Chemical Age

HYDRAZINE CONFERENCE
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VOL. 77 No. 1976

25 May 1957

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The first figures refer to advertisement in **Chemical Age Year Book**, *the second to the current issue*

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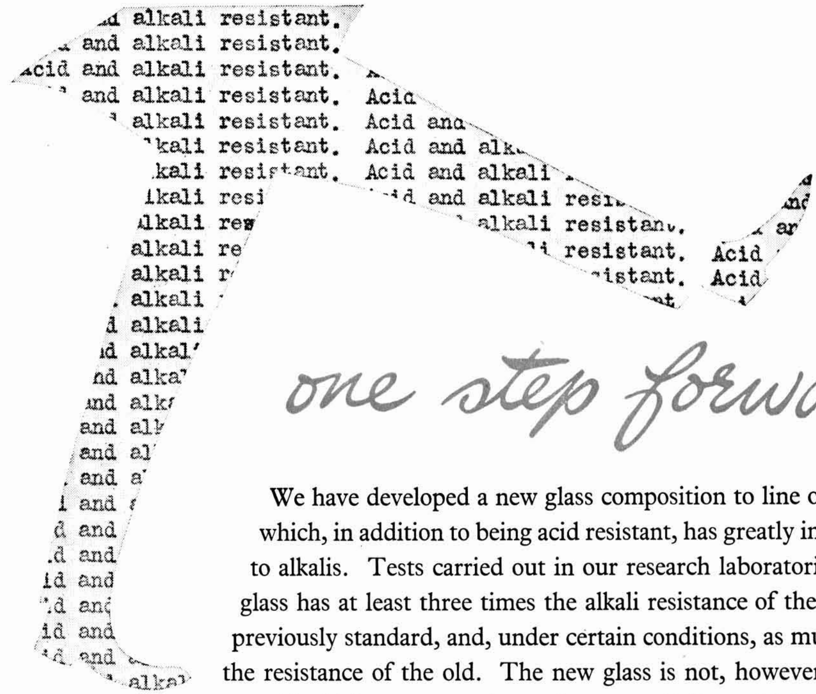

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CHEMICAL AGE

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SPOTLIGHT ON BORON

BECAUSE it is a good neutron absorber, boron is of considerable importance in the nuclear energy programmes. Natural boron, in various physical and chemical forms is used for reactor control rods. Boron-10 isotope is, however, five times better than natural boron for absorbing thermal neutrons, and its availability now may lead to new designs in reactor shielding as well as control.

In the UK and US, boron-10 is available to private industry. US prices range from $3.10 to $8.60 a gramme, covering assay values of 61 per cent to 95 per cent from the Hooker Electrochemical Co., a contract operator for the US Atomic Energy Commission. The isotope is separated from its isotopic twin B-11 when natural boron (containing 19.6 per cent B-10) in the form of dimethyl ether-boron trifluoride complex is distilled. The enriched complex is converted to B-10 by electrolysis of potassium fluoroborate in a fused-salt bath.

The use of boron-10 in the field of instrumentation is now being studied. Incorporated in a dosimeter which is carried on the person of workers in potentially radioactive areas, the amount of radioactivity being absorbed by the individual can be measured. Another possible use for boron appears to be in the use of B-10 dispersed as filter in plastics or paper or other carrying agents to fill specialised shielding needs.

The Atomic Energy Commission is desirous now of finding markets for the products of the B-10 process, namely, the DME-BF_3 complex which has a boron content of 10 to 12 per cent B10 and 88 to 90 per cent B-11. B-11 is, unlike its twin, extremely transparent with regard to neutron absorption. However, AEC believe that applications based on this property may be developed.

Interest is now centering on boron-based, high energy fuels which are the new fuels for jet aircraft and rockets. It is estimated that by 1960, about seven and a half million tons of borax may be needed by the US for this purpose. Last year, total output of borax in the US was 950,000 tons, with British Borax Holdings the biggest producer there. Hence Wall Street's interest in Borax's US subsidiary noted in last week's issue of CHEMICAL AGE.

Compounds being studied as high-energy, low-weight fuels are penta, deca, and alkyl boranes. A suitable starting point for making diborane, the intermediate for penta, deca and alkyl-boranes is potassium borohydride.

In the US, several companies are interested in these borane compounds since last September Boeing Aircraft announced plans to build a chemically powered bomber. Among these companies are Metal Hydride, whose process for preparing potassium borohydride involves the preparation of sodium borohydride and methyl borate, reacting it with potassium hydroxide.

Another method developed by Callery, US, involves making alkali metal borohydrides by atomising the metal in a stream of dry hydrogen at 300-660°F and reacting it immediately with dry, cool hydrogen and boron halide.

A method believed to be very much more economic with regard to equipment costs is a fluid-bed chlorination technique to make BCl_3. Potash is reacted with boron carbide and chlorine. Periodically carbon deposits have

to be removed, but it is considered that this fluid-bed technique could be developed to make the process continuous.

Diborane is produced by reacting an alkali metal hydride or an alkali borohydride with a boron halide in anhydrous ether. Alkyl boranes are produced by the reaction of diborane with a metal alkyl such as aluminium trimethyl, the production of which is also interesting certain US companies (see CHEMICAL AGE, 16 February, page 282).

From Western Germany has recently come a report from the Max Plank Institute claiming a new method of producing borohydrides. This involves hydrogenation under pressure of boron trialkyl compounds with a tertiary amine to produce N-trialkylborazane. Borohydride of 100 per cent purity is obtained by treating the N-trialkyl borazane with a suspension of metal hydride powder in an inert solvent. Lithium, sodium, potassium, magnesium and calcium borohydrides have been produced to date.

POLYCARBONATES DEVELOPED

POLYCARBONATES are a new series of synthetics which have been developed in the US and Western Germany almost simultaneously. The companies investigating polycarbonates are General Electric in the US and Bayer in Germany.

Up to the present neither company has revealed specific information about polycarbonate chemistry or production routes, although a polycarbonate resin by Bayer is the subject of an already issued Belgian patent. It is suggested that starting materials might be a polyphenol and an acid chloride, e.g., phosgene, methallyl chloride. A production technique reported by Bayer involves an emulsion of a polyphenol in a methylene chloride carrier, addition of caustic soda and phosgene with a quaternary ammonium hydroxide as catalyst.

As there are many possible polyphenols it appears likely that a variety of polycarbonates can be synthesised. Indeed, both Bayer and the General Electric Company claim to have synthesised from 20 to 50 different polycarbonates.

From information available from General Electric, a polycarbonate resin of interest is Lexan. This, the company claims, has such great physical toughness that it can replace even metals in some applications. Hollow-moulded parts can be hammered into wood with no damage. Nails and spikes can be knocked into the product without causing splitting or tearing. Properties reported for Lexan include also, good electrical properties, good heat resistance, low water absorption, high dimensional stability and non-flammability.

At the present time, having regard to the pilot-scale production, pricing of this polycarbonate resin is difficult. Present samples are priced at $2.50 per pound. Commercial production is deemed unlikely before 1960.

ACCIDENTS IN INDUSTRY

IN the April issue (Vol. 31) of the quarterly publication of the factory department of the Ministry of Labour and National Service—*Accidents—How they happen and how to prevent them*—the dangers of bandaged hands or fingers are described. Since solvents are much used in the chemical and allied industries, the following cases of ignition of solvent-wetted bandages are of interest.

In one case inflammable petroleum solvent was being used. The workman, who had been using muslin cloths soaked in the solvent for cleaning car bodies, left the workshop for a smoke. On lighting a cigarette, a lint bandage on his left thumb, that had become soaked with the solvent, caught fire, and his hands were burned.

In the second case a machine attendant in a rubber and plastics factory had cut his hand and the wound had been bandaged. In the course of his work, he had to clean the rubber rolls of his plastic spreading machine with acetone. After completing this, he left the department, and while lighting a cigarette the acetone-soaked bandage caught fire. His hand was severely burned.

Accidents of the above type occur frequently when smokers have ignited bandages soaked by inflammable liquids used in the course of their work. It is therefore not superfluous to warn persons handling inflammable solvents of the danger of fire and burns.

SEWAGE DISPOSAL PROCESS

RESEARCH is now being carried out in the US on the application of the Zimmermann process in sewage disposal. The process has been shown to be effective in eliminating pollution from waste sulphite liquor and laboratory investigations on domestic and industrial sewage have proved promising. If the process can be applied on a large scale, it is considered in the US that it could mean a large saving to taxpayers.

In the Zimmermann process waste is charged to a closed reactor with compressed air at about 800 p.s.i. and about 500°F. Inorganic chemicals are oxidised and organic chemicals are both oxidised and cracked. After wet combustion end products are water with an acceptable chemical oxygen demand, carbon dioxide and a small amount of inoffensive ash.

A pilot plant to evaluate the cost of burning sewage sludge in concentrations of two to six per cent or more is to be built in the US by Sterling Drug Company.

First commercial trial of the Zimmermann process will be in Norway where waste liquor from a 500 ton/day pulp mill of Aktieselskapet is to be handled by a $3 million unit. The process is expected to pay for itself by converting heat of combustion into process steam.

IMPORTANCE OF CERAMICS

A STRONG AND CONCERTED EFFORT is being directed towards the development of ceramics and refractory metals because of the demand for increased efficiency in obtaining power from a heat engine of any type, either fossil or nuclear. This efficiency is, of course, dependent upon the attainment of higher and higher temperatures in the engine, and refractory metals and ceramics capable of withstanding very high temperatures, i.e. between 2,000° F and 4,000° F, under the various conditions of corrosion, radiation and stress are being sought.

It is believed that in the decade to come the new field may be more important than the now successful development of titanium and zirconium. The metals expected to take a prominent place in the coming years are mainly molybdenum and niobium. Their strength to weight ratio is exceptionally high and thus makes them more favoured than metals such as tungsten, although even this is being re-examined for higher temperature applications.

To be successful in breaking through the present temperature limitations, the metals will have to have a high strength to weight ratio, a good oxidation resistance to air at temperatures over 2,000° F, must be capable of standing moderate stress and, in the nuclear field, must be stable against radiation.

Above 2,500° F and up to 4,000° F ceramics hold great promise. At these high temperatures, the problems are ductility, thermal shock resistance, heat conductivity, ability to carry stress, and for nuclear purposes, impermeability to the escape of fission products through the cladding.

Development of such ceramics may take longer than finding appropriate metals, because of the brittle nature of ceramics. Thus, either ductile ceramics are required or the inherently poor mechanical properties of ceramics must be overcome by designs which avoid these properties of ceramics.

HYDRAZINE AND WATER TREATMENT

Whiffen and Sons hold International Conference at Bournemouth

Development of hydrazine as a deoxidant has been rapid. The 1943 edition of 'Thorpe's Dictionary of Applied Chemistry' states 'Hydrazine is used only to a minor extent in technical practice, e.g. as an antioxidant or in the application of azo dyes.' Since that date its use in boiler feed water treatment has increased tremendously and the time was ripe for a critical assessment of its value compared with other reagents such as sodium sulphite.

DELEGATES from eight countries assembled at Bournemouth on 15, 16 and 17 May for an international conference on 'Hydrazine and Water Treatment' organised by Whiffen and Sons, the industrial and pharmaceutical chemical division of Fisons, and sole British manufacturers of hydrazine.

The following papers were presented:

'The reaction between hydrazine and oxygen' by Dr. S. R. M. Ellis and Dr. C. Moreland, chemical engineering department, University of Birmingham.

'Experiences with hydrazine as a chemical deoxidant in high pressure boilers' by Mr. W. F. Stones, divisional chief chemist, North-eastern division, Central Electricity Authority.

'Practical works experience concerning the deoxygenation of boiler feed water with hydrazine' by Dr. Max Zimmermann, Farbenfabriken Bayer, Germany.

'Treating industrial water with hydrazine' by Mr. E. R. Woodward, Olin Mathieson Chemical Corp., US.

'Experiences with hydrazine in Italy' by Signor Piero Sturla, Edisonvolta, Italy (in Signor Sturla's absence his paper was read by Mr. R. C. H. Spencer, of Whiffens).

'How the demands of modern boiler design have influenced water treatment' by Mr. S. P. Walker, Babcock and Wilcox Ltd.

Short Discussions

Prepared short discussions

(1) Monsieur R. Rath, Electricite de France.
(2) Mr. F. R. Houghton, Sutcliffe, Speakman and Co.
(3) Mr. W. H. B. Fletcher, CEA.
(4) Monsieur Celis, Laboratoire Reigniers, Belgium.

'The use of hydrazine for oxygen removal' by Mr. J. Leicester, director of research, British Launderers' Research Association.

'What sort or reactor' Dr. T. A. Hall, United Kingdom Atomic Energy Authority (Dr. Hall also introduced a showing of the film 'Great Day' made for the opening of the Calder Hall atomic power station).

The conference was summarised and the future of hydrazine discussed by Mr. R. Llewellyn Rees, chief chemist, Central Electricity Authority. An 'Any Questions' session was also held, during which a technical panel consisting of Mr. Woodward, Mr. Spencer, Mr. Stones and Dr. Ellis, under the chairmanship of Mr. R. S. Law (Whiffen and Sons) answered specific questions on hydrazine usage.

Introducing the first morning's proceedings, Mr. C. E. Horton, research director, Fisons Ltd., said that leading technicians, manufacturers and users of hydrazine were present, together with representatives of alternative methods of boiler treatment. He hoped that the discussions would be objective and scientific Whiffens had 'flirted' with hydrazine since 1931 said Mr. Horton.

Dr. Ellis was the first speaker. He said that the work at Birmingham University had been concerned with three aspects of the hydrazine-oxygen reaction: rate of reaction, decomposition of hydrazine and inhibiting effect of hydrazine on corrosion.

Earlier work carried out by Dr. Moreland and himself had shown that the reaction between hydrazine and oxygen in water was heterogeneous. Some of the previous work had now been repeated using improved methods of analysis and covering a wider range of initial oxygen concentrations.

Results obtained for the oxygen-hydrazine reaction in glass flasks indicated that the reaction was approximately first order, figures varying from 0.9 to 1.2 with an average of 1.0.

