do not come here as often or for as long as do, particularly, their West German competitors. . . . West German firms spend something like three times as many commercial man-days in Sweden. . . .' Chemical exports, however, have not been falling in immedi-

ately past years, as these Board of Trade figures show:

Value, £'000

	1953	1954	1955
Chemicals:	4,805	6,138	6,159
Elements & compounds ..	1,922	1,856	1,624
Dyestuffs etc.	208	269	251
Pigments, paints, etc. ..	480	557	569
Drugs, medicines	387	426	526
Soaps, perfumery, etc. ..	289	745	705
Plastics	876	1,213	1,298

Nor does the sales position of chemical-allied goods seem too disturbing. Non-ferrous base metals were exported to a value of £2,257,000 in 1953, and £3,694,000 in 1955. Scientific instruments (although as usual this classification includes cameras and watches!) had an export-sales value of £1,364,000 in 1953, and of £1,561,000 in 1955. It would certainly seem that British chemical scientific goods are increasing their sales in Sweden and at a rate not seriously below the rate of expansion of the Swedish market itself. Yet no one would imagine that competition from Germany has been anything but keen and persistent, for these are the old 'naturals' for German business—typically German products and an adjacent market to sell them in. If a fuller study of export statistics figures is made, it is clear that the trend for the UK share in Sweden's needs to drop back is more evidenced in some classes of engineering goods, vehicles, etc. Still, if the chemical picture appears to be good, there is nothing to show that it could not be better. There is obviously a strong Swedish desire to buy British chemical products or sales would not be increasing so consistently. Is that disposition to place business with us being fully exploited? Are personal contacts with buyers sufficiently frequent?

Diamonds Count

THAT extraordinary form of carbon, the diamond, seems to be developing one more scientific-cum-industrial use. In *Nature* (1956 [177] 1075) the definite suggestion is made that certain types of natural diamond will act as ideal room-temperature radiation counters. It is this temperature feature that is so useful for crystal counting instruments which could then be more simply designed. Also, the diamond being carbon, its electronic density is of the same order as that of human tissue; that is to say, high-speed particles would penetrate both to about the same degree. It can therefore be assumed that a diamond counter could be used to measure dosage-rates for patients receiving ray-therapy more accurately than other types of counters. There is, as often with natural materials, one snag. Polarization can develop through the building-up of 'space charge' inside the diamond crystal; there are electron-trapping sites in most diamonds. This building-up of a space-charge reduces a diamond's counting efficiency. Such a defect might have been regarded as insuperable, but the view was taken that some diamonds 'electronically perfect enough not to be seriously affected by polarization' must exist. Some 100,000 diamonds have been sorted, using the ultra-violet fluorescence test, and this optimistic view that these exceptional diamonds can occur has been confirmed. They are described as 'structure-sensitive diamonds peculiar to certain diamond fields,' and it is said that diamonds of this kind have now been in counting use (experimentally) for five years. An interesting speculation is whether synthetic diamonds could be made without the structural defect of internal electron traps. Perhaps this would be too tall an order. However, it was a US electrical company that claimed early last year to have developed a synthetic diamond batch process (*Chemical Engineering News*, 21 February, 1955).

Automation Meeting

A MEETING on automation, arranged by the Manchester Joint Research Council, will be held in the Whitworth Hall, University of Manchester, at 2.15 p.m. on 9 July. The meeting will be addressed by the Earl of Halsbury, F.R.I.C., F.Inst.P., managing director of the National Research Development Corporation, who has indicated that his talk will range over a wide field.

Applications for tickets should be made to the Joint Secretariat of the Manchester Joint Research Council, c/o Manchester Chamber of Commerce, Ship Canal House, King Street, Manchester 2.

Chemistry & Medicine

'INDUSTRIAL Chemistry in the Service of Medicine' was the title of an address due to be given by Mr. John E. McKeen, president and chairman of Chas. Pfizer & Co. Inc., at a meeting of the British Association of Chemists in London on 20 June.

Born in New York, Mr. McKeen graduated in 1926 with a B.S. degree in chemical engineering. The day after his graduation, he became associated with the Pfizer organization as a control chemist.

In 1935, he was appointed head of one of the manufacturing departments, and subsequently became assistant superintendent of the company's New York plant. During this period he was in Britain to assist in the design and construction of a fermentation plant.

Mr. McKeen was appointed superintendent of the New York plant in 1942 and throughout World War II he directed the expansion of the Pfizer plant to supply critical chemicals and penicillin.

In 1944, he was appointed to the board of directors, and a year later was elected a vice-president, becoming president in 1949 and chairman a year later.

Mr. McKeen holds degrees in engineering and laws, together with many foreign decorations.

Mr. John E. McKeen, president and chairman, Chas. Pfizer & Co. Inc.

Netherlands Antilles Exports

According to the Canadian publication *Foreign Trade* for May, exports of phosphoric lime from the Netherlands Antilles in 1954 amounted to 125,940 tons. Mining is carried out on the island of Curacao.

Management of Research Labs

THE ACUTE shortage of scientists makes good management of research laboratories of particular importance today. The problems of how to choose a research project, of when and how to stop research and the proper use of research staff and facilities is a matter to which considerable attention is being directed. The National Physical Laboratory is to provide a focus for all this thought at an international symposium on the direction of research establishments to be held at the NPL, Teddington, Middlesex, from 26 to 28 September.

Opening speakers on the selection of the research project will be Professor J. D. Bernal and Dr. Willis Jackson. Major discussions will also be held on developing the creativity of scientists, and administrative controls on their work.

Three parallel groups will discuss methods of internal organization, staffing and communication problems, and a final session will be addressed by Mr. A. H. Wilson on the methods by which the work of a laboratory can be assessed.

Among the chairmen of the main sessions will be Dr. H. W. Melville, the new secretary of DSIR, and Dr. G. B. B. M. Sutherland, who takes up the post as director of the NPL early in September. Group chairmen are to be Dr. J. Bronowski, National Coal Board, Dr. D. Hill, director, Shirley Institute, and Dr. A. King, head of Intelligence Division, DSIR.

This is believed to be the first international conference on science administration held in this country at which representatives of industry and government organizations will be able to exchange their experiences. Attendance will be restricted to directors of research and research administration.

Details are available from the secretary of NPL, Teddington (MOLesey 1380).

Turkish Chemical Fertilizer Plans

A superphosphate plant, with a capacity of 100,000 tons a year, has been built recently in Iskenderun with the assistance of American capital. Now another plant is to be started. Work on the Kütahya plant of the Turkish Nitrate Company is expected to be completed by mid-1958. Annual output capacity of this plant will be 110,000 tons of chemical fertilizers and 8,000 tons of nitric acid. Plans for increasing this output are already being studied.

Expansion at Littleborough

UK Firm to Produce Armour Chemicals

PRODUCTION of Armour Chemicals in this country was inaugurated on Tuesday, 19 June when Mr. S. R. H. Fletcher, chairman of Hess Products Ltd., officially opened a new chemical section at the Littleborough, Lancs, plant of Hess Products Ltd.

Armour & Co. Ltd. and Hess Products Ltd., acted as joint hosts at the ceremony which was attended by many representatives of industry, commerce, the academic world, research institutions and other bodies.

Anglo-American Co-operation

Speaking at the inaugural luncheon, Mr. T. D. Lively, managing director, Armour & Co. Ltd., London, described the new plant as a good instance of Anglo-American co-operation. It was a joint effort involving the most intimate co-operation in all aspects.

Mr. J. Hoerner general manager, Armour Chemical Division, Chicago, Ill., who flew over specially for the occasion, said the plant was designed as a replica of the Armour plant at Chicago. Referring to the company's products, he added that the phenomenal growth of these non-ionic and cationic products which the US had experienced in the past few years was being repeated in Britain, Europe and other countries.

The company's fractionation plant, which has been producing Distec fatty acids for over five years, supplies the raw materials needed in the new plant. The units, both of which are fully automatic and run continuously, are placed next to each other and are connected with pipelines and pumps. The factory is planned on the 'straight run' principle. Raw materials—animal and vegetable oils—enter the factory at one end and finished products emerge at the other end where they are stored in tanks for bulk or packaged delivery, or pumped directly into road tankers for despatch to customers in this country or for filling ships' tankers for export.

As the raw fats enter the factory they are first submitted to a preliminary cleaning and are then split in autoclaves at high pressure, yielding glycerine and fatty acids. Glycerine is regarded as a valuable by-product and is purified and concentrated on the premises. The fatty acids are then distilled or fractionated according to need.

The fractionating plant works on principles similar to those used in the petroleum industry using bubblecap trays and reflux control to obtain a maximum degree of fractionation at an economical cost. For a unit of identical throughput a fatty acid fractionation plant is however much more expensive that a petroleum fractionator because stainless steel has to be used throughout. This is necessary not only because hot and especially volatilized fatty acids are highly corrosive to mild steel, but because even minute metallic contamination can completely discolour a fatty acid. The fatty acids produced in the plant are sold by Hess Products Ltd. under the trademark Distec and are used in rubber, paints, cosmetics, lubricating greases and many other fields.

In the new plant the fatty acids are brought into intimate contact with anhydrous ammonia, forming nitriles. The ammonia is produced on the spot in a separate distilling plant. A portion of the nitriles is sold under the trademark Arneel, but the bulk is processed further. When hydrogenating a nitrile primary $R.NH_2$, secondary $R_2.NH$ or tertiary $R.R'_2.N$ amines result according to the type of catalyst used and the operating conditions. All these amines are sold under the trademark Armeen and find applications in many industries.

Further Processing

The amines can, however, be processed further. For instance, they are made into Ethomeens, which are ethylene oxide condensation products of amines. They are also made into their water soluble forms, i.e. their acetate salts, which are sold under the trademark Armac, or their quaternary ammonium salts, sold under the trademark Arquad. A range of oil-soluble quaternary salts of the type dialkyl-di-methyl-ammonium-chloride is also manufactured. The two most widely used chemicals of this

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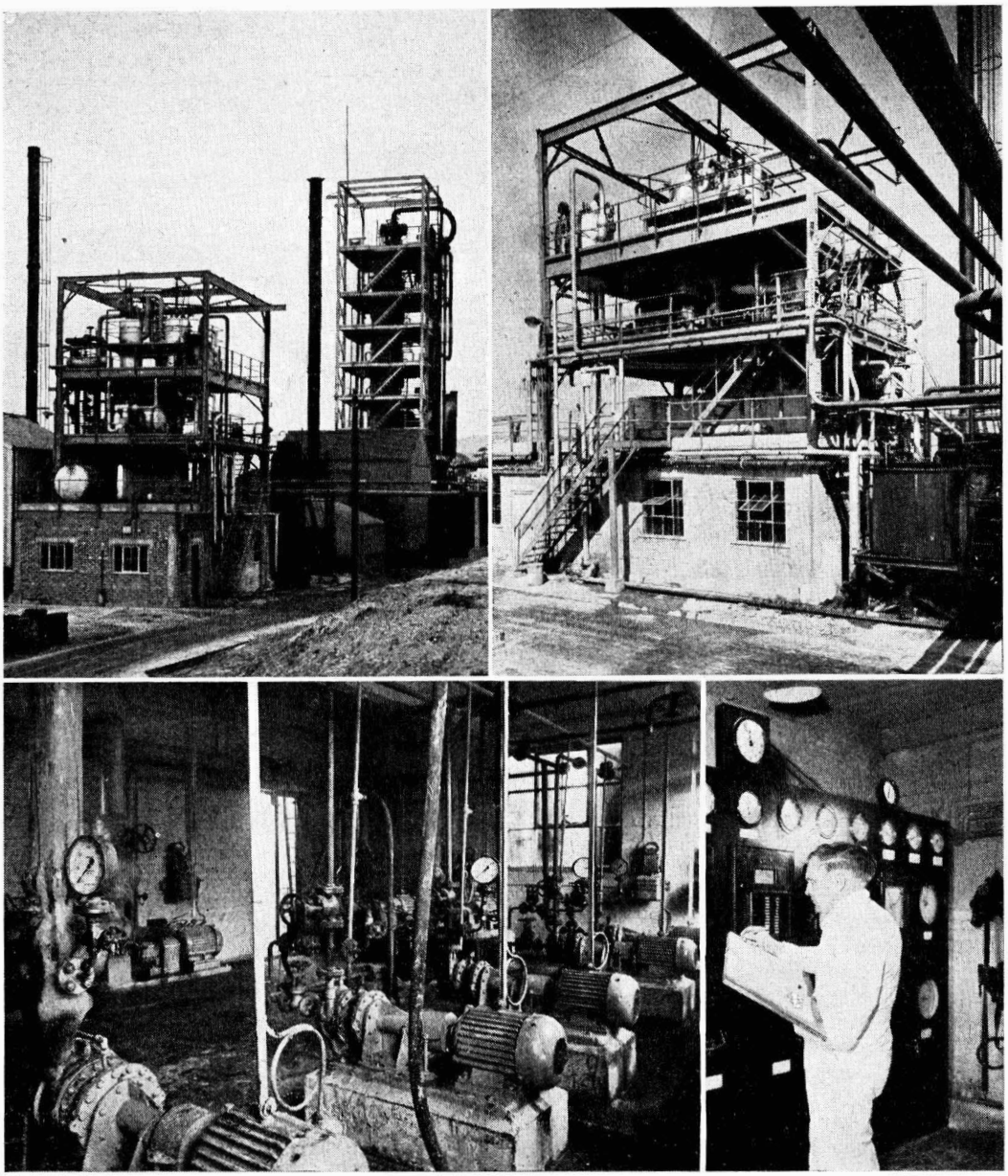
Anglo-American Co-operation Expanded This Plant



This is the plant of Hess Products Ltd. at Littleborough, near Rochdale, Lancashire. Picture 1 shows the fractionating unit producing Armour chemicals and in the background the fractionating unit for the production of DISTEC fatty acids. Picture 2 is the continuous catalytic unit in which fatty acids and ammonia are reacted to give nitriles (ARNEELS) which, on hydrogenation, yield amines (ARMEENS). Picture 3 illustrates the machinery layout in the pump room of the continuous nitrile unit, while in 4 is shown the instrument panel for the automatic control of the nitrile unit. (A. T. Handley Ltd. photographs)

Littleborough Expansion

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range are Arquad 2HT made from hydrogenated tallow and Arquad 2C made from coconut oil.

Another interesting range of products are the Armids, which are non-ionic amides of fatty acids of the general formula $R.CO.NH_2$, and the Duomeens, which are diamines of the formula $R.NH.C_3H_6NH_2$, where R are fatty acid chains. The Duomeens themselves are capable of a number of additive and other chemical reactions.

All Armour chemicals made by Hess Products Ltd. are sold in this country by the chemical division of Armour & Co. Ltd., London EC1, who are also responsible for all exports. The outstanding characteristic of Armour chemicals is that all of them are cationic or non-ionic. Some are oil soluble, some are water soluble, and most dissolve in the common industrial solvents. Both oil and water soluble types have the characteristic of plating out in the form of mono-molecular films on most solids.

Many Uses

Armeens and Duomeens are used in primer paints to cause them to adhere to damp surfaces, for pigment grinding for paints and printing inks, as anti-stripping agents for road making, as corrosion inhibitors in the petroleum industry, for cutting oils and other preparations for the metal working industries etc.

Armacs are mainly used as flotation agents, emulsifiers, wetting agents, solubilizers etc. and Arquads are used as textile softeners, laundry aids agricultural toxicant emulsifiers, bactericides, in the production of oil corrosion inhibitors, anti-static agents, in the manufacture of foam rubber etc.

Armides are used as foam stabilizers, wax substitutes, mould release agents etc. The non-ionic Ethomeens and Ethomids are used as emulsion stabilizers in latex paints, in rubber latex, as emulsifiers for insecticides and other agricultural toxicants etc.

Aircraft Design Centre

A fully equipped aircraft and guided missile research and design centre is being built at Whitley near Coventry for Armstrong-Whitworth Aircraft Ltd. The centre will include laboratories, and design offices.

Grangemouth Polythene Plant

A PLANT at Grangemouth, Scotland, is being erected for Gemec Chemicals Co., a subsidiary of Union Carbide. When complete it will bring the total annual production of polythene by Union Carbide to about 290 million lb. a year. Production is expected to begin in 1957.

Site of the plant is Grangemouth airfield, the cost is likely to be approximately £105,000. It will be the first polythene plant built by Union Carbide in Europe.

Bakelite Ltd. have an agreement with Union Carbide under which Bakelite will market polythene plastics produced in the United Kingdom by Union Carbide. The sales organization of Bakelite will be available for sales of this polythene both at home and in export markets, according to THE CHEMICAL AGE, 1955, **73**, 232.

Polythene produced by Gemec Chemicals Co. will be of the same quality and type as that made in the US by Union Carbide.

Control for Detergents ?

THE composition of household synthetic detergents may come under state control if the Government accepts the majority view of the Committee on Synthetic Detergents. Independent research into the effect of detergents on sewage treatment processes and effluents, and on public water supplies is also recommended by the Committee, whose report was published on Wednesday 20 June as a blue book. (HMSO 3s).

The report further stresses that a new type of agent, which is the basis of most of the household detergents, is not eliminated by existing sewage treatment processes and is being carried back to the domestic consumer in drinking water.

Dunlop Research

A considerable part of the work of the Dunlop research centre at Castle Bromwich near Birmingham, is being devoted to research on new synthetic fibres developed by the textile and chemical industries, and their adaptation for Dunlop products. In conjunction with the research centre's activities, intensive research by Dunlop Cotton Mills continues with a view to introducing improved synthetic and natural textiles for the widening field of activity in the rubber and plastics industry.

OVERSEAS

Oil Exploration in W. Africa

An oil exploration licence, covering a large area of Senegal, West Africa, has been granted to British Petroleum's French associate, the Societe Francaise des Petroles BP. A new company, Societe des Petroles de Senegal, is to be formed shortly to take over this licence and carry out oil exploration in the area. BP Exploration Co. will have a 30 per cent holding in the new company and SF BP a 20 per cent holding. The remaining 50 per cent participation will be in the hands of French Government organizations.

Nickel Production Still Rising

Free world mine production of nickel continued its upward trend for the fifth consecutive year to establish a record of about 225,000 short tons in 1955, an increase of about 15 per cent over 1954. Canada produced about 78 per cent of the total. Total consumption of nickel was 109,153 short tons in 1955 compared with 94,733 tons in 1954.

American Celanese in Europe

Celanese Corporation of America European office has been moved to 17 Rue Neuve du Molard, Geneva, from Dusseldorf, Germany. Mr. R. J. Davis remains in charge of the office.

Australian Coal to be Displaced

During the next year coal will be displaced by other fuel in the boilers of the South Australian Electricity Trust, and by the supply of gas from Petroleum & Chemical Corporation (Australia) Ltd. to the Australian Gas Light Co. (Sydney), states the report of the Joint Coal Board.

Industrial Fellowships

Celanese Corporation of America has established graduate fellowships in 13 universities in the US. Fields of study covered by the fellowships include physics, chemistry, engineering, textiles, cellulose and plastics.

Hydrogen Atmosphere Furnace

A unique hydrogen atmosphere furnace for use in the heat-treatment of delicate equipment is being manufactured by W. J. Mills & Co., of Annandale, Sydney. It is built to operate for 24 hours a day at temperatures up to 1,000°C. The company specializes in different problems of heat treatment in manufacturing processes, and its furnaces are used in most types of laboratories in Australia.

Search for Underwater Oil

A steel artificial 'island', from which oil wells can be drilled into the sea bed, has just been set in position in the South China Sea, 25 miles from the coast of Brunei, British Borneo. The 'island' is expected to be completed, and drilling operations begun, in about two months' time. A second, similar, 'island' is shortly to be set up eight miles from the coast of Sarawak and 60 miles south-west of Ampa Patches. The total cost of these two projects, which are being carried out by the Shell Petroleum Co. Ltd., is expected to be about £625,000.

Norway's Industrial Productivity

A survey published by the Central Statistical Office, Oslo, shows that in the first three months of this year industrial production in Norway was 7 per cent greater than in the first quarter of last year. The value of imports during the first quarter (1956), not including ships, was 2 per cent above the level for the corresponding period in 1955. Exports were 13 per cent greater, 65 per cent of this increase being due to higher exports of metals. The Office comments that it is the heavy investment in the electro-metallurgical industry after the war which is now yielding results.

Atoms for Asia

A new nuclear centre for Asia, operated under the Colombo Plan, is to be established in the Philippines. The centre was proposed by the United States at the Colombo Plan meeting in Singapore last October 'as a means of putting atomic energy to work for the economic and social progress of Asia'.

Butyrate Pipe Production

Polychemical Industries Ltd., the first plant to make butyrate pipe in Canada west of the Lakehead, expects to be in production by 1 July and to turn out 1,000,000 ft. of such pipe by 31 December. The company, headed by Mr. L. G. McCulloch, former president of Regent Drilling Co. Ltd., will be able to produce 2,500,000 ft. of butyrate pipe annually. Raw materials are imported from the US.

Second Plant Protection Conference

Over 200 Delegates at Fernhurst

OVER 200 delegates from 40 countries came to England for the Plant Protection Second International Conference which was held at the Fernhurst Research Station, Sussex, of Plant Protection Ltd. (a subsidiary of ICI) on 19, 20 and 21 June. The subjects discussed included means of combating weeds, insect pests and diseases which account for the loss of at least half of the world's food supplies every year.

At the inaugural luncheon, held at the Dorchester Hotel, London W1, on 18 June, delegates were welcomed by Mr. E. M. Fraser, chairman of Plant Protection Ltd. The guest of honour was Mr. R. A. Butler, C.H., M.P., Lord Privy Seal.

Fernhurst Research Station carries out investigations into the efficiency of a wide range of agricultural and horticultural chemicals and into their suitability for application under field conditions. Hormone weedkillers, which were discovered at the ICI research station at Jealott's Hill, Berkshire, were largely developed at Fernhurst.

Conference Programme

The programme of the conference was as follows:—

Tuesday 19 June

Morning Session:— *Chairman*: Sir Frank Engledow 'World Aspects of Crop Protection'. *Author*: Dr. J. G. Knoll (FAO).

Afternoon Session:— *Chairman*: Dr. S. C. Harland (UK) 'Genetics in Relation to Crop Protection'. *Author*: Dr. W. F. Hanna (Canada) *Principal Speakers*: (1) Professor K. G. Suchorukov (USSR), (2) Dr. R. L. Knight (UK, formerly Sudan).

Evening:— Tour of Fernhurst Research Station.

Wednesday 20 June

Morning Session:— *Chairman*: Sir Rudolph Peters (UK) 'The Mechanisms of Toxicity'. *Author*: Dr. S. E. A. McCallan (US). *Principal Speakers*: (1) Dr. J. W. L. Beament (UK), (2) Dr. J. T. Martin (UK).