Previously published work for saturated water at 20°C with 10 per cent excess hydrazine gave an order of 1.7. Evidence suggested that the reaction was not the simple one indicated by the equation:

$$N_2H_4 + O_2 = N_2 + 2H_2O$$

The reaction was also investigated in a packed column of carbon of the type used in Germany and Italy. Active carbon was found in all cases to have a marked effect on the hydrazine-oxygen reaction. The activity of the carbon decreased with time but could be restored by immersing in fresh hydrazine solution and degassing. Decomposition products were mainly nitrogen and ammonia.

Dr. Ellis referred to the work of Dr. W. C. E. Higginson of Manchester University on the hydrazine-oxygen reaction.

He also mentioned the work of Mr. M. A. Pearson at Birmingham University which showed that hydrazine had an inhibiting effect on the rate of corrosion.

Main points to emerge from Dr. Ellis's paper were:

(1) A hydrazine residual must be maintained. It does not matter whether hydrazine and oxygen react or co-exist in the vapour as the reaction takes place at the walls.

(2) Hydrazine is a corrosion inhibitor, decreasing rate of iron pick-up.

(3) No trace of carbon must enter the boiler because of its catalytic effect.

(4) Morpholine will stabilise hydrazine against decomposition.

Dr. Ellis's paper provoked considerable discussion. Dr. R. G. H. Watson, Admiralty Materials Lab., asked if there was any evidence of the reaction:

$$N_2H_4 \rightarrow N_2 + 2H_2$$

The answer was 'no, as far as was known' but no quantitative experiments had yet been carried out. Monsieur Celis of Belgium said that work in Belgium indicated that the reaction was not stoichiometric.

Dr. Zimmermann of Farbenfabriken Bayer stressed that Dr. Ellis's results were obtained under static conditions and did not approximate to practical conditions.

Mr. Stones, CEA, said that he was in favour of hydrazine. After three years' trial it was now regarded as a normal deoxidant. A possible deterrent to the use of hydrazine had been the formation of ammonia. It was now realised that the ammonia formed prevented copper attack by providing a suitable *p*H.

Mr. Stones gave examples from four power stations belonging to the CEA. The conclusions he drew were that hydrazine was an efficient deoxidant and had many advantages over sulphite. There was

Dr. Zimmerman answers a point made by another speaker, Dr. Fox (Fisons Ltd.) stands by, ready to interpret

l. to r. Mr. R. Llewellyn Rees, Mr. W. F. Stones, Dr. W. C. E. Higginson and Mr. Eric R. Woodward

no loss of heat or chemicals because of blowdown. Feed line corrosion was considerably reduced and corrosion of feed heaters had been arrested.

Dr. Zimmermann commented on his own paper which had already been printed. He said that the use of sulphites as deoxidants was unsatisfactory because of their solid content and the possible formation of hydrogen sulphide. He produced a slide which showed the effect of hydrogen sulphide on a turbine blade.

The stability of hydrazine under 6, 30 and 130 atmospheres was investigated. It was found to be stable. It was possible to distribute hydrazine over the whole water-steam circulation system and provide complete protection.

Tests on Hydrazine

Tests on the introduction of hydrazine were arranged in two locomotives. These two locomotives had previously used condensate to which trisodium phosphate and sodium sulphite were added. Despite the fact that up to 180 g. of sodium sulphite was used per cubic metre in the boiler water the boiler tubes corroded and had to be replaced after six months to a year.

In 1944 the sulphite was replaced by hydrazine. At first it was necessary to use hydrazine sulphate and this caused a certain amount of acid corrosion in one of the locomotives. New tubes were put into this locomotive in 1951 and treatment was then commenced with hydrazine hydrate. At the same time a small active carbon filter was built into the feed line in order to achieve the reaction between oxygen and hydrazine before the boiler. The locomotive had been running continuously since 1951 without showing any sign of damage at all.

Many other examples of the protective power of hydrazine were given by Dr. Zimmermann. In a large power station about one to two buckets of sludge were removed from the boilers each year. After the addition of hydrazine this did not occur.

All the ships of the Hamburg-America Line now used hydrazine with perfect results.

Experiences with hydrazine in the US were described by Mr. Eric R. Woodward. Before beginning manufacture of hydrazine, he said, it was necessary to carry out a market survey. To obtain some idea of the potential market an examination was made of sodium sulphite figures. These figures increased from 900,000 lb. a month in 1948 to nearly 1,700,000 lb. a month in 1956. Assuming that one lb. of hydrazine was equivalent to eight lb. of sodium sulphite, figures were worked out for the potential market in the US. For 1956 the potential figure for hydrazine was 2,500,000 lb. a year.

Development problems were discussed by Mr. Woodward. Flammability and explosive hazards worried some people. It was found that if the material were marketed as a 35 per cent solution there was no flash or fire point. Another danger was the use of stainless steel containing molybdenum for containers. It was found that molybdenum caused decomposition of hydrazine.

An example of how new potential markets may be opened up was given by Mr. Woodward. The hot water system of a large apartment was troubled by boiler corrosion. Hydrazine was found to be a simple and reliable remedy. This is one of the first instances of hydrazine being used for a low pressure system.

On the question of transport of hydrazine Mr. Woodward said that Olin Mathieson had found mild steel drums satisfactory. Stainless steel drums were expensive and were not always returned, causing a considerable financial loss to the company. The possibility of using polythene drums was being investigated.

No Corrosion Troubles

In a short paper, Monsieur R. Rath, Electricite de France, said that he used hydrazine. He did not consider it necessary to remove the last traces of oxygen. He had never had any corrosion troubles with a well operated power station and only used hydrazine when stopping or starting.

Mr. W. H. B. Fletcher, CEA, said that in his opinion hydrazine and ammonia were complementary deoxidants.

Discussing his paper, Mr. Leicester talked of the possibility of using hydrazine in low pressure systems. Attempts had been made to find the mechanism of the hydrazine/oxygen reaction. Surfaces evidently played a large part for after thoroughly cleaning one particular plant it was found impossible to return to the old reaction rate.

Mr. Leicester said that he was interested in a solid compound of hydrazine for use by semi-skilled operators. He asked if anyone had had experience with solid compounds.

He agreed with Mr. Stones about the beneficial effects of small amounts of ammonia.

The point about a solid form of hydrazine was answered by Mr. Woodward who suggested the use of monohydrazine phosphate.

During the general discussion which followed, Dr. Zimmermann made a number of further points. To the question 'is it necessary to add hydrazine when an efficient deaerator is used?' he said that there was no guarantee that thermally deaerated water would not take up oxygen.

Mr. D. Bass, Armour and Co., said that there had been no mention of the toxicity of hydrazine. He wanted to know whether hydrazine treated water could be used in food processing. Mr. Woodward said that in his opinion hydrazine should not be used as we did not yet have sufficient knowledge about its effects.

Handling Dangers

Another speaker was interested in the dangers of handling hydrazine. Mr. E. Vero, Whiffen and Sons, said that in 15 years' experience he had come across no serious attack of dermatitis. He emphasised that all that was necessary for safety was normal 'good housekeeping.'

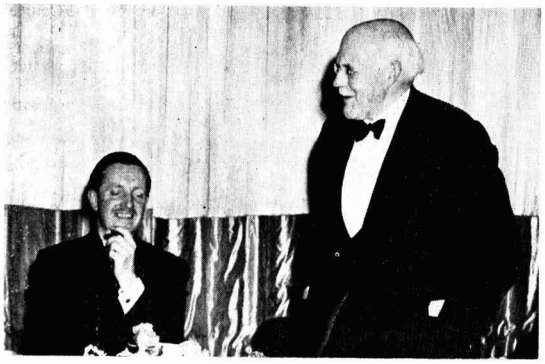
Summing up the conference, Mr. R. Llewellyin Rees, chief chemist, CEA, said:

'We have been taking part in an exercise in the art of communications. Too often communication between producer and user took place only through the salesman and the atmosphere of casual knowledge. It was good management, especially during the development of a new technique, to bring about a free interchange of information between supplied and user. 'All credit to the organisers of this conference for having taken such an efficient method of implementing this principle.

'My job in summing up the conference, as I see it, is not to recapitulate what must be fresh in your minds, but to try to bring the picture into broad perspective, the perspective of a user, and especially to point to some of the still outstanding questions that seem important to a user.

'There are two main reasons, which seem to me to be fundamentally legitimate, for giving constructive thought to the use of water treatment in normal power station operation. The first is to provide a margin of safety to cover an emergency. The second is to give the plant designer greater flexibility, leading to overall long term economies, and I say plant designed and not boiler designer because the quality of the water affects much more than the boiler.

'The purpose of hydrazine treatment is not fundamentally to remove oxygen but to stop corrosion. It is conceivable that hydrazine can inhibit corrosion in the presence of oxygen, for example by



Sir Harold Hartley speaking at the hydrazine conference dinner. On the left is Mr. A. Robinson, managing director of Whiffen and Sons

acting electrochemically at the surface without disrupting the protective oxide layer.'

Preliminary experiment, he said, showed that hydrazine did not prevent the reaction between iron and oxygen up to 500°F. These points needed further study, especially as they had heard evidence at the conference of protection in presence of oxygen, at least at low temperatures, which was not due solely to the *p*H value. 'We should try to decide whether we wanted zero or nearly zero oxygen in the water (which might not necessarily prevent corrosion), or whether we wanted a positive concentration of hydrazine with or without a little oxygen.

'There seem to me to be excellent reasons for extending the use of hydrazine in h.p. boilers, at the same time making appropriate observations and measurements so that the programmes laid on as normal operating practice are in fact combined with field trials. There is also scope for academic research, correlated with the field trials and with corrosion studies. I have tried to indicate some of the directions that these investigations might take.

'Methods of analysis and control need attention. The method of determining oxygen in presence of hydrazine is tricky, as hydrazine interferes with the Winkler method and with its usual modifications. The CEA has developed and proved a method (which is about to be published) of analysing for oxygen down to about 0.001 p.p.m. including full correction for interfering substances. The other methods that are now being used generally appear to be giving reasonably reliable practical results at the higher levels of construction.'

After the conference a dinner was held at which the guest of honour was Sir Harold Hartley. Sir Harold possesses what must be the rare distinction of having studied under Curtius, the discoverer of hydrazine.

BSI Yearbook Available

The British Standards Institution's *Yearbook* has recently been published. The volume contains a complete numerical list of British Standards and Codes of Practice current on 1 January together with other information about BSI, and a comprehensive index in which all standards are listed according to subject.

Non-members of the Institution may obtain copies at the published price of 15s plus 1s 6d for packing and postage by writing to 2 Park Street, London W1.

ALLEN AND HANBURYS' OPEN STERILE PRODUCTS UNIT

PHARMACEUTICAL manufacturers, Allen and Hanburys Ltd., organised a visit to their new sterile products unit at Ware on Monday this week. In the words of the chairman, Mr. John C. Hanbury, the new developments in the unit constituted the techniques of today and tomorrow.

No branch of pharmaceutical manufacture was more exacting than that concerned with the preparation of sterile solutions for injection, and the increasing demand for such material made it desirable for the company to establish a separate sterile products unit to provide as far as possible the ideal conditions required for asepsis.

Not only have technical considerations been borne in mind in the design of the unit. Because of the necessarily exacting nature of the work of a sterile products unit, a too monotonously 'clinical' appearance has been avoided by the use of cheerfully coloured wall panels and glazed walls of adjoining laboratories with pleasant views of the open country which surrounds the building.

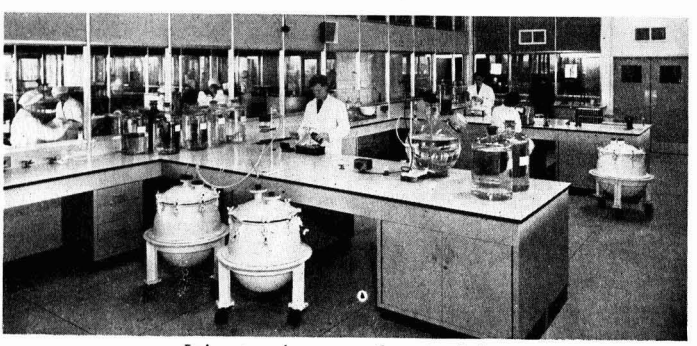
Of interest in the preparation room illustrated where solutions are prepared were p.v.c. candle filters, inserted in 10-gallon digesters containing solutions being filtered under vacuum. A rather unusual piece of equipment in the container preparation laboratory is a Bendix washing machine which has been adapted for washing rubber vial caps to rid these of any particles of rubber adhering to them. The vehicle in the washing machine is the same as that to be used in the injectable solution, for which the caps will be used.

Very large quantities of distilled water are required in the sterile unit. An unusual and very new piece of equipment is the Mascarini high efficiency water Superstill, produced by Societa Mascarini, Via Cappelari 3, Milan. This still works on a pressure system. Ordinary domestic water, which is softened, is boiled in a chamber. The steam arising is then compressed and the latent heat in the steam heats more water. Output is 150 litres an hour. It is understood that this type of still is being used in submarines to prepare drinking water from sea water.

Laboratories in the sterile unit are served not only with gas, electricity, vacuum and compressed air services, but also with supplies of oxygen and nitrogen.

A striking example of automation is the plant room which houses the air-conditioning plant (a Precipitron electronic precipitator), and from which ventilation and heating of the entire building are controlled. From a central control panel the air supply to all rooms can be increased or lowered, heated or cooled, to offset the effects of changes in the weather or to meet the needs of the particular work in hand. Outside air is ionised by passing through an electric field of 6,000 volts and is then drawn through negatively charged metal plates. The positively charged particles in the air adhere to the plates. A very fine filtration system is installed in all the sterile rooms. Such is the efficiency of the air-conditioning plant that four out of five plates in the laboratories have been found to be clean when examined.

Another panel in the plant room shows the temperature in each room as well as providing a record of fluctuations of the external temperature. This panel is by Electroflo.



Laboratory for preparation of solutions

DISTILLATES

★ A 'MYSTERY FIRM', said to be a large producer of chemicals, anxious to expand, is interested in sites near Cardiff and Barry Docks for a new works. Group Captain G. B. Bailey, chairman of the joint ports committee of the Industrial Association of Wales said last week that the name of the chemical company could not be disclosed at present.

The Cardiff and Barry sites can certainly provide vast quantities of water for chemical processing and the docks can handle imports of raw materials and exports of finished products, services which the firm regards as vital. There is no doubt that for firms specialising in fertilisers, plastics and, perhaps, petrochemicals, the site would prove ideal.