Afternoon Session:— *Chairman*: Professor T. A. Bennet-Clark (UK) 'The Role of Systemics in Crop Protection'. *Author*: Dr. R. L. Metcalf (US). *Principal Speakers*: (1) Dr. P. W. Brian (UK), (2) Dr. E. Aberg (Sweden).

Evening Session:— *Chairman*: Professor S. Zuckerman (UK) 'Residual Effects of Crop Protection Chemicals'. *Author*: Dr. J. M. Barnes (UK). *Principal Speakers*: (1) Professor R. Tauhaut (France). (2) F. J. D. Thomas (Australia).

Thursday 21 June

Morning Session:— *Chairman*: W. C. Moore (UK) 'Applying Crop Protection Chemicals'. *Author*: R. P. Fraser (UK). *Principal Speakers*: (1) Dr. E. W. B. van den Muijzenberg (Holland), (2) Dr. R. C. Rainey (UK).

Afternoon Session:— Demonstration of crop protection machinery. *Commentator*: F. W. J. Lane (UK).

In a paper entitled 'The Role of Systemic Insecticides in World Agriculture', presented at the session on 'The Role of Systemics in Crop Protection', Robert R. Metcalf of the University of California Citrus Experiment Station said that systemic insecticides were insect poisons which could be absorbed by plants (e.g. through roots or foliage) and permeate their tissues in the sap (or accumulate in parts of the plant susceptible to insect attack), thus poisoning insects which fed on them. The author gave a brief historical account of the development of systemic insecticides, starting with selenium compounds, followed by the fluoroethyl acetals, then organic phosphorus compounds, (e.g. OMPA or schradan, dimefox and systox (R)), and the carbamic acid esters (e.g. isolam).

Properties Defined

The properties needed for a systemic insecticide were defined as: sufficient solubility in water; ability to penetrate into the plant through root, leaves or stem; sufficient stability to persist in the plant for a reasonable time.

The author then reviewed the current position of systemic materials for crop protection in agriculture with special reference to the well-established commercial compounds: schradan, dimefox, systox (R)

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1. Rt. Hon. R. A. Butler, Lord Privy Seal, speaking at the second international plant protection conference inaugural luncheon held in London on 18 June. 2. Sir William Ogg, director of the Rothamstead Experimental Station (left), being welcomed by Mr. E. M. Fraser, Chairman, Plant Protection Ltd. 3. Mr. K. T. Suhorukov from Russia (right) talking to Mr. P. S. Hudson of Cambridge and a fellow geneticist

4. Mr. & Mrs. B. P. K. Rao of ICI (India) Ltd., were among the many overseas representatives attending the luncheon. 5. Dr. S. Sidky of the Egyptian Ministry of Agriculture talking to Mr. G. A. Fetouh from the Egyptian Embassy. Also in the group is Mr. A. Farisi of the Iraq Embassy

Plant Protection Conference

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or demeton, metasystox (R), and to other promising materials now under large scale testing or in limited commercial use, e.g. OS-2046, pyrazoxon, mipafox or isopestox (R), R6199, Thimet (R), isolan. The use of these materials was discussed from the standpoint of crops, pests, dosage, application methods and timing.

One of the most promising uses of systemic insecticides was as seed dressings for the protection of young seedlings of, e.g. cotton, sugar beet, lucerne, cabbage. This was likely to make possible the relatively inexpensive insurance of a healthy plant stand without several of the early treatments otherwise required, and it seemed safe to predict that such use would ultimately be made on millions of acres.

Another potentially very important development was the use of systemic insecticides with selective action in such a way that, while controlling noxious insects, they did not kill off the natural parasites and predators of such insects, or other beneficial insects, liable to suffer from ordinary contact insecticides.

Prevention of Virus Diseases

Systemic insecticides also showed great promise in the prevention of virus diseases which were propagated by insect vectors, for example, the swollen shoot disease of cacao which was carried by mealy bugs. The possibilities and limitations of the use of systemic insecticides for this purpose were discussed.

Public health problems of the use of systemic insecticides were then considered, in relation to hazards to the consumer of food crops which had been so treated, and with special reference to available information on the toxicity of such compounds or their transformation products to human beings, and the rate of decomposition or metabolic transformation in the plant tissues of materials such as schradan, dimefox, systox (R), metasystox (R), Thimit (R) and OS-2046.

As part of the session on 'Residual Effects of Crop Protection Chemicals', Dr. J. M. Barnes, of the Toxicology Research Unit, Serum Research Institute, discussed 'Hazards Arising from the Use of Toxic Chemicals in Agriculture'.

The paper dealt only with the hazards facing people who handled toxic chemicals. Such chemicals have been used in agriculture for many years, and there was nothing novel about the control of their use by statutory regulations and legislation.

A new era in the use of synthetic insecticides began with the introduction of DDT and BHC on a big scale in 1945. Both proved so safe to handle that few precautions had ever been taken by those using them on the largest scale. Soon afterwards, with the introduction of the organo-phosphorus compounds there were a few cases of poisoning by parathion, while there had already been some serious cases of poisoning by DNOC used as a weed killer.

Hazards Discussed

The hazards arising from the use of other toxic materials such as the new chlorinated hydrocarbons (aldrin, dieldrin, endrin, chlordane); pentachlorphenol; and mercurial fungicides, were also discussed and analysed.

For outdoor workers the skin was the main route of exposure, while indoor spraying also involved risks from inhalation. Experience suggested that even the most dangerous chemicals could be used with only minimum precautions, e.g. prevention of contact with the skin (as by wearing a shirt) and above all, by thorough washing with soap and water, but that these minimum precautions, and especially the availability and the use of facilities for washing, were absolutely vital.

In many cases poisoning had been the result of gross carelessness by workers, or ignorance of the risks involved through lack of proper instruction. Rules and regulations must be designed to protect the careless workers.

Treatment for cases of poisoning by the common crop protection chemicals were outlined, including atropine in cases of poisoning by organo-phosphorus chemicals, and barbiturates for poisoning by chlorinated hydrocarbons.

It was suggested that perhaps too high a proportion of effort might be directed to the devising of new pesticides and not enough to learning how to use safely those we already had. Toxicity by itself was no insuperable bar to use, especially if methods could be developed for simpler and safer handling.

A Review of Organic Phosphorus Insecticides

VI Parts—Part IV : Biological 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)

DESPITE the comparative newness of the subject of organic phosphorus insecticides, it will be obvious from the foregoing parts of this review that a considerable number of physical and chemical methods of assay of these compounds has now been established. Although much progress has been made, there is still much to be desired by way of a highly sensitive method which will determine with reliability and reproducibility, amounts of organic phosphorus insecticides in plant materials of the order of a fraction of one part per million.

The problem of differentiating between closely related isomeric forms of the insecticides is also particularly difficult. Biological test methods are not very accurate, and are often laborious and expensive in comparison to physical and chemical methods, but in some instances they may be the only available methods of obtaining essential data. The biological methods are highly sensitive and can often determine amounts of less than one part per million with sufficient reliability and reasonable reproducibility. Isomers of organic phosphorus insecticides are difficult to distinguish chemically, but very often their biological activity differs very markedly and can easily be assayed.

Radiochemical Methods

Radiochemical methods using radioactive isotopes have been shown to be superior in sensitivity to biological methods. A serious disadvantage of radiochemical methods is that they measure only the amount of a particular element, and do not take into account any chemical change which might have taken place in the living body.

The biological approach is based on the determination of a particular biological action possessed by the insecticide and some of its isomers, but not inherent in its other composite materials. The biological action may be measured in two ways. The first involves the application of regular fixed dosages of the insecticide to a number of animals and the measurement of the number of physiologically affected animals. Parallel tests are conducted on similar animals, particularly with respect to standardized weight, age, and nutritional state, using known doses of the chemically pure insecticide. The second type of biological assay is more by way of a biochemical test. This involves the enzymatic decomposition of the insecticide *in vitro*.

Highly Sensitive Method

Glick (**52, 53**) and, more recently, Metcalf and March (**54**) have indicated that organic phosphorus insecticides are inhibitors in varying degree of the enzymes cholinesterase and pseudo-cholinesterase. Giang and Hall (**55**) devised a highly sensitive method for the determination of those organic phosphorus insecticides that inhibit cholinesterase. The insecticides having large differences in inhibitory power could be distinguished. Generally, however, this method is not specific.

By the enzymatic method, Giang and Hall could distinguish between parathion and paraoxon. Paraoxon could be obtained by converting parathion by oxidation with a mixture of concentrated nitric and fuming nitric acids. Paraoxon was found to be an extremely powerful inhibitor, greatly exceeding parathion in respect of its effect on cholinesterase. Parathion and methyl parathion could be distinguished from each other by the fact that parathion was a stronger inhibitor than the methyl isomer.

Giang and Hall could not distinguish between EPN and parathion because they did not find sufficient difference in the inhibitory potencies of these two compounds. The authors adapted Michel's (**56**) method for the measurement of cholinesterase activity of human blood plasma and blood cells. The method consisted of measuring on a *p*H meter the acetic acid produced by the splitting action of cholinesterase on the substrate acetylcholine. The

*p*H change was measured in the presence of a standard buffer over a definite time interval, and converted to percentage inhibition, which was related to microgrammes of the insecticide under examination.

Initially, tetraethyl dithiopyrophosphate (sulfotepp) was determined in various plant materials. The spray residue was extracted from the plant material with ether. The ether solution was then washed with a 10 per cent sodium bicarbonate solution, followed by a second washing with a saturated sodium chloride solution. The ether was removed by evaporation and an aliquot of the extract was incubated with a standard cholinesterase solution and a standard buffer solution at 25°C for 30 minutes in order to effect the inhibitory action. A standard acetylcholine solution was added to the mixture. The *p*H change was then measured at 25°C after 60 minutes.

Conversion Graph

The conversion of *p*H change to percentage inhibition was done by referring to a standard graph calibrated in terms of known amounts of the inhibitor. Other organic phosphorus insecticides that could be determined by this enzymatic-inhibition method were E-1059 (Systox, demeton), TEPP, E-605 (parathion), paraoxon and EPN. Other insecticides, namely, DDT, BHC, chlordane, toxaphene, Dieldrin, Aldrin, rotenone, and pyrethrum were examined for their possible interfering enzyme-inhibition effects, but no interferences were encountered. Despite being a relatively weak inhibitor, parathion could be readily tested because of the ease with which it could be oxidized to its oxygen analogue, paraoxon, which is a very strong inhibitor. Schradan and methyl parathion were found to be weak inhibitors, and their determination by the enzymatic method was not very practicable.

A colorimetric micro-estimation of human blood cholinesterase was described by Metcalf (**57**). This method is applicable to studies on poisoning due to organic phosphorus insecticides. The method involved the interaction of unhydrolysed acetylcholine with alkaline hydroxylamine to form acethydroxamic acid which gave a coloured complex with ferric ion, which could be measured spectrophotometrically.

Cook (**58**) used Metcalf's colorimetric method in conjunction with the Giang and Hall method for the determination of organic phosphorus insecticides by their inhibition of cholinesterase activity. The combined method was successfully demonstrated in the determination of Systox in apples.

Recently Cook (**59**) extended his studies on the paper chromatography of organic phosphorus insecticides by developing spot tests for *in vivo* cholinesterase inhibitors. Visual location of the inhibitors along the chromatograms of the insecticides was accomplished by placing four prepared paper strips in the following order starting from the top: substrate, enzyme plus bromothymol blue, chromatogram, and water. The enzyme preparation consisted of alkaline blood plasma and the substrate was acetylcholine chloride.

It is not always possible to correlate the toxicity of any particular insecticide with its inhibitory effects on the enzymes of warm-blooded animals. The inhibitory effect may also vary according to the nature of the esterase. Giang and Hall performed all their experiments using a desiccated cholinesterase preparation (purified bovine plus human serum cholinesterase). Metcalf and March (**54**) in their investigation of the effects of phosphoric esters of the parathion type on insect cholinesterase, found that there was some correlation between the inhibitory action and the insecticidal toxicity.

Tests on Flies & Bees

They found that a homologue of parathion, di-isopropyl *p*-nitrophenyl thiophosphate, was completely non-toxic to bees, and inhibited only very slightly the cholinesterase from the bee's brain. On the other hand they found that di-isopropyl *p*-nitrophenyl thiophosphate was highly toxic to house flies and also strongly inhibited cholinesterase from the fly brain. Metcalf and March found that parathion and paraoxon had approximately the same toxic effects on the housefly and the bee, and approximately the same inhibitory effect on cholinesterase. The results of these experiments indicated that the combination of the thiophosphoryl and the isopropyl groups was in some ways sterically incapable of combination with cholinesterase from the brain of the bee. This showed that there is a marked difference between flies and bees in the protein structures of the true or specific cholinesterase of the central nervous system.

Metcalf and March (**60**) extended their studies of the housefly and the honey bee to the white mouse. In the case of nine organic phosphorus insecticides, they found a correlation *in vitro* between the inhibitory effect on cholinesterase and toxicity. Hecht and Wirth (**61**) confirmed the findings of Metcalf and March. On the basis of such evidence, it appears that the inhibition caused by cholinesterase is an index of the toxicity of an insecticide to warm-blooded animals and organisms. Giang and Hall's method must, however, be used with some care, because Heath and Park (**62**) reported that cholinesterase-inhibiting substances occur in extracts of untreated clover. These substances may occur in other plants.

Although the anti-esterase property of the organic phosphorus insecticides is a criterion of their poisonous properties, it has not yet been established whether such compounds which have lost their anti-esterase activity, no longer possess other poisonous properties. It is however very encouraging to note that there is an increasing tempo in biological research with respect to the thorough testing of organic phosphorus compounds for their ovicidal, acaricidal, insecticidal, rodenticidal, fungicidal, and herbicidal properties.

Bio-assay Methods

Newman (**63**) emphasized that bio-assay methods do not provide reliable data on the toxicity of organic phosphous insecticides in man. He suggested that before a biological assay is performed plant materials require a preliminary extraction to remove interfering materials. Newman recommended that parathion in tomatoes be extracted by mixing with carbon tetrachloride and leaving to stand overnight. The solvent was evaporated under an air jet, and the residue was taken up in acetone. The assay was done with mosquito larvae, and concentrations of 0.02 parts per million could be detected in 100 grammes of contaminated material. Newman observed that the inability of the larvae to swim in test solutions was a better measure of toxicity than was death.

An extensive attempt was made by Angelotti, Fletcher, Brown and Weiser (**64**) to find bacteria, yeast, protozoa and other organisms sensitive to a large group of common insecticides (including parathion) for their possible use as means of detecting these insecticides in spray residues. In general, their efforts to detect fungicides and insecticides by microbiological techniques gave negative results.

Hoskins, Witt and Erwin (**65**) developed the adult fly technique for the quantitative bio-assay of residual insecticides in foodstuffs. Their method was concerned essentially with the determination of 1,2,3,4,5,6-hexachlorocylohexane (Lindane) but it was found to be applicable to the determination of other insecticides also, including TEPP and parathion. The insecticide residue was collected upon the interior surface of a shell vial in which house flies were confined. Uniform contact between the chemical and the flies was secured by addition of a small amount of light oil to the vial.

Exposure Time

The flies were exposed to the insecticide for a period of approximately 30 minutes. With such an exposure time, a 50 per cent kill of flies could be produced by 6-7 microgrammes of TEPP. Other experiments, involving oral administration to adult houseflies, were performed by Frawley, Lang, and Fitzhugh (**66**). They evaporated to dryness over sugar an ether extract of the plant material. The sugar and residue were dissolved in an aqueous medium and flies were allowed to feed on the solution for 24 hours. This technique obviated the meticulous purification of sample extracts which was often necessary for other bio-assay procedures. The method was found to be sensitive to three microgrammes of parathion and four microgrammes of EPN.

In a subsequent paper Frawley and his co-workers (**67**) described the *in vivo* inhibition of fly cholinesterase as a measure of microgramme quantities of organic phosphorus insecticides. The method consisted of allowing approximately 100 weighed flies to feed *ad lib* on the above mentioned sugar and insecticide residue test solution. The flies were then mixed with water. The cholinesterase activity of the extract was measured by the change in *p*H resulting from a one-hour incubation with acetylcholine. This method was found to be sensitive to one microgramme of parathion and to two microgrammes of EPN.

Knocker, Roth and Treboux (**68**) reported the use of the crustacean *Daphnia pulex* for the determination of small quantities of organic phosphorus insecticides. To 100

grammes of an insecticide-treated plant material were added 200-500 grammes of anhydrous sodium sulphate. The mixture was extracted for 12 hours with diethyl ether. The extract containing five mls of ethyl alcohol was distilled and taken up in 20 mls of ethyl alcohol. Controls were run with extracts from similar plants which were treated with known amounts of insecticides. Tests were carried out in small jars, each containing 20 *Daphnia pulex* in 100 mls of water. 0.1 ml of the alcoholic solution of the toxicant was added to each jar. Counts were made of the number of organisms which had lost their ability to swim. This method was reported to be sensitive to 0.1 part per million of parathion in cherries.

Histochemical Technique

Koelle and Friedenwald (**69**) devised a very useful histochemical technique for the localization of cholinesterase activity in tissues. The tissue sections were incubated in a medium of *p*H 8.0 which contained acetylcholine iodide, copper glycine, and was saturated with the very sparingly soluble copper thioglycine. Thioglycine was liberated by the enzymatic action and copper thioglycine was deposited at the site of action. The copper thioglycine was treated with ammonium sulphide to convert it to copper sulphide which could be determined.

Bergner and Durlacher (**70**) employed Koelle and Friedenwald's technique for the histochemical detection of fatal anti-cholinesterase poisoning. They reported that following death in mice from α-naphthylthiourea, sodium fluoroacetate, morphine, potassium cyanide, arsenic, diethyl-ether, nembutal, 2,3-dimercaptopropanol (BAL) and acetylcholine, the deposition of copper sulphide, indicative of cholinesterase activity at the site of action, was not distinguishable from controls. Bergner and her co-worker also reported that subsequent on death from the anticholinesterases, di-iso-propyl fluophosphate (DFP), neostigmine, eserine, parathion, TEPP, and OMPA, the deposition of copper sulphide was partially or completely inhibited. The authors claimed that with DFP the *in vitro* inhibition of human cholinesterase was also demonstrable by this technique.

Koelle, Koelle, and Friedenwald (**71**), by experiments on segments of cat ileum, correlated the effects of DFP with the total, specific and non-specific cholinesterase activities. The approximate inhibitions of the enzyme at different regions were determined histochemically. Their findings show that non-specific cholinesterase activity promoted the hydrolysis of endogenously liberated acetylcholine at certain sites. Bergner and Bayliss (**72**) modified the Koelle, Koelle, and Friedenwald method for the histochemical detection of cholinesterase activity in post-mortem materials. Mice poisoned with diethyl ether, carbon monoxide, BAL and other substances showed no diminution of cholinesterase activity, but in tissues of mice poisoned with anti-cholinesterase, including TEPP, DFP and OMPA, there was a diminished or complete absence of the copper sulphide deposits in the histochemical detection of cholinesterase.

Schulemann (**73**), at the request of Farbenfabriken Bayer AG, Pflanzenschutz wiss. Abteilung (Plant Protection), Leverkusen, conducted extensive toxicological tests on the effect of 0-0-dimethyl-2,2,2,-trichloro-1-hydroxy-ethyl phosphonate (Dipterex, Bayer L 13/59) on animals. Schulemann compared these effects with those of parathion, Systox, malathion and Diazinon, which were biologically tested out under the same conditions as those for Dipterex. It was found that Dipterex inhibited the cholinesterase *in vivo* and *in vitro* in the blood and in the tissues of animals. This explained to a great extent its insecticidal action and the clinical poisoning syndrome for warm-blooded animals.

No Danger to Humans

The cholinesterase inhibition of Dipterex was considerably less than that of Systox and parathion. Its toxicity was found to be of approximately the same degree as that of Diazinon and malathion. These toxicological investigations showed that Dipterex could be applied at normal insecticide concentrations without endangering human beings and animals, provided that the conventional precautionary procedures were observed.

Much emphasis has already been placed in this review on the obvious toxic effects of organic phosphorus insecticides, and their danger to mankind when uncontrolled and improperly used. It follows, therefore, that toxicity must always be carefully controlled from the very earliest stages in the development of any organic phosphorus compound which shows promising insecticidal properties. Immediately following biological screening tests, all organic phosphorus com-

pounds must be subjected to routine pharmacological and toxicological testing on the usual test animals, that is, rats, mice, guinea pigs and rabbits. These early tests invariably decide the subsequent fate of any insecticidal preparation.

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Chlorine Dioxide Process

AN IMPROVEMENT in the process for generation of chlorine dioxide for pulp bleaching which may mean mill savings in the order of $6,000 to $8,000 a year per ton day of the gas produced has been developed by Olin Mathieson Chemical Corporation, the company announced recently.

Under present practice chlorine dioxide is generated at the mill site by reduction of sodium chlorate with sulphur dioxide or methanol in an acid medium. The Olin Mathieson improvement involves the introduction of sodium chloride into the reaction mixture in the ratio of 0.06-0.08 pound per pound of sodium chlorate.

This procedure results in almost quantitative reduction of sodium chlorate to chlorine dioxide, compared with yields of about 90 per cent obtained at present. It also produces chlorine dioxide of improved quality in that the free chlorine in the gas stream is usually less than 1.5 per cent compared with two to five per cent currently common.

The development is the subject of a patent application naming W. W. Northgraves and B. H. Nicolaisen of Olin Mathieson as the inventors.

According to Mr. Northgraves, existing chlorine dioxide generator installations can easily be adapted to the addition of sodium chloride by adding a salt made-up tank and making necessary piping changes. This can be done at nominal cost.

Increased demand for brighter, higher quality pulp, he added, has already resulted in a more than doubling of the use of chlorine dioxide during the past year. More than 25 mills in the United States and Canada are now using this method of bleaching, and additional installations are in the planning stage.

Mr. Northgraves further stated that the savings afforded by sodium chloride addition may result in still wider use of chlorine dioxide bleaching by the pulp industry.

Ethylene Regulator

A NEWLY developed ethylene regulator has been introduced by British Oxygen Gases Ltd., London. Previously, the diaphragm of the regulator was made of a rubber compound, but this reacted unfavourably with the gas. Diaphragms on the new regulators are made of a non-ferrous metal. Ethylene is used to ripen imported fruit. The unripe fruit is stored in a closed room and ethylene is then fed into the room from a cylinder. An automatic regulator must be used to control the amount flowing into the room as the gas can be highly inflammable.

Norwegian Research Centre

The new premises of the research institute of the Norwegian paper industry were opened recently. Costing £400,000, the premises are at Blindern on the outskirts of Oslo—near the science faculties of Oslo university. There will be a staff of 90.

£100 Donation for SAC

The Society for Analytical Chemistry has received a donation of £100 from Dunlop.