★ AN ANCIENT industry making the most of modern science in its fight to hold its own against competitors in the field of plastics and synthetic rubber is leather. Leather chemists are very much on their mettle and the past year has seen a major effort at the Milton Park, Egham, laboratories of the British Leather Manufacturers' Research Association to improve the physical properties of sole leather.

It is in this sphere that most of the competition from newer materials is being met. Leather chemists say their work is already pointing the way to longer wearing sole leather that will match the properties of other materials. At the BLMRA Open Days last week, visitors were able to see the research programme aimed at increasing the waterproofness and wear resistance of sole leather by impregnation (see page 890)

In this work, chrome, vegetable and chrome retanned leathers have been impregnated with a range of materials, including certain polymers. For increasing the waterproofness of upper leathers, a silicone treatment has been found the most effective.

★ AS USUAL the Open Days of the National Physics Laboratory held this week at Teddington attracted much attention. Among exhibits that caught Alembic's eye in the programme was a reference to helium purification and liquefaction. Although there are at present no industrial or commercial applications of liquid helium, Alembic recalls interesting work in this sphere carried on in the US by the Arthur D. Little Inc.

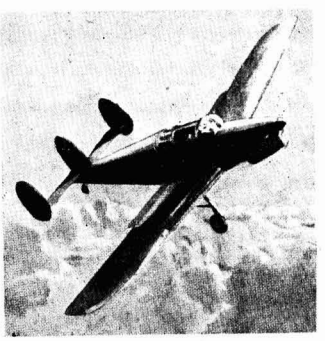
There, chemists developed equipment for ultra-low temperature research. This institution does valuable work in manufacturing instruments of a highly specialised character and for which there is only a small world market. This 'help-your-neighbour' policy saves much duplication of effort in other countries.

So far they have sold about 100 of their helium liquefying equipment. This is basically the apparatus used by the NPL. The equipment is very costly—in the region of £15,000—and although the NPL has the facilities for making it, it was no doubt found more economical to draw on the resources of the Arthur D. Little organisation.

The raw materials for the NPL work are helium gas, imported from the US and, of course, liquid nitrogen. Some of the liquid helium, at 4.2°K (−269°C or −452°F), is used for low temperature research at the laboratories; the rest is sold at the actual cost of production to other research units in British universities, industrial concerns or Government departments. The helium gas which 'boils off' from the liquid helium during storage and use is recovered, purified and liquefied again.

★ A FINE chemical firm that probably gives speedier delivery than most other UK manufacturers, has its headquarters at Welwyn Garden City, Herts. When Carnegies of Welwyn Ltd. receive an urgent request for an immediate consignment of adrenaline, one of the 70 or so main chemicals produced by them, they can normally promise delivery within a few hours.

Distance presents no problem for the supply is flown from nearby Panshanger



The Carnegie company aircraft, from a painting by Keith Shackleton

airport in the company's own four-seater Miles Messenger. This family firm was started by the late R. B. Carnegie in 1911 and soon after the late R. B. A. Carnegie became senior partner. Mr. Donald Carnegie, who joined the firm in 1924, decided to go into business on his own account and started in a small factory at Welwyn.

Rapid expansion followed and early in the last war, in response to a Government request, the company put down a 'shadow factory' for the production of quinine from cinchona bark. Now Carnegies are one of the world's leading suppliers. The Welwyn works also has an analytical and research section.

★ A GROUP of polythene tube manufacturers who first met in 1955 have registered their club under the Restrictive Trade Practices Act, as the 1972 Club. The club is concerned with polythene tubing made to British Standard 1972 and has no written constitution and no rules or regulations.

According to a memorandum, it recommends terms of sales to members and facilitates the exchange of technical information. Recommended re-sale prices and discounts are issued to purchasers but these are not made an implied condition of sale, except in a limited number of cases.

★ IN THE House of Commons last week, Lord Waverley told Alembic something of the work of the Parliamentary and Scientific Committee, which can claim to be unique. It is non-party and was formed to provide Members of Parliament with authoritative scientific and technological information in connection with debates in the House and ensure that proper regard is had for the scientific point of view.

Lord Waverley was particularly concerned that scientists should not only tell their scientific colleagues of the results of their work, but that they should reach out to a wider audience. 'They must,' he said, 'take the trouble to make their results intelligible to the general public.' A sentiment which Alembic heartily supports, although he appreciates the difficulties.

★ A NEW industrial medical centre, said to be the biggest of its kind in the Commonwealth, was opened at Wilton last week by Imperial Chemical Industries. It is intended to serve the 8,000 employees there and is capable of handling the 12,000 who are expected to be needed under the expansion plans now in hand.

Object of the new centre, which replaces the inadequate hutting used since 1949, is to maintain a high standard of physical and mental well being and reduce lost time to a minimum. ICI regard the new centre as a factor in determining the toxological safety of the chemical plants operated at Wilton. The staff comprises two full-time doctors and one part-time doctor, 10 State registered nurses, two laboratory technicians, four ambulance drivers and five clerical assistants. Visiting specialists will be called in from time to time and when the payroll reaches 12,000, two or three dentists are expected to be employed.

Alembic

ANOTHER RECORD YEAR FOR ICI

Home and Export Trade at Higher Levels, Despite Rising Costs

DESPITE a trend of rising costs and higher competition, most of the divisions of Imperial Chemical Industries Ltd. reported record home sales and export trade during 1956. Even the pharmaceutical, paint and plastics divisions, which faced particularly difficult conditions, enjoyed a record year.

These facts are disclosed in an attractive 30-page colour booklet which surveys the company's 13 operating divisions in the UK, which between them operate more than 100 works, employ a work force of 115,450 and make 12,000 different products. This survey accompanies the annual report and for the first time is published separately.

The survey shows the important part that ICI play in Britain's export drive. In 1956, the f.o.b. value of the company's shipments was £73.1 million, a little more than a quarter of total sales. This was achieved by a world-wide network of selling organisations, comprising subsidiary or associated companies of varying importance in 42 countries, with selling agencies in most of the remainder.

Besides marketing, some of these subsidiaries are also manufacturers. In the case of the Australian company, sales of products of its own manufacture accounted for 70 per cent of its business in 1956. Similarly the Canadian company's output accounted for 80 per cent of its 1956 business.

Capital Expenditure

ICI's commitments at the end of 1956 in respect of expenditure on capital projects already sanctioned by overseas subsidiary and associated companies, were slightly in excess of £25 million. Half this sum will, it is expected, be financed out of earnings retained overseas.

At December last, ICI had 115,450 employees, of whom 5,800 men and 50 women were technical. The number of chemists employed is shown as 950; engineers number 1,900, and chemical engineers, physicists etc., total 950. Assistant technical officers and laboratory assistants total 4,990 men and 1,230 women.

Home sales of alkali products by the alkali division in 1956 were 9 per cent greater in value than in 1955, which was itself a record year. Alkali exports also set up a new record, mainly because of resumption of large shipments to Brazil. These results were achieved in the face of heavy competition from Chinese alkali in the Indian market, from Iron Curtain countries (East Germany in particular) both in India and the Middle East, and from US manufacturers particularly in Central and South America.

As a logical offshoot of its alkali business this division is extending its interest in rubber fillers. Winnofil, a form of calcium carbonate used as filler to improve wearing qualities of coloured rubber is being produced in a new plant. The product is also being increasingly used in paints. New processes have been developed for manufacturing other rubber fillers such as calcium silicate, aluminium silicate and silica; production will be begun this year, and will be expanded in 1959.

Sales of Alkathene last year are reported as 33 per cent in value above those of 1955, and, in spite of US competition, exports were almost twice as high as ever before. There was particularly heavy demand for Alkathene tube for cold-water plumbing.

A falling-off in demand for some of the products of the general chemicals division is reported, due to fluctuations in particular trades, import restrictions in some overseas markets and credit restrictions in the UK. However, even with these difficulties sales were 3 per cent higher in value than in 1955 and despite lower prices to meet competition in overseas markets both volume and value of exports was greater than in 1955.

Sales Increases

Products which showed increased sales were: Arcton for refrigerants and propellents in aerosols; Alloprene chlorinated rubber, for paints, adhesives and printing inks; and Cereclor, chlorinated paraffin wax used in p.v.c. compounds and high-pressure lubricants.

Sales of all main products of the lime division reached record levels last year and the salt division's sales maintained the high level achieved in 1955. Dendritic and granular forms of vacuum salt showed increased sales. A quarter of the salt output was exported.

There was a record increase in the sales of the dyestuffs division, these being 6 per cent in value above those of 1955. Total home sales increased in value by 3 per cent despite the reduced activity in the textile industry. Overseas sales, which were greater by 10 per cent than in 1955, represented more than one-third of this division's turnover. Currency difficulties and import restrictions, however, affected exports, particularly to China but progress in a number of newer markets is reported.

Nylon polymer production reached record levels. Construction of the new Wilton nylon plant is now well advanced, and when complete, will increase production capacity for nylon polymer to 6 million pounds a year.

Plans are well in hand to expand production of the Procion range of dyestuffs for which a world-wide demand is expected.

Research and development work on isocyanates (which form the basis of flexible or rigid foams, heat-resisting, hard surface coatings or rubber-like materials) has been carried out. A large plant to produce these compounds was completed by the end of last year and should be in operation soon.

A difficult year is reported for the pharmaceutical division, although sales measured by volume reached record levels both at home and overseas. More than 65 per cent of the total turnover was exported. However, intense competition, particularly for penicillin and sulphonamides, has meant low prices. Of new products, Fluothane, ICI's inhalation anaesthetic, has proved highly satisfactory in clinical trials and development work is now proceeding in many countries. The importance of research in this division is stressed. Last year, 11.6 per cent of its turnover was spent on research and development compared with 3.1 per cent for ICI as a whole.

Record outputs are reported for many of the sections of Billingham division and turnover increased by nearly 13 per cent. There was an increase in exports of organic chemicals and a further expansion in these is expected. However, total exports dropped, mainly, it is stated, owing to increased sales of sulphate of ammonia to British farmers.

Demand for fertilisers is growing, ICI's sales in 1956 reached a new record and extensions to capacity for Nitro-chalk and concentrated complete fertilisers are planned.

Sales of organic chemicals increased markedly, particularly with regard to the

Highlights from ICI Survey

- **ICI divisions report many sales records: alkali sales up 9 per cent; Alkathene exports almost double; Billingham turnover up 13 per cent; and record sales for main lime division products, fertilisers, paints and plastics.**
- **Marked increase in sales of organic chemicals, with the accent on industrial alcohols.**
- **Ardeer nitroglycerine plant is to be remote controlled by closed circuit TV.**
- **Plans for new and expanded capacity cover: silicones, isopropyl nitrate, resin plant for paints division, Melinex polyester film, Butakon butadiene co-polymers, rubber fillers, nylon polymer, Procion dyestuffs, isocyanates, Nitro-chalk, concentrated complete fertilisers, methanol, isopropanol, butanols and higher alcohols, phenol, octyl phenol and Topanol anti-oxidants, ethylene, ammonia, aluminium, nitroglycerine.**
- **An Ardil fibre with better properties is being evaluated.**

industrial alcohols. Plants producing methanol, isopropanol, butanols and higher alcohols are to be extended, as also plants manufacturing phenol, octyl phenol and iopanol anti-oxidants. A third ethylene plant is expected to be in production early in 1959, when a total of 100,000 tons a year of ethylene will be produced.

Because of the increasing cost of boiler and coking coal, of which ICI until now has used large quantities in its processes and for steam and generating purposes, the Billingnam division is using oil in the new ammonium plant which began operating recently (see CHEMICAL AGE, 9 March, page 417). Manufacture of petrol, by hydrogenation of creosote oil, is to be discontinued at the end of 1958 for economic reasons. A large quantity of hydrogen now used in the process, will thus be freed and will be used to make a further 60,000 tons of ammonia a year.

A difficult year was experienced by metal division with regard to home sales of wrought metal products due to credit restrictions and recessions in the motor industry. Export sales, however, maintained the 1955 levels.

At Waunarlwydd, South Wales, a new titanium rolling mill should be in operation shortly, and modernisation of the aluminium plant there is almost complete. Encouraging progress is reported on investigations on zirconium for nuclear power plants.

Some of the Nobel division's products achieved record sales and a satisfactory high level of sales for the division's products generally is reported.

The new nitro-glycerine plant at the Ardeer factory in Ayrshire, started in 1956 will eventually be operated entirely by remote control, using a closed-circuit television system. Considerable research and development is being undertaken by ICI to use automatic units and remote control in their explosives manufacture.

ICI are installing additional manufacturing capacity for silicones and new plants are also being built for isopropyl nitrate, increasingly used as an engine starter in modern aircraft engines, and for Cellopas cellulose derivatives, required in textiles and ceramics industries and in making adhesives etc.

Because of trade recessions in the motor industry, and in the manufacture of washing machines, refrigerators etc., the conditions for the paint division in 1956 were not favourable. Despite this, home sales are stated to be appreciably higher than in the record year of 1955. The decorative finishes, Dulux and Dulite, were the main contributors in the record sales. However, due to the international situation last October, exports of paints, etc., were slightly lower than in 1955.

A large new resin plant for this division is under construction at Slough. Good progress has been made in erecting this plant.

Conditions for the plastics division were also unfavourable. But despite the slump in the motor industry and general financial restrictions, total sales of ICI's plastics increased in value by 11 per cent over 1955, although the profit margin was lower due to competition, particularly in export markets. Home sales rose by almost 4 per cent and by 25 per cent in export markets. In fact, sales overseas now represent 35 per cent of ICI's output of plastics. As sales by the British plastics industry in total increased in 1956 by only 2 to 3 per cent, and exports by about 15 per cent ICI's results are very favourable.

Increased quantities of Melinex polyester film and Butakon butadiene co-polymers will soon be available, Melinex from a new plant at Welwyn, and Butakon from a 10,000 tons-a-year plant now nearing completion at Wilton.

Conditions affecting the furniture and motor industries influenced the leather-cloth division last year. Despite this, the division continued as the leading supplier at home, and increased its overseas trade particularly in p.v.c.-coated fabric.

In ICI's fibres division, sales of Terylene were again spectacular, and doubled those of 1955. In overseas markets, direct exports were nearly treble those of 1955. Sales of Ardil are stated to have been disappointing last year, showing no increase over the 1955 figure. An Ardil fibre with improved properties is now being evaluated.