• PERSONAL •

DR. J. H. BIRKINSHAW, Reader in Biochemistry at the London School of Hygiene and Tropical Medicine, has been appointed to the university chair of biochemistry tenable at that school. Dr. Birkinshaw was at one time a member of the staff of ICI Ltd. Nobel Division research department.

Scottish Agricultural Industries Limited announce that SIR WILLIAM GAVIN, C.B.E., has resigned the chairmanship of the company and from the board, on reaching the age of 70. A director for 25 years and chairman since 1951, he has seen the turnover of the Company increase from some £3 million to £23 million. The board has appointed as his successor MR W. DONALD SCOTT, a director of Imperial Chemical Industries Limited.

At the last meeting of the council of the Textile Institute the following officers were re-elected:— *chairman of council*: G. LOASBY, ESQ., B.Sc., F.R.I.C., F.T.I; *vice-chairman of council*: A. DRAPER, ESQ., F.T.I.; *honorary secretary*: J. BOULTON, ESQ., M.Sc.Tech., F.R.I.C., F.T.I., F.S.D.C.; *honorary treasurer*: R. J. SMITH, ESQ., F.T.I.

MR. C. F. LAWSON has been appointed foundry manager of Distington Engineering Co. Ltd. MR. G. ELLIS will act as personal assistant to the general works manager as from 25 June. MR. C. SCOTT has relinquished the post of assistant works manager.

DR. G. H. LAW has been appointed vice-president of research and DR. FRANKLIN JOHNSTON director of research for Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corporation. MR. D. B. BENEDICT and MR. H. B. MCCLURE have been appointed president and a vice-president of the division, and MR. H. M. WEST now becomes manager of textile fibres for Carbide & Carbon Chemicals.

MR. A. W. RUNDLE, managing director of A. Gallenkamp & Co., scientific apparatus manufacturers, has recently concluded a tour of Africa, visiting universities, research and industrial laboratories, and agents in Egypt, Sudan, Kenya, Federation of the Rhodesias, South Africa and Portuguese East Africa. With the appointment on this tour of A. V. & G. Nasce Co., in Khartoum, as agents for Sudan, Gallenkamp is now fully represented throughout Africa on the Cairo-Cape route.

New chairman of the Anchor Chemical Co. is MR. THOMAS MARTIN who succeeds the late MR. THOMAS H. HEWLETT. Mr. Martin will retain the managing directorship which he assumed in 1945.

Leicester, Lovell & Co. Ltd., Southampton, announce that MR. H. A. COLLINSON, technical director since 1946, has been appointed assistant managing director. MR. P. G. PENTZ and MR. B. E. G. MASSEY have been elected to the board of directors. Mr. Pentz is manager of the technical sales and development department. Mr. Massey is the company's export manager.

MR. S. HUGHAN, M.P.S., formerly a senior representative with Benger Laboratories Ltd., in Scotland, has been appointed northern regional manager. The new southern regional manager will be MR. D. P. HICKEY, formerly the company's wholesale liaison manager. These appointments are part of a plan to expand the company's services to the pharmaceutical and medical professions.

MR. J. A. ORME and MR. J. E. O. ARNOLD have been appointed directors of Midland Aluminium.

The council of the British Institute of Management announce the appointment of MR. F. R. LIVOCK as director of the Institute. He succeeds the HON. L. O. RUSSELL who resigned as director last December.

MR. WALTER H. HINDLE, associate director in charge of dyeing and finishing for the Chemstrand Corporation, of Alabama, has been promoted to the newly created post of associate director in charge of the textile research divisions.

New Tall Oil Derivative

Prize-Winning Paper by Dr. J. Rinse

TALL oil is a mixture of fatty and rosin acids with some unsaponifiable material. It is available in several grades obtained by refining crude tall oil by distillation or solvent extraction. The tall oil soaps, which are called tallates, are no definite chemical compounds but are mixtures of metal soaps varying with the type of tall oil from which they have been prepared. While the tallates from monovalent metals, e.g. sodium, are principally mixtures of sodium oleates and rosinates, in aluminum tritallate, acids of various kinds are attached to one aluminum atom, e.g. two oleate and one rosin radical, or if rosin prevails in the tall oil, two rosin and one oleate (or linoleate) radical.

Only recently has it become possible to prepare aluminum trisoaps. References in literature are contradictory and some authors have even come to the conclusion that trisoaps do not exist at all. (A. E. Alexander *J.O.C.C.A.*, 1954, **37**, 382.)

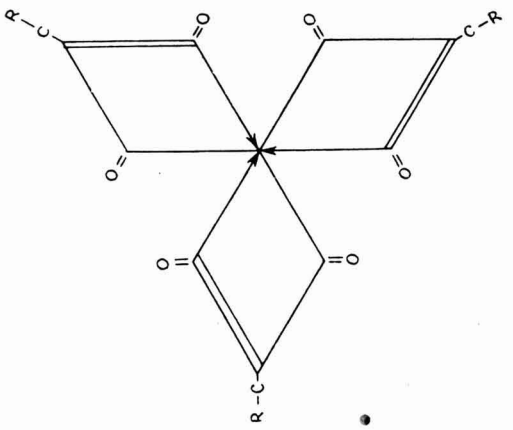
Though it is not possible to prepare aluminum trisoaps by metathesis, i.e. double decomposition of hydrous solutions of an aluminum salt and a sodium soap, which is the usual method for preparing hydroxy aluminum stearates and other soaps, it appeared that aluminum alcoholates reacting with fatty acids under carefully controlled conditions will yield aluminum trisoaps and alcohol. The reaction formula is

$$Al(OR)_3 + 3\ R'COOH \rightarrow Al(OOCR')_3 + 3ROH$$

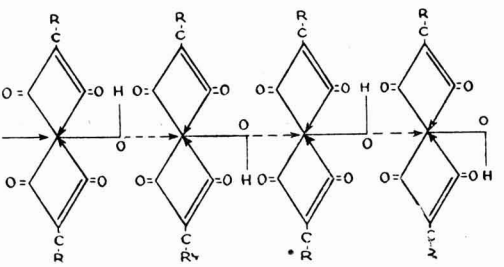
in which R and R′ stand for alkyl groups. The replacement of alkoxy by acyloxy groups proceeds in three steps. The first two alkoxy groups are replaced easily but the removal of the third one is much more difficult. It is an equilibrium reaction, which means that the aluminum trisoap will react with alcohol to be converted into a disoap and free acids. Proper reaction conditions will prevent the formulation of by-products and enable the manufacture of aluminum trisoaps. The so-called aluminum trisoaps prepared by metathesis are mixtures of hydroxy aluminum disoap and fatty acid. The properties of the latter are different from those of the true trisoaps.

The new process (patent applications pending) has been used for preparing aluminum tritallates and it appeared that any tall oil can be used as long as it is free from water and the acid value is taken into account. The tallates from the high rosin tall oils are solid and those from tall oil fatty acids are viscous oils. Consistency will vary depending upon content of dimerized fatty acids in the tall oil. Depending upon the end use the tallate will be used as such or in solution, e.g. in mineral spirits, mineral oil, vegetable oil, gasoline, etc.

The aluminum content depends upon the acid value of the tall oil and varies from 2.7 per cent for a rosin-free to 3.0 per cent for a normal tall oil. All alcohol being recoverable, this small percentage of aluminum will increase raw material cost only



Left, aluminum triacylate (McGee); below, hydroxy aluminum diacylate (McRoberts & Schulman)



D

slightly (approx. 1c per lb.). Accordingly, aluminum tritallate when made in bulk should be relatively low cost material.

The properties of tritallate are as follows:

(1) Excellent solubility in any hydrocarbon solvent, mineral or vegetable or animal oil to give low viscosity solutions;

(2) Compatability with fatty acids, rosin, ester gum and plasticizers;

(3) Rapid partial hydrolysis in presence of water or humid air to water resistant solid products;

(4) Reactivity with alcohols, phenols, glycols, glycerol and any other hydroxy compound.

The chemical reactivity is caused by the substitution of one acylate radical by hydroxyl or by alkoxy groups

$$AlX_3 + H_2O \rightarrow HOAlX_2 + HX$$
$$AlX_3 + ROH \rightarrow ROAlX_2 + HX$$
$$2\ AlX_3 + HOROH \rightarrow X_2Al\text{-}O\text{-}R\text{-}O\text{-}AlX_2 + 2\ HX$$

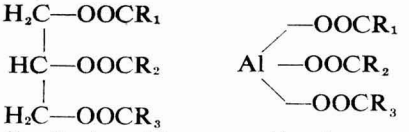
The reaction products are stable solids, in particular the hydroxy compounds. The molecules of the latter are bound together by secondary forces, mostly hydrogen bonds. The alkoxy aluminum diacylates hydrolize only very slowly to the corresponding hydroxy aluminum acylates.

Molecular Structure

Only one acyloxy group can be removed from the trisoap by hydrolysis. The remaining acyloxy groups do not react with water but can be removed with alkali.

The molecular structure of the aluminum soaps has been described by various authors (McGhee, *J. Amer. Chem, Soc.*, 1949, 71, **278**, McRoberts & Schulman, *Proc. Royal Soc. London*, 1950, **A200**, 139. The structure formulas explain the properties of various aluminum soaps. The trisoaps cannot be associated because three acyloxy groups surround one aluminum atom leaving no possibility for association with other molecules. On the contrary the hydroxy aluminum trisoaps are strongly associated by hydrogen bonds, which cause their gelling properties.

If a liquid aluminum tallate or its solution in mineral spirits is exposed in a thin layer to the atmosphere, it dries rapidly to a clear water-resistant coating with high gloss. In order to promote crosslinking by oxidation and to obtain a tough coating, the common driers (lead, cobalt, manganese, zirconium etc.) may be used. In many cases, however, no driers will be needed. Aluminum tritallate is a vehicle itself. It may be considered as an ester in which aluminum has replaced glycerol.



Tall oil glyceride *Aluminum tritallate*

Because of the solubility of the tritallates and the low viscosity its solutions are easily handled. Upon mixing with a small quantity of water (approximately two per cent of tritallate) in presence of a small quantity of emulsifier to disperse water in the oil phase, the tritallate solidifies or its solution gels or becomes solid, depending upon concentration. In general 10 per cent tallate solutions will set to a stiff gel and higher concentrations become complete solids when treated with water.

Strong Drying Properties

Its strong drying properties allow the addition of large quantities of non-drying, e.g. mineral oils. These mixtures dry to tack-free coatings on exposure to the air.

Aluminum tritallate accordingly may find uses as gelling agents, vehicles for paint, core-binders, waterproofing agents, moisture set printing inks, adhesives etc.

Rapid drying long oil varnishes can be made by simply mixing aluminum tritallate with a drying oil, e.g. soybean or linseed oil and adding the common driers. They are clear solutions, drying rapidly to water-resistant coatings without wrinkling even in thick layers.

Aluminum tritallate is a new tall oil derivative with great reactivity causing rapid drying by partial hydrolysis and combinations with all hydroxy compounds. The reaction products are stable aluminum diacylates which can be used for various technical applications.

(One of the prize winning papers in the recent contest conducted by the Tall Oil Association.) The author is with the Chemical Research Associates, Bernardsville, NJ. The paper was published in the 'American Paint Journal.'

Antibiotic Soon Available

It is reported that Albamycin, an antibiotic claimed to be able to kill disease organisms in such infections as blood poisoning, bone and heart diseases, pleurisy and scarlet fever, will soon be available in most European countries.

Man-Made 'Natural Rubber'

CLAIMS to have made in the laboratory the true molecule of natural rubber are made by Goodrich-Gulf Chemicals Inc., who are jointly owned by the B.F. Goodrich Co. and the Gulf Oil Corp. Goodrich-Gulf calls its product Ameripol SN, for American-made polymerization synthetic natural.