CONTINUED EXPANSION IN ICI's OVERSEAS INTERESTS

Sales of African Explosives and Chemical Industries Ltd., jointly owned by Imperial Chemical Industries (South Africa) Ltd. and De Beers Industrial Corporation Ltd., increased by approximately 10 per cent and net profit before taxation rose by almost 27 per cent from £2.2 million to £2.8 million. There was a record demand for AE and CI's fertilisers and explosives, while the growing uranium industry produced increased demands for ammonia and acids used in uranium recovery from gold extraction processes.

In Canada sales of ICI's subsidiary, Canadian Industries Ltd., were 9 per cent higher in value in 1956, and the net income at $8¼ million was 4 per cent greater. ICI's own exports to Canada continued at the 1955 level.

Capital expenditure in Canada was over $17 million last year compared with $17 million in 1955. At Millhaven, Ontario, an ammonia plant is nearly completed, construction of a hydrogen peroxide plant has been begun at Hamilton, Ontario, and because of the growing demand for acids from Ontario's uranium mines, a second sulphuric acid plant at Copper Cliff has been authorised. CIL is also constructing a new explosives laboratory at Beloeil.

ICI's exports to the US rose by 16 per cent in 1956 compared with 1955—to a record value of £5¾ million. In partnership with the Hercules Powder Co. of the US, ICI have formed a new company to make and sell methyl methacrylate and products based on the compound.

In the South American markets, the company reports a rising export trade and greater participation in local manufacture in Argentina. Exports increased in value by 60 per cent during 1956, with heavier shipments to Brazil, valued at more than £1½ million, making the greatest single contribution to the improved trading position.

In Argentina ICI's subsidiary, Industrias Quimicas Argentinas 'Duperial' SA, is stated to have interesting manufacturing projects in view. One of these is the manufacture of p.v.c. in association with la Celulosa.

External sales of ICI of Australia and New Zealand Ltd., and its wholly owned subsidiary companies reached the record level of £A36.7 million. Although about 70 per cent of ICI products sold in Australia are now manufactured locally by various ICIANZ factories, Australia and New Zealand are still big markets for ICI exports, particularly dyestuffs and plastics.

Early this year arrangements were made to raise £A6,075,000 by issue of 4,860,000 ordinary £A1 at a premium of 5s a share.

Towards the end of this year, a polythene plant being erected at Botany, NS Wales, should be in production. Production of alkalis is to be increased at Osborne, S Australia, to 130,000 tons a year.

Exports to Europe have doubled since 1949. Western Europe took a quarter of the company's total exports. Exports to the common market countries increased by over £1 million last year. Exports to Ireland and Spain, however, were reduced due to shortage of fertiliser supplies.

ICI's activities in India brought new sales records with larger sales of traditional products such as alkalis, dyes and explosives, and enhanced demands for plastics, paints and pharmaceuticals. ICI (India) is extending the Calcutta polythene film plant and production of polythene tube is to begin shortly. A subsidiary of ICI (India)—Alkali and Chemical Corporation of India Ltd.—is to build a polythene plant at Rishra. Work on the site has begun. A company, Atic Industries (Private) Ltd., established by ICI (India) in partnership with Atul Products Ltd., has now received the Indian Government's approval for production of an extended range of vat dyestuffs.

Activities of ICI (Pakistan) Ltd. suffered due to the severe import restrictions imposed by the Pakistan Government, because of shortage of foreign exchange. ICI's subsidiary in Pakistan, the Khewra Soda Co. Ltd., had another successful year, with demand exceeding capacity.

In spite of the unsettled situation in the Near and Middle East and strong competition from East European countries, ICI's trading results in these parts of the world are considered satisfactory. In fact, a record turnover of alkalis, dyestuffs and metals was achieved in Iraq and the Sudan.

For the Far East markets, ICI report a large drop in dyestuff sales to China, but sales in Hong Kong and such territories as Formosa, S Korea and the Philippines were well maintained. ICI (Japan) Ltd. made substantial sales of dyestuffs in spite of competition from the US, Europe and Japan, and large sales of polythene, despite US competition.

A NEW CLASS OF SURFACE ACTIVE COMPOUNDS

Perfluoroalkane Sulphonic acids

By
Dr. M. A. Phillips,
F.R.I.C., A.M.I. Chem. E.

USE of surface active compounds to minimise or to reduce the surface tension of chromium and other plating baths is not new, although little emphasis on this matter is to be found in standard works on electro-plating. This is probably because, until recently, there has been no real solution to this problem or at best, only partial solutions.

In the absence of a surface active material in the chromium bath, the chromium spray presents a serious problem. The mist rises a considerable distance and necessitates the use of an expensive venting system to avoid serious toxicity hazards to workers. Such ventilation is a legal requirement. The material taken into the vent corrodes the fans, represents a serious economic loss of chromium and has to be dealt with later, especially if the plating works is adjacent to a residential district. Loss of chromium can be as high as 5-10 per cent of the metal intake.

Hitherto, when surfactants have been tried, they have been of the sulphonated oil types as these have proved to be somewhat more stable to the oxidising conditions of the chromium bath than others such as fatty acids, long-chain alcohols etc. Nevertheless, these sulphonated castor and other oils have had little application since they are oxidised relatively rapidly. This has the double disadvantage that they have to be replaced at frequent intervals and that, in being oxidised, they introduce excessive amounts of chromium into the plating bath and so destroy the proper and delicate balance needed for efficient metal-plating. Oxidation potential of the chromium plating bath is very high since it consists essentially of a 30 per cent chromium trioxide solution in hot sulphuric acid (at 40°C). Mechanical methods of mist suppression by plastics plants have not, for various reasons, been successful.

Ideal Surfactant

There is a need for a surfactant which is, ideally, a surface-active material and is stable to the oxidising conditions. The surfactant need not be very cheap as only drag-out losses are incurred and even these could be recoverable. In any case, to offset the cost of losses there is the saving of chromium. Prevention of this mist using surfactant would mean an easing of legal requirements regarding ventilation systems now used, and thus a saving in capital and maintenance costs.

A near approach to the above ideal of a surfactant material, stable to hot chromic/sulphuric acid, is Zeromist. This material is marketed in 0.5 g. tablets or as a paste which, on drying, contains, like the tablets, about 75-80 per cent of sodium bicarbonate and 20-25 per cent of sodium perfluoropentane sulphonate, $C_5F_{11}.SO_3Na$. The sodium salt of the fluorosulphonic acid can be obtained by extraction of the powder with boiling 90-95 per cent alcohol and evaporation of the extract. The residual solid can be crystallised from boiling 90 per cent alcohol and is then quite pure and consists of colourless needles of characteristic shape.

In use, it has been found in the author's laboratories and in associated pilot plants, that a 0.06 per cent solution of the active fluorine compound reduces chromium mist so that none can be detected 0.5 in. above the bath surface and that the oxidation loss as judged from the increase of chromate content of the standard decorative chromium bath is less than two per cent per month of continuous use. Drag-out losses will depend on the size of the work and it would not pay a small works to recover this; in a larger works however, a recovery system for drag-out would be advisable to save chromium—the surfactant dragged out is not worth the trouble of recovery.

Use of Zeromist eliminates the need for a ventilation system, although one would have to be used until the law was amended to fit the technical facts. Zeromist is marketed on both sides of the Atlantic by the Udylite Corporation or its affiliates, but the invention is probably owned by the Minnesota Mining and Manufacturing Co. of the US.

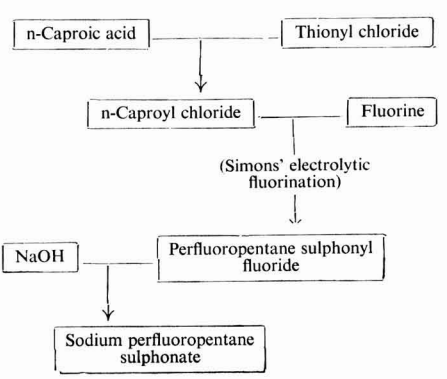
Corresponding carboxylic acids are not sufficiently stable since, in the chromium plating bath, decarboxylation occurs leaving insoluble fluorocarbons.

The history of Zeromist involves interesting modern research into the new fields of fluorine chemistry. A general survey of the literature reveals that the Minnesota company has filed a large number of patents (many naming J. H. Simons, the well-known fluorocarbon chemist) in the US and in this country on a large number of perfluoro compounds, perfluoroalkyl amines, perfluoro-olefines, perfluoroalkane carboxylic acids etc. Although none has yet been discovered dealing with perfluoroalkane sulphonic acids, no doubt one will appear in due course in this country and in the US (private communication from Minnesota Mining and Manufacturing Co.).

From this survey, it is possible to state with reasonable certainty that these perfluoro-sulphonic acids are manufactured by the method given in the following flow-sheet, which shows the Simons' electrolytic fluorination of alkylsulphonyl chlorides to give perfluoroalkane sulphonyl fluorides and the hydrolysis of these to the alkali perfluoroalkane sulphonates. Recently, Haszeldine *et al.* (7) has shown that perfluoromethane sulphonic acid can be made by this method and that the homologues may be similarly prepared.

The perfluoro compounds generally are known to be stable even to drastic oxidations. For example, polytetrafluoroethylene is non-inflammable and highly thermostable and chemically inert. It seems that the van der Waals size of the fluorine atom is such that, in perfluoro compounds, for example, $CF_3:CF_2.CF_2$ ——CF_2 —, the carbon skeleton is completely surrounded by the fluorine blanket which prevents access to the reactive carbon atoms by attacking reagents. For certain reasons it is also true that organic fluorine compounds generally and perfluoro compounds in particular, have lower surface tension than the corresponding hydrogen compounds. It follows, therefore, that a compound $C_nF_{2n+1}.COOH$ or $C_nF_{2n+1}.SO_3H$ will have a greater surface active effect than the compounds respectively.

It is not therefore surprising to find that the low m.w. perfluoropentane sulphonate with a C_5 skeleton is as highly surfactant as a non-fluorinated C_{12} to C_{18} chain sulphonic acid. The chemical inertness of the perfluorosulphonic acids and their great thermostability is responsible for their value as mist suppressors



Flow sheet for manufacture of sodium perfluoropentane sulphonate

in the chromium plating bath.†

The isolated perfluorosulphonic acids are hygroscopic fuming liquids of high dilution heat with water and are very strong acids, stronger than sulphuric acid. They are stable to heating up to 400°C as are their sodium salts; the corresponding carboxylic acids are of much lower boiling point, are weaker acids and decompose at much lower temperatures by de-carboxylation, Trifluoromethyl sulphonic acid boils at 166°C.

In view of the interest in this subject, we investigated other thermostable and chemically inert surfactant materials including derivatives of silicon, silicon and fluorine and on other fluorine compounds; in the latter field, we had achieved some success on the synthesis of compounds of the desired properties when we were anticipated by the work of Barrick of du Pont (**6**) and of Koshar *et al.* of the Minnesota company (**4**). This work concerned the synthesis of highly fluorinated sulphonic acids containing a proportion of hydrogen; it is known that such compounds and also compounds allied to perfluoro compounds but containing a small atomic proportion of other halogen, have similar chemical and physical properties to the corresponding perfluoro compounds:

(i) $CF_3(CF_2)_n \ldots CF_2SO_3Na$
(ii) $CF_3(CF_2)_n \ldots CHF.SO_3Na$
(iii) $CF_3(CF_2)_n \ldots CF_2COON$

The compounds of type (i) are made by autoclaving at low pressure a mixture of perfluoro-olefines with sodium sulphite or bisulphite; if the olefine is polytetra ethylene (see ref. **6**) the product is sodium 1:1:2:2: tetrafluoro ethane-1-sulphonate: $CF_2H.CF_2.SO_3Na$. The free acids are also very strong hygroscopic liquids and are thermostable up to 350°C; the sodium salts are also thermostable up to 250°C or more.

We give below some surface tension measurements for some of the above materials and compare them with some known surfactants:

Lorol* 90 per cent BP, 0.1 per cent solution, 30 dynes/cm.
Sodium oleate, 0.1 per cent solution, 25 dynes/cm.
Aerosol OT**, 0.1 per cent solution, 28 dynes/cm.
Sodium perfluoropentane sulphonate, 0.1 per cent solution, 36 dynes/cm.
Sodium perfluorohexane sulphonate, 0.1 per cent solution, 25 dynes/cm.
Sodium tetradecafluoroheptane sulphonate***, 0.1 per cent solution, 38 dynes/cm.
Water, 70 dynes/cm.

*Sodium lauryl sulphate
**Sodium di-octyl sulpho-succinate
***$CF_3.(CF_2)_4.CHF.CF_2.SO_3H(Na)$

Addendum.—Since the above was written, two interesting patents have appeared; these are BP 758476 (Minnesota Mining and Manufacturing Co.) and BP 758025 Udylite Research Corporation).

The former covers preparation of perfluoroalkane sulphonyl fluoride and of the corresponding sulphonic acids and sodium sulphonate, and the latter covers the use of these acids and sodium salts in chrome plating baths. The suppositions of this article are thus now confirmed.

† Initial work in our laboratories indicates that these compounds can be successfully used even in the hard chromium bath, in which conditions of oxidation are more drastic than in the decorative chromium bath.

REFERENCES
(1) Brown, *et al.*, *Industr. Hyg. Quarterly*, Sep. 1954, 211-216.
(2) EP 686678; 3M; perfluoroalkane carboxylic acids.
(3) Trott, *et al.*, *Amer. chem. Soc.* meetings; *Abs.* 1954, 42-3M.
(4) Koshar, *et al.*, *J. Amer. chem. Soc.*, 1953, 75, 4595 (*Chem. Abs.*, 1955, **49**, 7847d).
(5) Simons, J. H., 'Fluorine Chemistry', 2 vols. 'Electrochemical fluorination'. vol. I, 414 (see also Haszeldine, R.I.C. Monographs, No. 1, 1956, 'Fluorocarbon derivatives', p. 36; p. 38.
(6) BP.579897 (USP2403207) Barrick, 'Highly fluorinated alkane sulphonic acids containing small proportion of hydrogen'. British patent expired in 1949 due to non-payment of renewal fees.
(7) Gramsted and Haszeldine, *J. chem. Soc.*, 1956, 173.
(8) Simons, *et al.*, *J. Electrochem. Soc.*, 1949, **95**, 47.
(9) Kauck & Diessler, *Industr. Engng. Chem.*, 1951, 43.