Construction is believed to be well advanced at Avon Lake, Ohio, US, of a plant for the production of this synthetic 'natural' rubber. This should be in production by the end of 1956.

The product is claimed to be chemically and physically identical with the hevea grown on rubber plantations. This has been established by X-ray diffraction, photographic and infra-red studies.

The raw materials for this new product have not yet been disclosed but it is believed that they are not styrene or butadiene from which synthetic rubbers are normally produced.

Goodrich-Gulf believes that it will be able to produce its man-made rubber at prices competitive with the higher grades of plantation rubber.

The Case of Mr. Lang

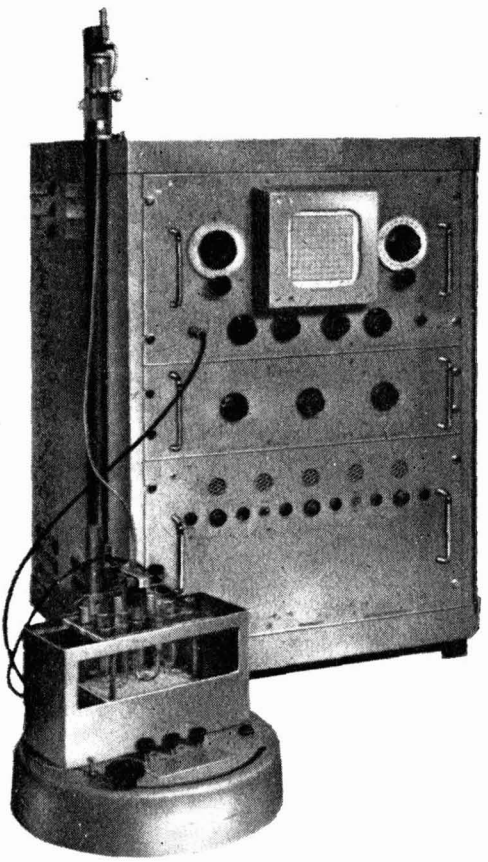
MR. J. H. A. LANG, an assistant solicitor of ICI, who was recently dismissed (see THE CHEMICAL AGE, 9 June & 16 June) underwent an operation last week and was said on Monday to be 'seriously ill'.

The first of the Labour Party's new policy statements, published early this week under the title 'Personal Freedom: Labour's Policy for the Individual and Society', points out that while Civil servants may appeal to an advisory board if they know they are considered unreliable for certain kinds of public employment, workers in private employment on secret defence contracts are also involved. The statement suggests that there should, therefore, be an advisory board for private industry.

Colours Intermediates Reduced

British Industrial Solvents announce that, as a result of further improvements in their large-scale intermediates plant at Hull and as a contribution to the exports of British colours, the UK prices of 'BISOL' aceto-acetanilide and acetoacet-*o*-chloranilide have been reduced by £50 and £75 per ton respectively, with effect from 1 June 1956.

Cathode Ray Polarograph



Mr. W. B. Horner and Mr. T. R. Davies of Southern Instruments, Computer Division, Camberley, Surrey, recently completed a tour of Switzerland with the company's new cathode ray polarograph shown here. The tour was arranged in conjunction with the firm's Swiss agents, Sorensen-Ardag of Zurich. Many leading chemists engaged in industry and research attended demonstrations of the polarograph's capabilities in the analysis of organic and inorganic elements

Nu-Swift to Sell US Product

Nu-Swift Ltd. announce the conclusion of a trading agreement between them and Safety First Products Corporation of Elmsford, New York. This enables Nu-Swift to manufacture under licence and sell abroad (except in certain specified countries) the 'Safe-T-Meter Dry Powder Extinguisher'.

HOME

Change of Address

The Midlands sales office of Bakelite Ltd. has moved to Beaufort House, 92/98 Newhall Street, Birmingham 3 (telephone: Central 5011/7).

Baird & Tatlock's Appointment

Baird & Tatlock (London) Ltd. announce that they have been appointed suppliers to the United Kingdom Atomic Energy Authority.

ICI to Buy Farms

Imperial Chemical Industries Ltd. is to buy 20 farms in the Wyre agricultural district near Fleetwood in Lancashire to ensure supplies of water. More than 1,500 acres of land are involved, but the purchase price has not been stated.

BP to Issue Half-Yearly Reports

At the annual general meeting of The British Petroleum Co. Ltd. on 7 June, the chairman, Mr. B. R. Jackson, announced the board's intention to issue half-yearly reports, commencing in 1957, giving comparative figures for the corresponding period of 1956.

Henry Wiggin Acquisition

Henry Wiggin and Co. Ltd. have purchased the specialized high nickel alloy fabricating plant at Hereford, which they designed and erected for the Ministry of Supply and have been operating since 1954. The company is a wholly-owned subsidiary of The Mond Nickel Co. Ltd., an affiliate of The International Nickel Co. of Canada, Ltd.

New Acrilan Fibre Plant

Chelmsford Ltd., a wholly owned subsidiary of the Chelmsford Corporation, US, has announced plants to build an Acrilan acrylic fibre plant in Great Britain. The plant is expected to be completed within approximately two years and it is estimated that 400 persons will be employed. Location of the site will be disclosed at a later date.

Export of Aluminium Goods

The Board of Trade has announced that the export of aluminium scrap is prohibited. To ensure that aluminium scrap metal is retained in the UK, the export of certain aluminium and aluminium alloy goods to any destination has been subject to licence from 11 June 1956. The relevant Amendment Order is the Export of Goods (Control) (Amendment No. 6) Order, 1956 (SI 1956/789). The Board of Trade also announced the issue of an Open General Licence which authorizes the export of certain goods of aluminium or aluminium alloy valued at more than £240 per ton. The licence, which does not apply to exports to China, Macao, North Viet Nam or Tibet, also came into operation on 11 June 1956.

Purchase Tax Exemptions

The Treasury have made an order under Section 21 of the Finance Act, 1948, entitled 'The Purchase Tax (No. 3) Order, 1956' (Statutory Instruments 1956, No. 873). The order extends the list of essential drugs and medicines exempt from purchase tax under the Purchase Tax (No. 1) Order, 1956 (Statutory Instruments 1956, No. 27) which is revoked. All drugs and medicines previously exempt under the revoked order remain exempt under the new order.

British Oxygen Melamine Plant

The melamine plant of British Oxygen Chemicals at Chester-le-Street is being extended and rebuilt. When finished, the output will be about 10,000,000 to 12,000,000 lb a year. The site of this factory close to Newcastle was chosen as it was an already developed site near a port and well placed for the main centres of consumption.

Department of Industrial & Forensic Science

The Ministry of Commerce Directorate of Scientific Development, Chichester Street, Belfast, has changed its title and address to: Department of Industrial & Forensic Science (Ministry of Commerce), 5-11 Verner Street, Belfast (Telephone: Belfast 31722/5).

Oil Drilling at West Derby

Drilling for oil is expected to be resumed at Croxteth Hall Lane, West Derby, Liverpool, shortly. A derrick has been erected and is almost ready for the installation of drilling machinery. Previous tests carried out to a depth of 4,200 ft. on the Earl of Sefton's land have been sufficient to justify going ahead with drilling on a second site.

New Offices in London

Bourne Chemical Industries Ltd., whose works are at Welwyn Garden City, announce that the London office address from 25 June is Plantation House, Fenchurch Street, London EC3. (MINcing Lane 9911).

Publications & Announcements

THE National Bureau of Standards of the US Department of Commerce announces the publication of 'Bibliography of Solid Adsorbents, 1943 to 1953' by Victor R. Deitz. It is an annotated survey of scientific literature containing about twice as many references as are found in the 'Bibliography of Solid Adsorbents 1900 to 1942.' A feature of this edition is a complete author index and a complete subject index. The bibliography, 1,528 pages, is priced $8.75, and can be obtained from the Government Printing Office, Washington 25, DC. Foreign remittances must be in US exchange and should include an additional one-third of the price to cover mailing costs.

* * *

THE Grilsheim electrically and gas heated TP welding gun for thermoplastics is described in bulletin No. 03 81/82 published by Horwitch Smith & Co. Ltd. of Pensnett, Staffordshire. This gun can be used for the welding of rigid p.v.c., p.v.a., polythene, Oxythene (polyisobutylene), nylon and Perlon. These materials are thermoplastics and can be easily and repeatedly formed by heat. The hot air emerging from the nozzle of the welding gun softens the edges of the material as well as the welding rod. The rod is applied to the seam to be welded by gentle pressure of the hand. A hot air stream serves as the welding gas, or in the case of polythene a hot stream of nitrogen at 200-400°C. The temperature can be regulated and depends on the material being welded. The gun is manufactured by Knapsack-Grilsheim A/G of Frankfurt-am-Main, Western Germany, for whom Horwitch Smith are the agents in the UK and Eire. Training courses for intended users of the gun are available at the Pensnett works.

* * *

AN INVESTIGATION of the corrosion of titanium metal by hydrochloric acid is described in the *Journal of the Scientific Research Institute*, published in Japan. Experiments were carried out using 0.5 mm thick rolled titanium sheets supplied by Sumitomo Metals Co. Ltd. of Japan. They were prepared from the Kroll process spongy titanium by arc melting, hot rolling and finally cold rolling. Purity of the metal is said to be in excess of 99.3 per cent titanium. The conclusion drawn is that when titanium is immersed in hydrochloric acid the metal surface is coated with a hydride film, and this film shows a protective action against the acid. It is for this reason that titanium resists completely up to five weight per cent HCl at room temperature. Titanium coated with hydride film by cathodic hydridation resists completely up to approximately 24 weight per cent HCl at room temperature. This pretreatment is available for corrosion control of titanium. Studies are also described on the nitriding of titanium. Microscopic examinations, electron diffraction analyses and hardness tests were made on the nitrided titanium and thermo-electric effect and single potential differences were also examined. The results show that titanium, when nitrided, becomes hard and more resistant to corrosion.

* * *

PURE Chemicals Ltd., Kirkby Industrial Estate, near Liverpool, has published a brochure listing the products of its fine chemicals division. The products made at Kirkby include the alkyl bromides, bromoacetic acid and its esters, numerous other bromine compounds, betaine hydrochloride, colour photographic developers and organo-tin compounds, together with a range of other organic materials. PCL claims to be the largest manufacturers of organo-tin compounds outside the US. These materials find their main outlet as stabilizers for p.v.c. and this application is dealt with.

* * *

FACTORY inspectors and fire prevention officers of local authority fire brigades are becoming increasing insistent that the provisions of the Factories Act, 1937, relating to the provision of fire alarms shall be complied with. They expect, too, that recommendations given in the BS Code of Practice for electrical fire alarms shall be carried out. So state Gent & Co. Ltd., Faraday Works, Leicester, who have recently issued a new booklet giving advice and information on this subject. The booklet also contains details of the company's automatic fire detector and of their equipment for linking fire alarm systems with the nearest fire station. Copies of the booklet may be obtained free on application.

Wood Laminates

BH Permali

THE largest structure ever made in BH Permali densified wood laminates has now completed nearly two years satisfactory service. It is an acid, soda and dye hood for a cellulose film spinning machine at British Sidac Ltd., manufacturers of transparent wrappings. Weighing over four tons, the main hood measures about 63ft. long and a smaller dye vat hood 11½ ft. long.

These hoods have to deal with a mixture of sulphuric acid vapour and fumes from caustic soda tanks. Not only must they be chemically resistant to these fumes but also they have to withstand over 100°C.

During manufacture, the procedure adopted was similar to the practice used in the design and erection of large steel structures.

Various Applications

Other applications of these laminates, made by Permali Ltd., Bristol Road, Gloucester, have been described.

The Engineering Department of Hardman & Holden Ltd. had to filter warm sulphurous oxidizing liquor in a sulphur recovery plant. Timber plates had been tried but they became completely denatured after only a few months service, due mainly to the fact that temperatures would often reach boiling point for limited periods. The possibility was therefore discussed of using BH Permali for this application, although, because it is a cellulose based material, conditions were considered to be particularly arduous.

First of all, a trial number of plates were made up, each from one piece of material to eliminate metal rod jointing, which is liable to chemical attack on fabricated timber frames. After 12 months service these plates and frames proved to be satisfactory. The mechanical properties were unaffected so that when a full set was put into service, the thickness of the plates could be reduced with a corresponding increase in the frame thickness. This reduced the press shut-down time per day.

There were also additional advantages in the 'cake' washing process as the hard polished surface of the material resists chemical attack, simplifying the task of cleaning out the ports and reeds. Timber can become a mass of spongy fibre and difficult to clean under these conditions.

Measuring Plate Ductility

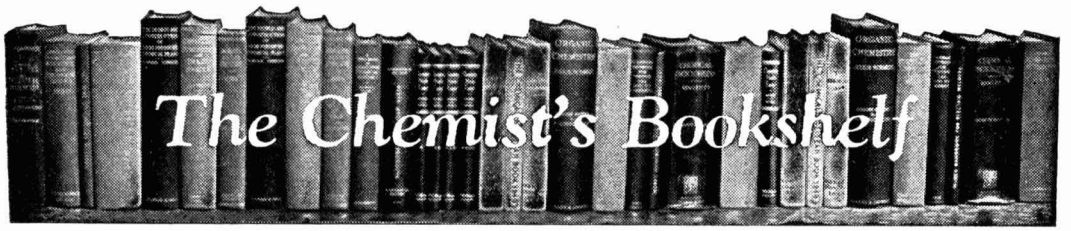
Effect of Impurities on Deposit

THE ductility of a bright nickel deposit can vary with the chemical content of the plating bath in a way which cannot be simply related to the concentration or purity of any particular constituent. Thus, for example, traces of grease dissolved in the bath may considerably affect the ductility of the resulting deposit, and it is therefore clearly of great importance to be able to provide some form of quantitative test by which a check can be kept on the ductility of the plating so that the bath may be kept at its optimum condition.

The degree to which a plated surface can be bent or worked subsequent to plating without developing fine cracks which are likely to be the seat of subsequent corrosion, is a measure of the ductility of the deposit. A technique recently developed by Electro-Chemical Engineering Co. Ltd. of Weybridge, Surrey, now permits quantitative determinations of ductility to be made. Test pieces are used. Each of these consists of annealed brass, and there are two circular holes by means of which they can be attached to the plating rack. The test pieces are prepared and polished in a standard way because if there are any scratches on the base metal it would create a tendency for the deposited metal to sheer under tension. The plating rack is designed to fit into a 1,500 ml. tall beaker and carries two test pieces so that duplicate extension measurements may be made. It is coated with polythene except for the contact points.

Plating Sequence

Following degreasing, the test pieces are placed on the rack and passed through a plating sequence in the bright nickel solution to be tested. Test pieces plated in customers' solutions can be sent to the Electro-Chemical Engineering Co's laboratory where they are subjected to a Tensometer test which quantitatively compares the ductility of the specimens with that obtained on similar specimens prepared in standard solutions. Alternatively, samples of the solution in question can be sent and test pieces will be plated in the laboratory and tested. From these results deductions can be made as to the chemical constitution of the plating baths in which the test operations took place and any deficiencies indicated.



DIE PAPIERCHROMATOGRAPHIE DER KONDENSIERTEN PHOSPHATE. By H. Grunze and E. Thilo. Akademie-Verlag, Berlin. 2nd Edition. 1955. Pp. 29. DM. 2.

This is apparently the reprint of a paper presented to the German Academy of Sciences, and describes the separation of ortho-, pyro-, tri-, tetra- and polyphosphates in various media. There is a section by W. Wieker on the colorimetric estimation of the separated constituents.—CECIL L. WILSON.

HANDBUCH DER MIKROCHEMISCHEN METHODEN. Edited by F. Hecht and M. K. Zacherl. Vol. II. VERWENDUNG DER RADIOAKTIVITAT IN DER MIKROCHEMIE. Springer-Verlag, Vienna. 1955. Pp. 423. 138s.

This, the second volume of a comprehensive and valuable series, is made up of three principal sections. The first of these, by E. Broda and T. Schönfeld, deals with general radiochemical methods in microchemistry, and occupies about 275 pages. There is a useful introductory section on the properties of radioactive materials, and the special problems of radiochemical determinations. This leads on to the use of radioactive indicators, both for general purposes and in analytical applications. This is followed by accounts of radio-activation-analysis and analysis by neutron absorption. A lengthy chapter gives details of the uses of individual radioelements, and the section closes with a discussion of the biological effects of radioactivity.

The second section, of about 70 pages, by T. Bernert, B. Karlik and K. Lintner, is concerned with the measurement of radioactivity, with special reference to its application in microchemical operations. This is a comprehensive section on both the theory and practice of instrumentation, and deals fully with all the various types of apparatus employed in radioactive measurements.

The final section, of some 40 pages, by H. Lauda, deals with photographic measurements in radiochemistry, and discusses fully both emulsion techniques and autoradiography

The book is both authoritative and critical. It is fully documented by extensive bibliographies, and will undoubtedly prove to be a most valuable reference work. It is unfortunate that its exceedingly high price will put it well beyond the reach of the individual, but chemical libraries certainly ought to add this to the first volume of the series.—CECIL L. WILSON.

PHYSICAL CHEMISTRY OF HYDROCARBONS. Edited by A. Farkas. Academic Press Inc., New York; Academic Books Ltd., London. Volume 1, pp. x + 453, 1950, 92s. Volume 2, pp. x + 411, 1953, 92s.

These two volumes give a useful summary of the extensive developments which have been made, chiefly in the last two decades, in the investigation of physico-chemical properties and in the analysis of hydrocarbons.

Volume 1 starts with a condensed but comprehensive account of the theories of the chemical bond, written by G. W. Wheland. The next four chapters describe various techniques which have become of major importance either for the study of molecular structure or for the analysis of mixture of hydrocarbons. The first of these covers X-ray and electron diffraction, the second mass spectroscopy and the last two deal with infra-red, Raman and ultra-violet spectroscopy. In each case the relevant fundamental theory is clearly presented and considerable care has been exercised in the choice of the results to illustrate applications.

Of course, there have been substantial advances made since this volume was published in 1950, but this fact does not really detract from the value of these chapters because the basic ideas and concepts still hold good.

Physico-Chemical Properties

The remaining four chapters deal with particular physico-chemical properties of hydrocarbons. A. Gemant reviews work on electrical conductivity including the enhancement of conductivity by radiation. Some general points about the nature of ternary phase diagrams are discussd by A. W. Francis in connection with the solubility relations of liquid hydrocarbons and other liquids, and the chapter includes two extensive tables listing publications on these topics. Various aspects of solid-liquid equilibria are described by M. R. Cines who gives an interesting and competent account of the relationship between melting point and associated thermodynamic quantities, and the structure of the molecules. Sections are also included on the determination of purity by melting point determinations and on purification by crystallization. The final chapter by F. D. Rossini comprises a valuable collection of thermodynamic data relating to chemical equilibria involving hydrocarbons. A large number of figures, showing variation of equilibrium percentages of isomers and equilibrium constants with temperature are included. Although such figures are to be welcomed as an aid to ready assimiliation of the salient features and are adequate for semi-qualitative calculations, reference to the original literature will usually be necessary when the more accurate calculations are being attempted.

Contents of Second Volume

In Volume 2, the first five chapters are a continuation of the last four in Volume 1, in that they comprise reviews of particular physico-chemical properties—density and refractive index, surface tension and parachor, heat capacity, critical behaviour and optical activity of hydrocarbons. These chapters are of a high standard and each includes at least a brief introduction covering the basic concepts involved, and extensive use is made of tables for the presentation of important results. The next chapter by R. C. Hansford on the mechanisms of some hydrocarbon reactions is rather different in scope in that it covers a wide field of investigation. Sections are devoted to all the major types of reactions of importance and the author has succeeded in producing a most readable and interesting chapter which brings together a great deal of valuable information both from older work and more recent papers. The final chapter treats the separation and purification of hydrocarbons by selective absorption.

As the Editor points out in the preface to Volume 2, there are two notable omissions in the absence of chapters on distillation and on the viscosity of hydrocarbons. However, the two volumes obviously represent a major achievement. Both are well-documented and contain author indexes as well as subject indexes. By their nature they will be chiefly of interest to those scientists concerned with the various ramifications of chemical industry which involve work with hydrocarbons, but there is a great deal in both volumes which may be read with considerable profit by academic scientists everywhere.—C. KEMBALL.

QUANTITATIVE METHODS OF ORGANIC MICROANALYSIS. By S. J. Clark. Butterworths Scientific Publications, London. 1956. Pp. x + 253. 30s.

It is in many ways surprising that the British school of micro-chemists has not produced a book on this topic before now, and that we have been dependent on textbooks from German and American sources. Dr. Clark has done a service in making available what are essentially the methods of the 'Birmingham School', the more particularly since to that school so many British microchemists, Dr. Clark himself included, owe their training.

The methods described are, on the whole, well tried, and have been utilized extensively in routine laboratories. They are up to date, and include methods for the full range of both elementary and group determinations. There is also useful guidance on the preliminary treatment of material intended for analysis—purification and identification.

The book is well written, clearly and fully illustrated and comprehensive in scope, but still sufficiently selective to be a first-rate guide for the practical worker. It will undoubtedly be regarded as a standard work in this field, and if kept up to date it should continue so. It can be recommended without reservation.—CECIL L. WILSON.

Law & Company News

Commercial Intelligence

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

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

BIOTOX LTD. Dublin, manufacturers of chemical compounds etc.—1 June, equitable mortgage securing all moneys due or to become due to the National Bank Ltd.; charged on the dwellinghouse, outoffices and premises, 81 Ranelagh Road, Dublin. *Nil. 13 March 1956.

FISONS LTD. Felixstowe, fertilizer manufacturers etc.—24 May, deed supplemental to a Trust Deed dated 4 September 1950; charged on shares specified in schedule to deed. *£3,500,000. 16 December 1955.

MAYCO PAINTS LTD. London SE.—17 May, charge, to A. B. Clarke, Lingfield, by way of further security to a mortgage dated 30 September 1955; charged on land at rear of 140 & 142 High Street, Deptford. *Nil. 1 August 1955.

Changes of Name

DINNEFORD & COMPANY LTD. manufacturing chemists and druggists etc. 55/56 Pall Mall, London SW1, to Market Surveys Ltd., on 27 April 1956.

SULBURN LTD. manufacturers of perfumes etc. 1A Shelton Street, London WC2, to Sana Chemical Products Ltd., on 23 April 1956.

KARMOR LTD., miners, refiners, manufacturers of and dealers in ore, mineral substances etc. 18 Austin Friars, London EC2. to Borax Consolidated (Sales) Ltd., on 1 May 1956.

New Registrations

Primrose Path Ltd.