Applications For Education Grants Invited by the Plastics Institute

THE TRUSTEES of the Plastics Industry Education Fund invite applications from young men or women engaged in the plastics industry for a limited number of training grants towards the cost of a year's full-time study at an approved course leading to a degree, diploma or other equivalent qualification in science or engineering, or in industrial design.

Courses for full-time study approved include those leading to the Associateship of the Plastics Institute, intermediate or final B.Sc., or Dip. Tech. courses in pure and applied mathematics, physics, chemistry or engineering, and diploma courses in chemistry, electrical engineering, mechanical engineering and industrial design.

Value of the grants in the past has been normally of the order of £100, but smaller sums will be awarded by the training grants committee when other resources are available to the candidates. Applications for renewal of grants for a second year will also be considered.

Deferment from National Service for periods of up to six years may be granted by the Ministry of Labour and National Service to students who are registered at the Plastics Institute offices, provided that they can complete the approved course of study prior to their 26th birthday. Candidates for industrial design courses should have preferably completed their National Service before making application.

Candidates are required to submit recommendation from their employers together with documentary evidence of scholastic or academic qualifications.

Applications for training grants must be submitted in writing to the Secretary to Council, The Plastics Institute, Mandeville Place, London W1, by 13 July.

Triplex Group's New Research Laboratories

NOW NEARING completion is the fundamental research laboratory of the Triplex Group of Companies at Holly Grange, Balsall Common, Warwickshire.

The laboratory will include laboratories for X-ray diffraction and electron microscopy. There will be a physical chemistry laboratory, an optical laboratory, a thermodynamics laboratory, a mechanical properties laboratory, an instrument and equipment workshop and a reference library.

A high-temperature furnace with ancillary equipment for research on the toughening of glass will also be installed. This furnace will make panels and samples for the various laboratories under closely controlled conditions.

In charge of the laboratory will be Mr. K. J. B. Wolfe. A staff of specialists at Holly Grange will study the basic problems of glass as they affect the parent safety-glass company and the subsidiary chemical-glassware companies and will also deal with problems for the Group's light-engineering companies.

Rust Prevention by Spirit-based Bituminous Ibetol X

LATEST introduction to contemporary protective coatings is a spirit-based heavy bituminous substance, Ibetol X, which, it is claimed, knits itself to new steel, or de-rusted and cleaned steel and provides a 'protective coating,' resistant to moisture, acid fumes, salt water, salt-laden atmosphere and a large number of acids. This coating material is made by British Bitumen Emulsions Ltd., Slough, Bucks.

Of thixotropic quality Ibetol X becomes a smooth heavy fluid on stirring which is easy to apply. It is stated that once applied, the preparation reverts to its original structure; it neither flows nor sags, nor 'curtains' and presents an even overall film of surface which is tough and elastic and does not chip. Widely varying temperatures or high humidity do not affect it. It can be used on damp or dry surfaces, and is applied by brushing or spraying.

An effective protective coating of Ibetol X is obtained at the rate of 10 sq. yds. per gallon. Depending on the nature of the surface, it can be brushed out to cover approximately 30 sq. yds. per gallon. For increased protection, successive coats of the product can be built up. Drying time is 24 hours. The preparation is available in black and red.

Redundancy at Ordnance Factory

Defence programme revisions may result in about 500 workers at the Royal Ordnance Factory, Bishopton, Renfrewshire, being declared redundant. Mr. J. Thomson, an official of the Transport and General Workers' Union, the union mainly involved, said that it was proposed to hold a meeting of the parties to discuss proposals to pay off 57 men over 65 years old and 450 women.

Overseas News

HOLLAND'S RISING CHEMICAL OUTPUT STIMULATES HIGH INVESTMENT RATE

THE DUTCH chemical industry is maintaining a high rate of investment, following a big rise in output last year. This production increase is mainly the result of higher domestic sales which showed a 15 per cent gain as against a six per cent rise in exports, states the *Financial Times*.

Of total exports in 1956 chemical exports represented about 10 per cent and were valued at Fls 950 million compared with Fls 389 million in 1950. Main importers of Holland's chemicals are the other European countries which take about 59 per cent of these exports.

The general increase in Dutch chemical output is indicated in the following table.

(1953 = 100)

	1956	*1955*
Sulphuric acid	121	116
Nitrogen fertilisers	119	118
Phosphate fertilisers	119	115
Benzol products	142	129
Dyestuffs	132	121
Printing ink	135	125
Soap	111	97
Soda	102	99
Petroleum chemicals	150	143
Plastics	175	145

Large plants such as those of the State Mines are the biggest investors. Others are the large soda project at Delfzijl, the petrochemical industry at Pernis, near Rotterdam where Royal Dutch has nearly completed its synthetic glycerine and the Royal Netherlands Blast Furnaces and Steel factories.

Israel Potash Development

Israel's Dead Sea Potash Works Ltd, has ordered within the framework of the Israeli-West German Reparations agreement new handling machinery for its factory at Sodom. Installation of the additional machinery should raise production from the present level of 5,000 tons a month to 11,000 tons monthly within a year.

Potash marketed by the company during the first quarter of this year totalled 51,000 tons of which 46,000 tons were exported. This was four times the amount exported during the same period in 1956.

Iron Crystals as Toughening Factors

Alpha iron crystals are being tested widely in US industry as toughening factors in a variety of other materials from copper to nylon. The crystals, of which 1,000 million occupy less space than a grain of salt, are now being produced by a complex electrolyte process at the Edsel B. Ford Institute for Medical Research in Detroit under the direction of Dr. Michael Freeman.

It is expected that a pilot plant which will be able to produce 20 lb. an hour, will be in operation within a few months. Present investigations with the crystals are being carried out with nylon, copper, steel and other materials. The crystals are placed in a mould with the materials with which they are to be combined, and are pressed into shape under heat. The products are used as bearings, car springs, electrical conductors, etc.

UK Agencies Sought

Davies Irwin Ltd., 121 Bates Road, Montreal 8, Canada, are seeking increased trade with UK manufacturers, either through manufacturing arrangements in Canada or representation. The firm, which has its own plant, warehousing and selling facilities is interested in chemical lines, related specialities, materials for food industry etc.

Salt and Sulphur Industries of Ecuador

Owing to the poor state of its machinery Ecuador's nationalised salt industry is producing less and less. Sal Chemical Inc. have put forward a proposal to the Government, which would mean that the company would take over the production and distribution of salt in Ecuador. This proposal is stated to be under consideration by the Ecuador Government.

The possibilities of re-exploiting the Tixan sulphur mine are being explored by a Brazilian expert. Brazil has no sulphur and would be interested in purchasing eventually from Ecuador. Also a Yugoslav company has offered to supply all the matches that Ecuador requires in return for 6,000 tons of sulphur annually.

Two New Epoxy Plasticisers by Celanese Corp.

Two new epoxy plasticisers, Celluflex 21 and Celluflex 23, produced by Celanese Corporation of America, are reported to impart outstanding low-temperature performance and colour stability to polyvinyl chlorides and other polymers with reduced plasticiser loss due to volatility. They also provide low viscosity and good viscosity stability for plastisols.

End product applications in which the new plasticisers contribute include vinyl film, sheeting and coated fabrics, extruded tubing and hose, slush moulded and injection moulded items. The materials are also of value in synthetic rubber formulations.

These plasticisers are the newest of an increasing group of products being produced in the new multi-million dollar Celanese chemical plant in Point Pleasant, West Virginia. Other Celanese plasticisers are flame-retardant tris-chlorethyl phosphate, DOP and DBP (phthalates), cresyl-diphenyl phosphate and tricresyl phosphate.

Uranium Discovery in India

From New Delhi has come a report of the discovery of vast uranium deposits, believed to be the largest in Asia, which have been discovered in Razasthan Province, North-West India. The deposits are 30 miles south-west of Jaipur, in the Bhilwana.

Assistance for Italian Sulphur Industry

A draft law has been submitted to the Italian Senate, which is to authorise the Ministry of Industry and Trade to spend 450 million lire a year, for two years, in making good the difference between Italian and world prices of sulphur used at Italian textile factories.

As Italy exports monthly about 27,000 tons of rayon and mixed textile materials, a monthly consumption of about 8,000 tons of sulphur is said to be involved.

Finish Prospects for Exploitation of Titanic Ore

In *Teknillisen Kemian Aikahauslehti* (15 March, 107) O. Runolinna of Otanmäki Co. described titanic ore production at Otanmäki mine. The ore contains 35 per cent magnetite, 28 per cent ilmenite, 1 per cent pyrites and silicate materials. Production of ore began in 1953. Output in 1956 reached about 743,000 tons.

Methyl Bromide as a Control against Groundnut Beetle

Methyl bromide was recently used to control infestation of a pyramid of stored groundnuts by the beetle 'trogoderma granarium' at Maiduguri, Northern Nigeria. The pyramid was covered by a large one-piece envelope of nylon and plastics. Liquid methyl bromide was pumped through a pipe run up under the envelope, which was left in position for 24 hours.

This work was carried out by a fumigation team of the Northern Region Production Inspection Service and reports indicate that no further signs of infestation are evident. The team state that methyl bromide is the only fumigating agent certain of controlling this beetle.

New Canadian Phosphate Plant

A $5 million chemical plant is to be built at Port Maitland, Ontario, on Lake Erie by the Electric Reduction Co. of Canada, one of Canada's major chemical companies, specialising in phosphate and chlorine chemicals (see CHEMICAL AGE, 4 May, p. 808).

Yellow phosphorus from the company's plant at Varennes, Quebec, near

Montreal, will be used to produce 'electrothermal' phosphoric acid. Facilities will also be installed for production of 'wet-process' phosphoric acid, derived from the treatment of phosphate rock with sulphuric acid. The phosphoric acid will be used in manufacture of a wide range of sodium and calcium phosphates at the site, and for several industrial applications in the area such as treatment of steel and aluminium.

The fertiliser industry in Western Ontario is also consuming increasing amounts of phosphoric acid, both for direct liquid application to the soil and for manufacture of high analysis granular products. The new plant will have ample capacity to supply all the requirements of both industry and agriculture in the area.

Phosphate ore used by the company is imported entirely from Florida at the present time. Export markets are also being developed. For these reasons ready access to deep water shipping facilities is essential.

Electric Reduction recently completed a multi-million dollar sodium chlorate plant in North Vancouver district. This plant was designed to serve the expanding requirements of the local pulp and paper and herbicide markets in Western Canada.

Development Plans For Bauxite

The newly discovered bauxite deposits at Cape York Peninsula in North Queensland, Australia, have been described as greater in volume than all known deposits in the world put together. Open-cut mining operations will begin shortly on a large scale, followed by the setting up of large chemical treatment plants employing thousands of workers. Bauxite may be converted to aluminium by atomic power.

Microscope Aids Paint Research

A German-made microscope is reported to be assisting new techniques in paint research at Balm Paints Pty. Ltd., of Cabarita, New South Wales, Australia. A technique by which a film of paint can be sliced with a microtome to transparent thickness has been developed by the company's chemists. With the aid of the microscope the slice can be examined to determine whether the pigments are performing properly and if their distribution is correct. Another technique is said to enable the side view of a flake to be examined and its composition studied.

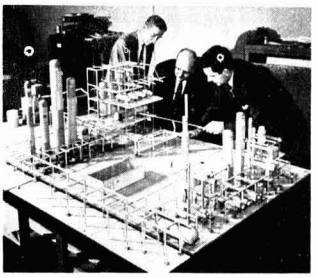
International Corporation formed by Olin Mathieson

The Olin Mathieson Chemical Corporation, US, have formed an international corporation which will be 'keyed to the national economic needs' of the European countries in which the company operates.

Production in Europe by the new organisation will include Squibb medicinals and pharmaceuticals, Mathieson industrial and agricultural chemicals, non-ferrous metals, cellophane and other packaging products.

European production will be centred in existing plants in Liverpool, Copenhagen, Berlin, Munich, Brussels, Paris, Rome, Madrid, Athens and Istanbul.

Mr. Henry A. Arnold has been appointed president of the new international corporation.



Model of the new ethylene oxide plant to be built for Wyandotte Chemicals, Geismar, Louisiana, by the Lummus Co. It will use the Shell Development Co.'s direct oxidation process (see CHEMICAL AGE, 18 *May, p.* 836)

Synthetic Rubber Tank Lining Developed by Du Pont

Ready-to-apply synthetic rubber lining for tanks and chemical equipment has been developed by Du Pont Co's fabrics and finishes department. Since the sheets are vulcanised during manufacture, installation is simplified, as air-drying will cure the cement without heat. Other advantages claimed are chemical resistance, economy, and ease of application. Also equipment and tanks can be lined or re-lined in place, without expensive equipment.

Use tests have shown that new Fairprene T-5594 ready-cured synthetic rubber lining material has good chemical resistance to inorganics such as hydrochloric and sulphuric acids, ferric and aluminium chlorides, and to organics such as benzoic, tannic, and tartaric acids. The lining is not recommended, however, for protection against petroleum products.

Other successful applications are a pipe and elbow lined with the material which has carried 12 per cent sulphuric acid for more than a year, while laboratory hoods, chemical drums, and even a pipeline carrying pulverised coal have been protected with Fairprene T-5594.

The new tank lining is available at present in continuous pieces 50 inches (1.27 metres) wide, one-eighth inch (.32cm.) thick, and 20 to 25 yards (18.3 to 23 metres) in length. Also available are specially developed primers, adhesives, and a special putty for use with the new material.

Explosion at US Atomic Plant

There was a chemical explosion last week at the US Atomic Energy Commissions Brookhaven National Laboratory at Upton, New York. It occurred in a so-called 'hot lab' where radioactive materials are handled.

A statement issued by the laboratory stated that a technician suffered severe chemical burns. The material being used was not radioactive and the explosion had not caused any radiation danger.

Vapour-plating of Magnesium

Information has been released in the US of Air Force-sponsored research on a vapour plating method of coating magnesium with corrosion-resistant aluminium. Investigations have shown that high-purity aluminium is exceptionally effective as a protective coating for magnesium against corrosion. Difficulties previously present in applying the coatings would now appear to have been overcome.