Private company. (567,560). Registered 13 June. Capital £1,000 in £1 shares. Objects: To carry on the business of manufacturing chemists and manufacturers of and dealers in chemicals of all kinds etc. The permanent directors (as stated in the Articles of Association) are: Herbert Edge, address not stated; James W. Edge (director of Blackburn Egg Packers Ltd. etc.) and Robert W. Edge, both of 28 Gorse Road, Blackburn. Secretary: R. W. Edge. Solicitors: Backhouse & Co., Blackburn. Registered office: 43 Preston New Road, Blackburn.

Southon Products Ltd.

Private company. (567,494). Registered 12 June. Capital £10,000 in £1 shares. Objects: To carry on the business of manufacturing chemists etc. The subscribers (each with one share) are: Norman E. Morris, 6 Forest Court, London E11, accountant; and Peter N. Beany, 1 Warwick Road, Sidcup, Kent, accountant. The first directors are: Leslie S. W. Southon and Oliver L. Lawrence. Solicitor: J. A. Hogg, 62 London Wall, London EC2.

Company News

Coalite & Chemical Products

As the cost of plant continues to rise, the final bill for the current investment programme of Coalite & Chemical Products Ltd. will amount to 'at least' £1 million. This point is made by the chairman, Commander Colin Buist, in his statement for the year to 31 March 1956. The bill includes £413,000 spent during 1955-56 and commitments of £455,000—of which £282,000 is with third parties. Mr. Buist adds that providing trading conditions are reasonable this year, the company hopes to finance the present scheme of expansion from its own resources. Reviewing the first quarter of 1956-57, the chairman says some effects of the credit squeeze had been felt, but trading conditions remain good apart from isolated weak spots, where profit margins had had to be cut somewhat. Meeting, will be held in London on 12 July.

Du Pont of Canada

Proposal to eliminate the present two-company corporate structure has been submitted to the shareholders of Du Pont of Canada Securities Ltd. The business and operations of its wholly-owned subsidiary, Du Pont Co. of Canada Ltd., would be transferred to the parent company and the subsidiary company would subsequently be wound up. The name of the parent company would be changed to Du Pont of Canada (1956) Ltd. A special general meeting was held on 28 June to approve the scheme which should become effective on 1 January next. To meet certain tax problems arising out of division of the old Canadian Industries Ltd. two separate concerns, Du Pont of Canada Securities Ltd. were established as a holding company which was a technical perpetuation of the old CIL as a corporate entity. Assets and operations of the old CIL allotted to Du Pont in the division were vested in the Du Pont Co. of Canada Ltd.

Works Annual Holidays

The works and offices of B. & F. Carter & Co. Ltd., Bolton, will be closed for the annual holidays from 5.30 p.m. 29 June, until 7.30 a.m. 16 July. During this period a reduced staff will be available for urgent enquiries, but it will not be possible to despatch or accept materials and goods.

Market Reports

LONDON.—A strong undertone persists in most sections of the industrial chemicals market although actual price changes, apart from the non-ferrous metal compounds, have been of little importance. Buying on home account has been fairly widespread, and some replacement business has been reported. Export trade in chemicals is keeping up to recent levels which, for the early part of the year, were slightly better than for the same period of 1955. Creosote oil and cresylic acid are moving well on home and export account, and naphthalene is also an active item in a steady coal-tar products market.

MANCHESTER.—Taking the Manchester chemical market as a whole, a fairly steady demand for contract deliveries has been reported for the alkali products and for most other leading lines from home consumers. There has, however, been perhaps less pressure from the textile and allied industries. A reasonably steady flow of new enquiries from home users and shippers has also been reported. Most sections of the fertilizer trade are seasonably quiet. The light and heavy tar products, with odd exceptions, are moving steadily into consumption.

GLASGOW.—The increased demand experienced last week has been maintained and a good week's trading is reported from all sections of the Scottish heavy chemicals market, both for spot and forward deliveries. Some price increases have been notified but, generally speaking, prices have been steady. The demand for agricultural chemicals has suffered a slight seasonal lull. Export has provided some interesting enquiries with a fair amount of business booked.

US Chemical Plant Construction

Texas, currently the third-ranking chemical-producing state in the US, led in chemical plant production during 1955. Sixty-six projects (costing an estimated $414.8 million) were completed, under way or definitely scheduled, according to a survey by the Manufacturing Chemists' Association of the US quoted in Canadian *Foreign Trade* for May.

Driers for Oil Paints

THE British Standards Institution announces the publication of a revised edition of BS332—'Liquid driers for oil paints.'

The previous edition, published in 1938, contained two standards, BS331-2, covering paste driers and liquid driers respectively. Since there is no longer a demand for BS331, however, the standard has been withdrawn; but it was considered desirable to revise BS332 in the light of experience.

The present edition applies to driers of the type employed by the paint users and not to the concentrated driers normally purchased by the paint manufacturer on a composition basis. It is based on a set of performance requirements relating to the use of the material in conjunction with standard oil paints. Provision is made for a standard strength of drier, although greater strengths, to be expressed in terms of the standard strength, e.g., 'double strength', may be agreed between purchaser and vendor.

Among the organizations represented on the committee responsible for the revision of this standard are: the Admiralty, the Association of British Chemical Manufacturers; the Building Research Station, the Ministry of Supply, the National Paint Federation, the Paint Manufacturers & Allied Trades Association, the Research Association of British Paint, Colour & Varnish Manufacturers and the Society of British Paint Manufacturers Ltd.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W1, price 3s.

Canadian Investments

EXPECTED capital investment in the Canadian chemical industry this year is $80 million. With still further increase expected next year, sales of securities to the public appear likely to multiply. This was the opinion given by a panel of experts, discussing the financing of Canadian chemical industry, at the 39th annual conference and exhibition of the Chemical Institute of Canada.

They were: Mr. Peter W. Blaylock, vice-president, Shawinigan Chemicals Ltd.; Mr. Dudley Dawson, president, Dawson Hannaford Ltd.; Mr. Harold B. Fewkes, associate treasurer, Sun Life Assurance Co. of Canada; and Mr. Selwyn Irwin, president, McArthur Irwin Ltd.

Next Week's Events

MONDAY 25 JUNE

SCI (Pesticides Group)

London: Rooms of the Geological Society, Burlington House, Piccadilly W1. 5.30 p.m. 'Physico-chemical Approach to Insecticide Action' by Dr. R. L. Metcalf.

THURSDAY 28 JUNE

The Royal Society

London: Burlington House, Piccadilly W1, 4.30 p.m. 'The National Physical Laboratory of India' by Sir K. S. Krishnan, F.R.S.

More Women Job Holders

The number of women in the working population of many countries is steadily increasing according to recent statistics. Austria holds first place in Western Europe with 39.3 per cent of its women gainfully employed, followed by France (34.8 per cent), Western Germany (33.1 per cent), Great Britain (30.8 per cent), Sweden (26.4 per cent) and Italy (25.4 per cent). In the Netherlands and Belgium roughly one-quarter of the working population are women, while in Spain only one-sixth are gainfully employed. Corresponding figures for the United States, Australia and Canada are 27.5 per cent, 23.4 per cent and 22.1 per cent respectively.

Plannair Blowers From France

A new licence agreement is announced by Plannair Ltd. for the manufacture of their high efficiency axial flow blowers in France and this will result in the distribution of these products becoming virtually world-wide. The agreement is with Societé Air Equipement, 18 Rue Basly, Asnières (Seine), France, who are manufacturers of air equipment and electric motors for the aircraft and electronic industries. Societé Air Equipement will make the full range of Plannair blowers not only for use in France and French territories but other European countries including Italy, Belgium, Luxembourg, Denmark, Greece, Turkey and Portugal. This further expansion of Plannair manufacturing facilities is in addition to the similar licence agreement last year with the Borg-Warner Corporation of America. Plannair Ltd. have their offices, laboratories and factory at Leatherhead, Surrey.

New Book List Published

A SPECIAL subject list (No. 6) concerning dyes, dyeing and textile printing has been issued by The Library Association, of Chaucer House, Malet Place WC1. Compiled by F. R. Taylor, F.L.A., sub-librarian, technical library, Manchester public libraries, the list is complete with an introduction describing some of the very earliest developments in the art of dyeing. The discovery of mauveine by Sir William Henry Perkin and the subsequent birth of the synthetic dyestuffs industry and the greater part of the organic chemical industry of the world, is also referred to. The introduction further states that the emphasis of the list is on recently published material, the only older items included being the more important ones without which it is impossible to present a balanced conspectus of the whole field. The literally thousands of major contributions that have appeared in periodical literature are specifically excluded, and can be traced by means of the usual aids such as Chemical Abstracts, Industrial Arts Index and the like. The arrangement is under broad groupings, namely: Dyestuffs, natural; dyestuffs, general and synthetic; dyeing, general; dyeing, specific materials, cotton, fur and leather; man-made fibres; silk; wool; textile printing; analysis and testing; bibliographies. Copies of the special subject list can be obtained from The Library Association's headquarters, price 1s. 3d.

British Standards

The British Standards Institution announces the publication of two more British Standards in its series for solvents and allied products. These are: BS 2713, '2-Ethoxyethanol (ethylene glycol monoethyl ether)', and BS 2714, 'Methylcyclohexanol'. Limits are specified for physical properties of the material and for other impurities likely to be present, and full details of the methods of analysis are given. Copies of these standards can be obtained from the institution at 2 Park Street, London W1, price 3s (BS 2713) and 2s 6d (BS 2714).

Research Reactor

West Germany is to have a research reactor of similar design to that being built for the AEI research laboratory at Aldermaston Court.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

Oil and Chemical Plant Construction Project
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Top men only need apply. Applications, giving details of past experience and positions held, should be marked "Confidential" and will be treated accordingly.

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has a vacancy for a
CHEMIST, BACTERIOLOGIST AND FILTRATION SUPERINTENDENT,
whose duties will involve the control of water treatment.

Applications will be accepted from experienced industrial chemists who have gained the Senior National Certificate, or equivalent, and who have also gained or are studying for the A.R.I.C. Some initial experience of water analyses is desirable and bacteriology should have been included in study subjects. An interest in, or knowledge of biology would be an additional advantage.

The post offers ample scope for study and research by an energetic technician. The person appointed will be required to stay at the site of one of the filtration plants where a **MODERN BUNGALOW WILL BE SUPPLIED RENT FREE.** The commencing salary will be £745 unless applicant holds A.R.I.C., when salary will begin at £805 and rise to £870.

The appointment will be subject to the Board's Conditions of Service and to entry into the Superannuation Scheme, for which the successful candidate will be required to pass a medical examination.

Applications, together with the names of referees, must be lodged with
MR. ERIC W. DENHOLM, M.I.C.E.,
WATER BOARD OFFICES,
"BROCKVILLE,"
FALKIRK,
not later than 4 July, 1956.

RESEARCH CHEMIST wanted by progressive food organisation with laboratory in the City of London. The successful candidate will be required to work directly under the Chief Chemist on immediate and fundamental research problems arising from factories both at home and overseas. This post requires a man capable of working on his own initiative and of developing ideas up to the pilot plant stage. The work will be varied and a generous salary will be paid to the right man. Contributory pension scheme Apply stating previous experience and salary required to **BOX NO. C.A. 3476, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

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FILTER PRESS by S. H. Johnson. 49 cast-iron recessed plates 36 in. sq. by 1¾ in. pyramid surface. Cake size 34 in. sq. by 1 in. Centre feed. Hand-ratchet closing.

2 Unused Johnson Wooden Plate & Frame **FILTER PRESS CARCASES.** Hydraulic closing gear, frame size 61 in. by 49 in. Cake size 48 in. by 38 in. by 2 13/16 in. Suitable for 28 chambers. Rubber-lined filtrate trough.

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