Steriod Sapogenins from Indian Dioscorea Plants

Barua *et al* (*J.Ind.Chem. Soc.*, 1956, **33** No. 11, 799) in a further paper report on their examination of 11 further different species of Indian Dioscorea plants. In an earlier report, of eight specimens of yarns investigated, *D. esculenta* and *D. prozeri* yielded 0.17 per cent and 2.1 per cent of diosgenin respectively. In this present communication, results in the case of *D. tomentosa, D. bulbifera, D. sativa, D. hispida, D. nummularia, D. bellephylla, D. aculeata, D. deltoidea* and unidentified species No. 1, 2 and 3 are given.

Diosgenin was isolated in 3.35 per cent yield from the yarns of *Dioscorea deltoidea* by hydrolysis of the saponin. *D. deltoidea* thus appears to be one of the richest sources of this valuable steriod sapogenin.

D. deltoidea is a climber and the rhizomes are hard and wood-like containing very little moisture (about 20 per cent). It is used by the Paharias as an insecticide for removing lice from hair, as a soap for washing wool and silk and as a fish poison. In small doses, it is used as a diuretic. Some of the Indian names for this particular species are kins, kildri kithi, krithi, krits, krish etc.

Both the ethylacetate and alcoholic fractions were found to contain saponin, the proportion in the latter fraction being considerable. Working up of the fraction gave 3.35 per cent diosgenin, m.p.204-206°; acetate, m.p. 194-195° and benzoate, m.p. 236-37°.

The other species giving a good yield of diosgenin is *D.prazeri* of Darjeeling which contains 2.1 per cent.

Neutron Absorbing Steel

Research in the growing field of nuclear power has resulted in Hadfields Ltd., of Sheffield, developing a steel with neutron absorbing properties. This was reported by Lord Dudley Gordon, chairman of Hadfields, at the annual meeting recently. This special steel has been used in the Calder Hall atomic power station.

Preparing Boron Polymers With High Temperature Stability

US Forces Reports Released for Industry

AMONG reports of research for the US armed services that have been released for industry use is 'Research on Boron Polymers, Part 4', by W. L. Ruigh and others, Rutgers University, September 1956 (PB 121718, price $1). The report covers one phase of a broad investigation into new hydrolytically stable polymers with exceptional fuel and oil resistance and into the preparation of materials for evaluation as hydraulic fluids and liquids.

Primarily, the report deals with the synthesis of alkyl and aryl boron dichlorides used as intermediates for the synthesis of boron substitute borazones and of tri-B-n-butyl-borazole. Also included is a study of the analysis of organo-boron compounds, with emphasis on the development of a method of analysis of organo-boron compounds. Preparation of B-beta-chlorovinylborazole also receives attention and the results indicate eventual solution of the problem of preparing boron polymers stable at high temperatures.

This and other similar reports mentioned below are available from the Office of Technical Services, US Department of Commerce, Washington 25.

Literature Survey

Results of a literature survey of the best methods to determine the dynamic mechanical behaviour of polymers is published under the title 'Survey of the Methods used to Determine the Dynamic Mechanical Properties of Polymers', O. R. Abolafia, September 1954 (PB 121767, price $1).

Progress made during 1956 in a research programme for the development of reinforced plastics laminates for aircraft are summarised in 'Annual Report on Research for Use in ANC-17 Bulletin "Plastics for Aircraft", Supplement 4', by D. G. Coleman, US Forest Products Laboratory (PB 121695, 50 cents). Data mainly relate to laminates reinforced with glass fibres.

'Performance of Glass-Fabric Sandwich and Honeycomb Cores at Elevated Temperatures', by V. C. Setterholm and E. W. Kuenzi, also of US Forest Products Laboratory, September 1956 (PB 121697, 75 cents), shows that cores treated with silicone resin suffered least reduction in strength in test temperature, but were much weaker at all temperatures than cores treated with other resins, which included phenolic resin, strongest at all temperatures. Best adhesive for bonding cores to aluminium was a phenol-epoxy resin formulation with about 20 per cent clay after an initial cure of 90 minutes at 320°F with a pressure of 20 lb. per sq. in. and a post cure of 16 hours at 320°F.

Recommendations as to compounds or types of compounds which appear promising as high-temperature lubricants are given in 'Literature Survey of Low Molecular Weight Polynuclear Aromatic Compounds', by C. F. Raley, Jnr., May 1955 (PB 121664, $4.75).

'A Study of the Absorption Spectra and Ignition Limits of Exploding Mixtures of Carbon Disulphide and Oxygen', by A. L. Myerson and others of the Franklin Institute, March 1956 (PB 121030, $3), deals separately with spectroscopy, ignition limits and induction times. The data is applied to construction of the chemical mechanism in a final section.

The development of a molybdenum alloy liner for steel cylinders and a study of the volume and gas changes on heating electrolytic chromium specimens are covered in two reports of Army investigation just released for industry. 'Vapour Deposited Coatings', by L. M. Schetky, H. S. Spacil and J. Wulff of the Massachusetts Institute of Technology, August 1955 (PH 121725, $1.75), states that the 6 in. high-quality, low carbon (0.003 per cent) tubes were formed through the use of a helium carrier gas, careful prepurification of the molybdenum pentachloride and use of a graphite reaction tube.

'Volume Change and Gas Evolution on Heating Electrolytic Chromium', by K. A. Moon and G. A. Consolazio (PB 121768, 50 cents), indicates that shrinkage of the specimen near 400°C was apparently caused by dehydration of finely dispersed inclusions, but not by inclusions of hydrous chromic oxide that were blamed in earlier research.

'Polymer Evaluation Handbook', by C. H. Adams and others of Monsanto Chemical Co., November 1956 (PB 121870, $1, includes information on principles of evaluation, properties and measurements and their significance, nature and behaviour of polymers and physical characteristics of plastics in relation to each other and to other classes of materials. A system for obtaining maximum information on small quantities of experimental polymers is included.

'Evaluation of Low-Dielectric Glass Fabric', by F. Werren and B. G. Heebink, US Forest Products Laboratory, October 1956 (PB 121859, 75 cents), details comparative tests run on laminates reinforced with fabric made with the new glass fibres with the standard 'E' (for electrical) glass when used in glass-fabric-base plastics laminates. Laminates made with the low-dielectric fabric were found superior in electrical properties but inferior in strength and elastic properties.

'Effect of Moisture Sorption on Weight and Dimensional Stability of Alkyd-Isocyanate Foam Core', by V. C. Setterholm and E. W. Kuenzi, US Forest Products Laboratory, September 1956 (PB 121800, $1), states that exposure to high humidity caused increases in weight as high as 4 per cent and dimensional increases of 0.7 per cent.

TRADE NOTES

The Metal Box Co. Ltd. and E. Shipton and Co. (Holdings) Ltd. have completed arrangements for the acquisition by Metal Box of the plastics bottle business in the UK of E. Shipton and Co. Ltd., who have been marketing these products through Industrial Appliances Ltd.

Metal Box are taking over the factory premises and plant at Ruislip and will continue to use the trade marks Poly-Tainer and Nylo-Tainer.

Megator's New Premises

Owing to continued expansion Megator Pumps and Compressors Ltd. have acquired extra premises at 6 Carlos Place, London W1 to house their supply department. All correspondence should continue to be addressed to the head office at 43 Berkeley Square, W1.

New Factory

Hewitt's of Cranleigh, Surrey, inventors of the Cranley system of clear span prefabricated building have moved from their former site of three-quarters of an acre to their new Elmbridge Works of over seven acres.

Oxygen Compressing Station

British Oxygen Gases Ltd., are to build a new oxygen compressing station at Mosley Road, Stretford, to meet the increased demands for the gas in the Manchester area.

The building will be erected by British Oxygen Engineering Ltd.

Gas Engineers Visit London Research Station

Work at the London Research Station of the Gas Council in Fulham was inspected by members of the Institution of Gas Engineers during the programme of works visits held in connection with their annual meeting last week. Examples of work in progress that were seen included analysis by vapour-phase chromatography, spectrographic methods and equipment, identification and isolation of micro-organisms, removal of hydrogen sulphide by liquid reagents, flaking of refractories in continuous vertical retorts, biological oxidation of effluents in packed towers and methods used in efficiency tests on full-scale plant.

Specifications of Rapid Method Combustion Tubes

Most recent addition to the series BS1428, of detailed specifications for a large variety of microchemical laboratory apparatus published by the British Standards Institution, is BS1428, Part A5 which specifies two combustion tubes for the rapid micro-determination of elements by the Belcher and Ingram method. Fully-dimensioned drawings and constructional details are given for the type 1 tube for carbon and hydrogen determination and for the type 2 tube for halogens and sulphur determination. (Price 3s from BSI sales branch, 2 Park Street, W1).

WORLD STUDY ON PURIFICATION OF BRACKISH WATER

INDUSTRIALISATION is increasing so much and living standards are rising in the world in general that it is becoming difficult to find enough fresh water to meet demand. Authorities in all parts of the world are discovering that they may soon have to think of using brackish water, perhaps even seawater itself. In spite of its rainfall Great Britain is no exception. For instance, seawater is infiltrating into fresh water wells in the Thames estuary and it is becoming more and more difficult to suggest other sources that do not involve expensive, long-distance pumping.

Talks on the possibilities of various methods of de-salting water have been going on for some time under the auspices of OEEC. One promising process is electrodialysis—the removal of salts from a liquid flowing between pairs of ion-selective membranes, by means of an electric field (see CHEMICAL AGE 18 May, p. 835).

Research work on this method is already well advanced in the Netherlands. Recently the Dutch offered to carry out development work in co-operation with other countries showing an interest. Great Britain has joined the Netherlands, South Africa, Australia and Algeria (representing France) in paying for this work and it has now begun. Problems to be solved are mainly those of scaling up the process to large pilot plant scale.

All the co-operating countries will share in the new knowledge and any patents that may be taken out in the future. Results which the previous Dutch work produced will also be shared between them. Manufacturing rights in any large scale process will be available to British industry on reasonable terms.

In the UK an Admiralty team has been working with seawater exclusively on scale and foam prevention in methods of distillation, a well-established process, and outstanding results have been achieved. DSIR has now given £5,000 to pay for an extension of the programme to cover other waters. Scale formation is a major snag in distillation and its prevention would bring the cost down. A Dutch scientist is joining this team.

Two other processes still in the exploratory stage have been put forward by the French as possibilities for co-operative research. These are certain aspects of ion-exchange and of solar distillation, which may be suitable for use in very hot, dry areas. No co-operative group to study these has yet been formed.

Any industrial concern interested in de-salting, particularly evaporation and distillation procedures, or in electrodialysis, should contact DSIR (Whitehall 9788, extension 364) for more information.

Further Share Call to be Made by International Synthetic Rubber

PLANT now being erected on a 54-acre site at Hythe, Hampshire, by the International Synthetic Rubber Co. Ltd., should be completed in the latter part of next year, Mr. G. E. Beharrell, chairman, told shareholders at the annual general meeting in London on Thursday last. The site is rented from Esso Petroleum Co. Ltd., and is adjacent to the plant which that company is erecting for production of butadiene, International Synthetic's main raw material.

Procurement of plant and equipment is proceeding satisfactorily and suppliers do not foresee any difficulties in meeting the required delivery dates. Contracts have been placed, it is stated, for the principal other raw materials, styrene and presinate which the company requires.

Principal contractors are from the US. the Blaw-Knox Co. of Pittsburgh, who have had considerable experience in the US in erecting synthetic rubber plants of the type required. Mechanical engineering sub-contractors are: Matthew Hall and Co. Ltd., and civil engineering contractors are John Laing and Son Ltd. Technical staff are being recruited by International Synthetic who can assist in the construction programme.

Cost of the project by the end of the year is estimated at £3 million. A housing scheme for employers is also being negotiated.

Shareholders were informed that all the four million ordinary shares of £1 each had been issued. Up to December last one call of 2s per share, amounting to £400,000 had been made. This year there had been a further call of 4s per share, producing £800,000. Mr. Beharrell also said that further funds at an increasing rate would be required this year as work proceeded. Arrangements with the Finance Corporation for Industry Ltd., provided that 15s per share must be called before use was made of the loan from that Corporation. It was therefore probable that a further 9s per share would be called to produce £1,800,000. Thereafter, the directors would draw on the loan from the Corporation.

Borough Polytechnic Technological Sandwich Courses

It is announced that the Borough Polytechnic is now recognised by the (Hives) National Council for Technological Awards as a centre for courses leading to the Diploma in Technology. Approval has been given to a four-year sandwich course in chemical technology with specialisation in one of three branches:

(i) Plastics and high polymers
(ii) Paints and surface coatings
(iii) Oils, fats and detergents.

Full details of the courses may be obtained from the secretary, Borough Polytechnic, London SE1.

Dutch and UK Chemical Engineers Meet Next Week

THIRD in a series of joint meetings between British and Dutch chemical engineers will be a symposium on 'Scaling-up of chemical plant and processes' at Church House, Westminster, London SW1, on 28 and 29 May. An attendance of about 550, including a large overseas contingent, is expected at the meeting, which is being organised by Het Koninklijk Instituut Van Ingenieurs (Chemical Engineering Group), De Koninklijke Nederlandse Chemische Vereniging (Section for Chemical Technology), Society of Chemical Industry (Chemical Engineering Group), and the Institution of Chemical Engineers.

Preprints of the papers to be delivered at the symposium are obtainable from the Institution of Chemical Engineers, 16 Belgrave Square, London SW1, price 30s. post free.

Application of Computors to Chemical Reaction Problems

The computor sales department of Short Brothers and Harland Ltd., East India House, 208a Regent Street, London W1, were asked recently by a leading UK chemical manufacturer to investigate the possible application of the Short analogue computor to chemical reaction problems. Reason for the enquiry was that in certain processes where several chemical reactions were taking place simultaneously, it was proving difficult to determine the conditions giving the most efficient yield of one particular constituent without building an elaborate and costly pilot plant.

Details of the equations governing the rates of reaction were of the form:

$$c_1 = k_1$$
$$dc_2/dt = k_2c_1c_2 + k_2c_2c_3$$
$$dc_3/dt = k_1c_1c_2 - k_3c_3c_5$$
$$- k_4c_1c_3 + k_3c_1c_5$$

Investigation of the problem consisted of setting up two coupled computors to solve a number of simultaneous first order equations. The computor solutions then showed the variation with time of the concentration of each of the constituents in the reaction. By altering the concentration of the various constituents it was found that it was possible to determine the ideal reaction conditions after only a few hours' work on the computor.

Poland Orders UK-Designed Plastics Plant

An order for the design of a large-scale polystyrene plant in Poland has been awarded to Petrocarbon Developments Ltd., of 17 Stratton Street, Piccadilly, London W1. The process employed is that originally engineered by Petrocarbon for Styrene Products Ltd., an associate of Shell Chemical Co. Ltd., and for an installation in France owned by the Pechiney group. Latest operating experiences of Styrene Products will be incorporated in the new plant.

A large amount of the equipment will be manufactured locally. The value of services and equipment supplied from the UK will be approximately £350,000.

TOXIC HAZARDS IN INDUSTRY—10

Radiation Hazards

By

Peter Cooper, F.P.S.

ALL ionising radiations, whether derived from electrical equipment or from radioactive elements, exert direct and indirect damaging effects upon living cells. These effects are the more startling and dangerous because they are insidious and cumulative over the lifetime of the exposed person; in the last resort they affect not only the person directly at risk but also his descendents and the human race itself.

Ionising radiations cause the ejection of electrons from the molecules through which they pass, leaving a light negative ion and a heavy positive ion in their track. The heavy positive ion remains approximately at the point where it is produced, whereas the negative one travels a distance measured in millimicrons. Radiations travelling a short path in tissue produce a relatively dense ionisation along their track, while those travelling further produce little ionisation in their track but a concentrated area of ionisation at their terminus.

The mechanism by which radiations damage cells is not understood, though cell damage seems inevitably to be connected with ionsiation. Proteins may directly be denatured by radiations, their large molecules losing an electron and undergoing internal rearrangement. When a protein essential to vital function is thus destroyed and is not readily replaceable, the cell dies. The destruction of an inessential or easily replaceable protein, on the other hand, need not dangerously embarrass the cell. Possibly the most sensitive targets exposed to radiations are the genes which control the essential cell enzymes. Since there are many hundreds of different molecules at risk in any irradiated cell, the probability of secondary reactions among the radiation products must be taken into account.

Effects of Radiation

Two theories, not mutually exclusive, have been postulated to explain the cytotoxic action of radiations. According to the target theory, each cell possesses a sensitive area where a certain minimum number of ionic hits will produce the toxic effect. Fractional irradiation of different parts of cells does demonstrate that ions within the cell nucleus have a more profound activity than those outside it; in particular, the damage done to the nuclear chromosomes by radiation suggests a target action. The chemical theory depends upon the demonstration of toxic ions in the water which abounds both within and around the cells. Radiation produces powerful oxidising and reducing agents in the shape of hydrogen ions and abnormal hydroxyl radicals; these hydrogen ions may go further and combine with molecular oxygen to make hydrogen peroxide, a powerful cytotoxic agent. Obviously, such chemical syntheses inside a cell-membrane could have dire effects.

Ionising radiations comprise three main groups. True electro-magnetic vibrations are represented by gamma-radiations, which resemble very 'hard' X-rays. They are very penetrating, and will traverse the entire human body with ease; some 15 cm. of lead, or several feet of stone or concrete are necessary to screen the gamma-radiations from cobalt-60, for example. X-rays are of longer wavelength, and (except when produced by a many million-volt machine) less penetrating. They are produced by the impact of a stream of accelerated electrons upon a tungsten target, and are produced in small quantities by a cathode-ray tube such as is employed in an oscillograph or a domestic television receiver. Most artificial isotopes emit gamma-radiations as well as beta-particles. The heavy radioactive elements found in nature are alpha-emitters.

Alpha-particles are comparatively enormous, being nuclei of helium atoms, and have a positive charge. They have scant powers of penetration, and are absorbed by 30 cm. of air, a thin sheet of paper, or some 50 microns of tissue. When they do produce cell ionisations, by circulation in the surrounding extracellular fluid or implantation, they are powerful and locally concentrated. Beta-particles, which are the characteristic emissions of most artificial radio-isotopes, are intermediate between gamma-rays and alpha-particles. They are electrons endowed with high velocity, and are able to penetrate several metres of air or a few millimetres of solids. Very readily scattered on impact, they exert rather a widespread effect on tissues. Beta-particles cause an intense local ionisation at the end of their track in tissue, but relatively scant ionisations along the course of it.

Alpha-emitters, such as radium or polonium, are dangerous in contact with the tissues, particularly when ingested. Some of the earliest casualties occurred in painters of luminous watch and clock dials, who used a mixture of zinc sulphide with radium or mesothorium (another alpha-emitter). Applying this paint with a fine brush, it was the custom to moisten the camel-hair with the lips, so ingesting traces of the radioactive material. Radium is laid up to a great extent in bone, and it is in bone that the most striking effects of radiation are seen. There is local weakening of the bone structure, with severe pain and destruction of the bone-marrow, which results in aplastic anaemia, a rapidly fatal condition. Chronic radium poisoning, which involves the deposition of only a few micrograms in the skeleton, produces clinical symptoms from five to fifteen or more years after the first exposure. General symptoms of over exposure are loss of appetite, nausea, vomiting, fatigue and sleepiness; these are of little diagnostic value, however, except that they demonstrate an anaemia. Cataract may develop in the eyes after exposure, taking about two years to appear.

Thorium is comparatively harmless, though it has been known to cause dermatitis of the hands; when injected for radiographic purposes, thorium dioxide has caused sarcomas in liver and kidney. Thorium-X, used in dermatology, produces in overdosage gastro-intestinal upsets, haemorrhages, blood disturbances and ulcerations leading to neoplasm formation. Mesothorium is as dangerous as radium.

Plutonium, formed in the uranium pile, is a powerful alpha-emitter of long life (24,000 years). It appears to be deposited upon the periostium of the bone, not within the mineral itself, and exerts an effect similar to that of radium. Soluble un-enriched uranyl compounds are liable to cause kidney damage, and should not be underrated since they are commonly used as analytical reagents. This effect is probably predominantly chemotoxic rather than radiotoxic, however, for uranium, unless enriched artificially, is only feebly radioactive. Uranium oxides are used in pottery, and have also a feeble toxicity. All uranium compounds should be kept away from the skin, and precautions taken to avoid their inhalation. This is particularly true of uranium hexafluoride, a volatile and reactive compound encountered in the enriching process.

Radon Toxicity

Radon, derived from the decay of radium, is gaseous, and is the agent responsible for the lung-cancers of workers in the notorious Schneeberg and Joachimsthal mines. It is a hazard invariably associated with the mining of pitchblende, demanding adequate ventilation to minimise it. Breath-radon is an index of radium exposure.

Methods of mobilising radioactive materials deposited in bone have been extensively studied. The effects of the chelating agent calcium disodium ethylenediamine tetra-acetate (versenate) on yttrium, zirconium, radium and plutonium hold promise, though this therapeutic agent is not without some toxic effect on the kidneys when employed freely. Excretion of the toxic substances is greatly hastened.

Exposure of excessive X-rays produces a dermatitis of hands and arms. In the mild forms of dermatitis the skin is cracked and the normal markings destroyed. (It is interesting to note that the modification of normal finger-prints is the first sign of over-exposure to radium). The skin folds are swollen and stiff, and there are capillary haemorrhages in the form of dots. The nails are striated and brittle.

The condition may progress to ulceration and to gangrene of the skin; even the tendon-sheaths and joints may become involved. Exposure of the nerve endings of the affected parts causes extreme pain. Single burns cause a transient reddening of the skin for a few days, then scaling. There is a burning sensation but not true pain. Locally there may be loss of hair. Deep burns turn into blisters resembling those of a scald, but which prove very reluctant to heal; these lesions tend to progress deeper and to resist treatment.

Certain elementary precautions are necessary in the case of persons employed in handling radioactive compounds or X-ray producing equipment. The blood-picture should be normal, and the general health good. A leucocyte count should be done before any material is handled, to serve as a control. Total counts lower than 6,000 per cu. mm., and lymphocyte counts below 1,200 per cu. mm. render a worker unsuitable to proceed. Periodical total and differential blood-counts are advisable, at three-monthly intervals. If there is a decided and sustained drop in the white count, work should be suspended and remedial treatment instituted. A rest of at least four weeks is needed to restore a deficient count to normal.

Unfortunately, leukemia and aplastic anaemia are not surely detectable at an early stage by blood-counts, and it has lately been considered that routine blood-counts are probably unjustifiable for workers whose average exposure does not exceed 5 r. per annum, and who have not been subjected to accidental over-exposure, always provided that comprehensive monitoring of these workers is performed. Monitoring is done largely by film badges, developed and examined at suitable intervals; different types of radiation can be determined by providing the film with a metal partial shield which will absorb, say, the beta-radiations and reveal the more penetrating gamma-rays.

Chemical protection against irradiation is doubtful. In animal experiments, sulphydryl compounds such as cysteinamine and dimercaprol, and pyridoxine, have limited value against radiation sickness due to total body irradiation; this, however, would only occur to humans as a result of a major catastrophe in warfare or at an atomic plant.

Radioactive isotopes used in medical and scientific research are less dangerous than misused X-ray generators or the natural elements of radio-decay, but their increasingly widespread employment makes their danger greater to more persons. Their main hazard lies in accidental leakage from shielding containers. Solutions of short-lived radioisotopes are handled in Pyrex glass vessels, which offer a considerable safeguard to persons manipulating them over short periods only. Care has to be taken that open vessels (beakers and flasks) are not looked into unless protective goggles are worn. Spilling or splashing is hazardous, and the substance should be immediately diluted by flushing with water. Substances tending to become adsorbed upon the sides of vessels may need removing with sodium hydroxide or dilute mineral acid; boiling detergent, left in contact for some hours, may prove an excellent decontaminator. Scrupulous personal cleanliness is essential in all who handle radioisotopes, and dust control must be rigid, since some of the most toxic effects produced are those resulting from inhalation of dried material.

REFERENCES

Medical Research Council : The Hazards to Man of Nuclear and Allied Radiations, 1956.

Hamilton and Hardy : Industrial Toxicology, 1954.

Leather Research Use Impregnants to Improve Quality

A LARGE proportion of the resources of the British Leather Manufacturers' Research Association at Egham, Surrey, is being devoted to the waterproofing of upper leathers and the impregnation of sole leathers to improve their resistance to wear and water penetration. New work in these fields was seen by visitors on the four Open Days last week.

In upper leathers, the best waterproofing agent proved to be silicones, which were applied from aqueous emulsions and from organic solvents. Other agents used included stearato-chromic chlorides, an alkyl derivative of succinic acid, aluminium stearate and a wax-casein emulsion. Work is now being concentrated on the use of silicones.

In sole leather, impregnants used have been polyisobutylene, polynonyl methacrylate, polythene, rosins, cashew nut shell liquid, paraffin waxes and greases.

In industrial leathers, thiokol-epoxide resin mixtures have been polymerised *in situ*, resulting in leathers that are waterproof and resistant to oils and most organic solvents.

Visitors were also shown the effect on analytical figures of the new official method of determination of water-solubles in vegetable-tanned leather; the results of zirconium retannages; the Immergan (aliphatic sulphonyl chloride) tannage which simplifies the chemistry involved in a chamois-type leather; elimination of sulphide in effluent by chemical treatments involving flue gas, chlorine and ferrous sulphate; and tests with antiseptics for addition to salt in the curing of hides and skins.

Two experiments compared the use of orthophenylphenol and pentachlorphenol; another test has been started on the use of salt containing sodium carbonate and naphthalene for curing certain hides.

The annual open day lectures were given by Dr. R. G. K. W. Penner, director of research, on 'Perspiration and its action on leathers'; and by Dr. R. G. Mitton, head of the physics department, on 'Combination tannages for sole and insole leathers.'

Institutes form Joint Powder Metallurgy Group

A Powder Metallurgy Joint Group has been formed by the councils of the Iron and Steel Institute and of the Institute of Metals. Objects of the group will be to study the science, technology and practice of powder metallurgy.

Membership of the joint group will be restricted to members of the two institutes, though the meetings of the group, as of the institutes, will be open.

Inaugural meeting of the group will be held at Church House, Great Smith Street, London SW1, on Wednesday 4 December 1957, from 10.30 a.m. to 4.45 p.m. The joint group's activities will be administered by a powder metallurgy joint committee. Lt.-Col. S. C. Guillan has agreed to act as secretary and further particulars may be obtained from him at 17 Belgrave Square, London SW1.

£1 m. Dock Improvements for Heavy Chemicals Handling

IMPROVEMENTS costing nearly £1 million are being carried out at Garston Docks, one of the major ports on the River Mersey for the bulk handling of heavy chemicals.

The improvements scheme, approved by the British Transport Commission in 1953, includes the extension of the main quay in the Stalbridge Dock from 775 to 1,000 ft. and the installation of 10 new electric level luffiing cranes and four electric grabbing cranes of 7½ tons capacity. The first of the level luffing cranes have just been commissioned.

New dock gates are being constructed at the North Dock and two mobile diesel electric ship discharging cranes are being provided for use at SE berth, Old Dock.

Each year Garston Docks handle thousands of tons of sulphur, potash and phosphates.

New Transistor Plant Opened by Mullard

ONE-THIRD of Mullard's projected plant at the Millbrook Trading Estate, Southampton has now been completed. This is the first stage of a new Mullard plant to make germanium transistors and other semi-conductors. It is claimed that the plant will be the largest single mass production unit for semi-conductors.

Present staff numbers 400, 60 of whom are graduates. It is planned that eventually some 1,500 to 2,000 persons will be employed at the plant.

The completed unit will undertake research and development work as well as manufacture. Basic research will, however, be continued at the Mullard central laboratories. An annual output of several million semi-conductor devices by 1958 is planned, with a high proportion of transistors.

Special equipment at the new factory includes a refining plant for germanium. At one stage of transistor manufacture germanium of a purity of one part in one million is required. The process used to obtain this high purity germanium is that of zone-refining, which uses radio-frequency heating.

CHEMICAL PIONEERS

7 Jean Chaptal

Jean Chaptal, the subject of the seventh article in this series on the pioneers of the chemical industry, specially written for CHEMICAL AGE *by Dr. D. W. F. Hardie, was one of the most important pioneers of the chemical revolution in France.*

JEAN ANTOINE CHAPTAL was born at Lozère, within sight of the Cevennes, on 4 June 1756. His father was a prosperous pharmacist, who in due course sent his son to be educated at the nearby towns of Mende and Rodez. Chaptal's uncle, a man of very considerable wealth, practised as a physician in Montpellier, a provincial capital with a university whose medical faculty had already half a millenium of history behind it and where science became an important interest towards the end of the 17th century. In 1777 Chaptal received his medical diploma at Montpellier and proceeded to Paris to continue his studies. Stimulated by the intellectual climate of the capital, young Chaptal's interests widened; his studies were extended to chemistry in which new notions were then emerging. A cadaver's lifelike reflex under his scalpel is reputed to have horrified him so profoundly that he forsook medicine for chemistry.

Returning in 1780 to Montpellier, heir to a fortune of 300,000 francs from his uncle, he established a chemical factory in which he manufactured sulphuric, muriatic, nitric and oxalic acids, as well as alum, copperas, sal ammoniac and soda. It is probable that it was at this time that he made attempts, in association with Bérard, to produce caustic soda by oxidation of common salt with litharge. His reputation as a chemist must by this time have been considerable, since, when the University of Montpellier founded its chair of chemistry in 1781, Chaptal was elected professor.

Although France had long been dependent on Spain for the bulk of the natural soda (barilla) used in its soap, glass and textile industries, considerable quantities of low-grade barilla were produced from glasswort growing wild along the Mediterranean coast in the neighbourhood of Montpellier. The newly-appointed professor, in 1782, assisted by Pouget and de Cette, began experiments to determine whether barilla of as high soda content (more than 20 per cent) as that produced in Spain could be made from *salsola soda* grown in France. 'It should be a matter of concern to all Frenchmen,' he wrote, 'to see our most valuable industries dependent on foreigners for a material of prime necessity and one so extensively used.'

On one occasion, in time of peace, the Spanish government, in order to raise barilla prices, had prohibited its export for eight months. It was Chaptal's object to free France in future from such arbitrary attacks on her economy by a foreign power. Spain, in defence of her monopoly of high-grade barilla soda, had imposed the direst penalties on anyone exporting the seeds of the plant. In vain the resident French Minister attempted to persuade the Spanish authorities to relax their ban. In the end, the captain of a French merchantman courageously smuggled out half a kilogram of the prohibited seeds. With this small quantity Chaptal and his collaborators carried out their experiments. From their first harvest they obtained 10 kilograms of plant stems and 2 kilograms of seeds. In 1783 and 1784 they again grew tiny crops, and Chaptal in his laboratory established that the soda yield was as good as in the case of the plant grown in Spain. There the experiments ended, their last crop being almost totally destroyed by enraged collectors of the wild glasswort, who saw danger to their livelihood in these activities.

Royal Attention

By 1787 Chaptal's renown brought him to the Royal attention and he was ennobled by Louis XVI. In 1790 he published his *Elements of Chemistry,* of which in a few years 14,000 copies were sold and from which its Parisian publisher, Deterville, made a fortune. 'For twelve or fifteen years,' wrote Chaptal, 'I had the satisfaction of knowing that my *Elements* practically replaced all other chemical textbooks in the hands of students in France, England, Spain, Italy, Germany and America.' Chaptal had become the champion of the new views of combustion and quantitative chemistry. Lavoisier wrote to him, in 1791: 'All young people adopt the new doctrines, and from this I conclude that the revolution in chemistry is complete.'

After having been involved in the revolutionary turmoil in Montpellier and later briefly imprisoned by the revolutionaries as a 'moderate,' Chaptal was summoned to Paris by the Committee of Public Safety to assist in organising the gunpowder industry. It was realised that 'chemistry is a profession from which the Republic should obtain the most powerful aids for its defence.' Chaptal did not fail his embattled country: at the Government's powder factory 22 million pounds of black powder were produced in 11 months, 'an accomplishment so extraordinary,' Chaptal justly remarked, 'that posterity will scarcely credit it.' This modern scale of manufacture was disastrously terminated by explosion, for which, fortunately, Chaptal was not called upon to assume the role of scapegoat.

Meanwhile the Committee of Public Safety, concerned as to the Republic's supplies of alkali appointed Citizens Lelievre, Pelletier and D'Arcet to report on the method then known of producing soda from common salt. Among the dozen or so processes reported on by the Commissioners was that devised by Chaptal and Bérard; it was considered, however, that the high cost of litharge precluded its general use, although it might be operated with advantage in the neighbourhood of lead mines and large glassworks. The process which found final favour with the Commissioners was that of LeBlanc's, although there is no evidence that their recommendation had any immediate effect in promoting its adoption.

Between 1794 and 1798 Chaptal was again in Montpellier, teaching chemistry and making chemicals industrially. In 1794 he courageously anticipated the public conscience in the matter of the execution of Lavoisier and openly extolled the genius of the dead chemist to applauding students. During this period of his career, *eight years after LeBlanc had been granted his patent for synthesis of soda from salt,* Chaptal again sought to secure his country's resources of alkali by advocating the growing of *salsola* of the Spanish variety on French soil. This is a remarkable fact, and no ready explanation can be given as to why the champion of the new chemistry should have turned his back on synthesis, with the merits of which he was fully acquainted. Hostilities with Spain had been interrupted. The large quantities of barilla reaching alkali-starved France from that country were produced from immature *salsola* plants, which, as Chaptal found, yielded mainly sodium *chloride,* instead of the carbonate.

In 1798 Chaptal was again in Paris and began chemical manufacture at a new works in Neuilly. He became a man of importance in the metropolis and, in 1800, when Napoleon was First Consul, Chaptal was appointed Minister of the Interior. Thus began his intimate association with Bonaparte. Secretly he noted in his journal every physical and mental change in his master. Lord Rosebery wrote of Chaptal: 'He was for some time Napoleon's confidential Minister, and he analyses his character with the dispassionate science of an eminent chemist.'

Important Chapter

This period of Chaptal's career was, perhaps, the most important. Chaptal may be regarded as the first practical scientist to hold a place of sufficient power in a modern state to enable him to promote directly the application of science to industry. With all the authority of Napoleonic France sanctioning his actions, Chaptal organised the emerging forces of industrial revolution, establishing technical schools, promoting inventions, the development of the wine and beet sugar industries and road and water communications. In 1801 he published two fundamental works on the manufacture of wine, establishing the modern importance of the wine industry in France.

In 1804 Chaptal's activities were temporarily interrupted owing to Napoleon's having succumbed to the fascination of Chaptal's mistress, a young actress of the Comédie Française Chaptal occupied his enforced retirement in writing his *Chemistry Applied to the Arts,* a work

(Continued in page 897)

People in the NEWS

● DR. THOMAS HODGSON MANNERS KERFOOT, joint managing director, Thomas Kerfoot and Co. Ltd., manufacturing chemists, has been elected president of the Association of British Pharmaceutical Industry. MR. E. D. CAREY, managing director, ICI Ltd., pharmaceuticals division, has been elected vice-president, and MR. G. T. MORSON, has been re-elected hon. treasurer of the association. Dr. Kerfoot has been a member of the ABPI council since January 1952 and was chairman of Division B (manufacturers of ethical medical specialities) from 1952 until 1956.

● On the second of the open days held by the British Rayon Research Association on 9 and 10 May, MR. J. WILSON, M.C., M.Sc., F.R.I.C., director of research since 1947, announced his impending retirement. He will be succeeded by the assistant director, MR. L. A. WISEMAN, B.Sc., A.R.I.C.

● New representatives for the chemicals division of Newton Chambers and Co. Ltd., are MR. R. F. BAKER (Bedfordshire, Cambridgeshire and Huntingdonshire), MR. F. SANSON (East Glamorganshire), and MR. B. H. SHORT (West London).

● SIR ROBERT ROBINSON, O.M., M.A., D.Sc., Ll.D., F.R.I.C., F.R.S., the distinguished organic chemist and Nobel Prize winner, has just returned from the US, where he visited Shell research centres in New York and Houston, Texas, in his capacity as consultant and director of Shell Chemical Co. Ltd.

● CAPT. G. P. CLARIDGE, R.N. (Ret.), has relinquished his position as chief executive of the Council of British Manufacturers of Petroleum Equipment for reasons of health. MR. G. V. SIMS has accepted the post of director of the council, having relinquished the chairmanship. MR. E. F. E. HOWARD, a past chairman of the council, has been asked to act temporarily as chairman until MR. G. H. THORNE, vice-chairman and chairman-designate, can take over after the annual general meeting on 24 July. MR. C. G. CARR, M.INST.MECH.E., F.INST.PET., formerly one of the chief engineers in the Shell group, has been appointed technical adviser to the council. MR. T. L. BONSTOW, M.INST.C.E., M.INST.MECH.E., F. INST.PET., remains with the council as consultant.

● MR. G. J. CRUICKSHANK, A.R.I.C., has been appointed technical development manager of QVF Ltd., Fenton, Staffs. Formerly development chemist at Whiffen and Sons Ltd., Mr. Cruickshank, who is 36, was born in Poland and completed his education at St. Andrew's University.

● Among those elected as foreign members of the Royal Society are OTTO HAHN, of Gottingen, 'distinguished for his work on the chemistry of radioactive substances, for the discovery of several radio elements and especially for the discovery of the fission of uranium and thorium'; ARNE WILHELM KAURIN TISELIUS, of Uppsala, 'distinguished for his outstanding contributions in the field of physicochemical analytical procedures and their application to labile molecules of high molecular weight and biological importance.'

● New president of Linde Co., division of Union Carbide Corporation is MR. WILLIAM M. HAILE. He joined Union Carbide in 1925 when he went with the Linde Co. in the New Orleans office. He became manager of the eastern region in 1952 and vice-president of the company in 1955.

● SIR GRAHAM CUNNINGHAM, chairman and managing director of the Triplex group of companies, which includes Quickfit and Quartz Ltd., has been elected a visitor for the Royal Institution of Great Britain.

● MR. A. W. HOPKINS (General Electric Co. Ltd.) was re-elected chairman of the Association of British Ebonite Manufacturers at the recent annual meeting.

● DR. BERNARD RAISTRICK, B.Sc., PH.D., M.I.CHEM.E., F.R.I.C., F.R.S.E., research director of Scottish Agricultural Industries Ltd., who, as reported last week (p. 850), has been elected president of the Fertiliser Society, is a native of Pudsey, Yorkshire. Dr. Raistrick won a scholarship to London University and entered the Royal College of Science, Imperial College, in 1934. He graduated in chemistry with first class honours—B.Sc. (LOND.)—and then did research in chemical technology for PH.D. In 1939 he was appointed research assistant to Professor D. M. Newitt, F.R.S., but, after the outbreak of war, joined the research department of Albright and Wilson Ltd., Oldbury, Birmingham, in 1940. During the war he was mainly occupied on the development of weapons containing phosphorus compounds and in 1945 became assistant director of research. Dr. Raistrick joined SAI in January 1951 as research manager. In March 1954 he was elected a Fellow of the Royal Society of Edinburgh. He was appointed to the board of S.A.I. on 6 October 1955.

Dr. Raistrick

● MR. R. W. ANCRUM, formerly technical director, left the service of British Titan Products on 30 April 1957 to take up another appointment. MR. S. G. TINSLEY, formerly general sales manager, is appointed technical controller responsible for the company's technical activities including production. DR. P. A. LINTERN, formerly production manager is appointed overseas controller of the company, responsible for overseas projects and undertakings. DR. A. BOWMAN, formerly export sales manager, will take up special duties in the technical organisations of the company at Billingham. MR. L. W. ROBSON, formerly home sales manager, is appointed general sales manager. MR. C. N. TAYLOR, formerly London sales representative, is appointed assistant to general sales manager and will shortly move to the company's head office in York.

● MR. DAVID W. PAYN, has been appointed general manager and secretary to the Lead Development Association.

Obituary

DR. NIELS EDWARD RAMBUSH, chairman and managing director, Power-Gas Corporation Ltd., Stockton-on-Tees, died on 15 May at the age of 68. Born in Denmark, he became a naturalised British subject in 1930. He began his career in this country in 1911, and a firm he established with Arthur H. Limm was bought out by Power-Gas in 1918. He studied chemistry and chemical engineering under Professor Hinchley, was a founder member of the Institution of Chemical Engineers, and held patents for many processes in chemical and gas engineering. He was author of the text book 'Modern Gas Producers' and was an hon. D.Sc. of Durham University.

ICI Extend Transfer Scholarships Scheme

THREE NEW scholarships have been offered to each of the Universities of Bristol, Birmingham and Sheffield by ICI Ltd. as an extension of their Transfer Scholarships scheme. The new scholarships will be available for the academic year 1957/58.

First announced in March 1956, the ICI transfer scholarships scheme is designed to offer an honours course in various pure and applied sciences to able young men who for various reasons have not specialised in science subjects at school but, although qualified to enter a university in a non-science faculty, wish to change over to science.

This requires an additional year at the university in order to take an intensive and specially designed transfer course. The collaborating universities have agreed to provide appropriate transfer courses and the ICI scholarships finance the students during their additional university year, no account being taken of parents' income.

Commercial News

Shell Agreement Should Help Kleemann Widen Interests

AT the annual meeting of O. and M. Kleemann Ltd., the chairman and joint managing director, Mr. D. Kleemann, referred to the recent announcement on the manufacturing agreement between the company and Shell Chemical Co., (see CHEMICAL AGE, 4 May, page 765).

Advantages of the arrangements, the directors believe, are that in the long view they should benefit the company through the enlargement of its participation in the plastics industry, namely, through sales of additional products. Until 'matters crystallise a little' Mr. Kleemann stated that he could not usefully say at this stage anything further on the matter beyond indicating that the company's range of products for the years ahead show promise of expansion.

Immediate benefits lay in the arrangements now effective between Kleestron and Styrene products. For the past five years Kleestron had been a major producer of polystyrene in the UK and for much of that time, the second largest individual seller of this product, with a large proportion of its sales in overseas markets.

To combat the progressive keenness in competition greater efficiency and reduced costs were required. This is believed to have been achieved by the present arrangement, while the company has preserved its independence.

Activities of Kleestron in 1956 had for the first time since they began polystyrene production, shown a setback. Although the tonnage produced was still large, a decrease on 1955 figures was shown. This was due to the effect of the credit squeeze on consumers of plastics materials. Reduced production had had the effect of increasing costs, and profits due to US competition in export markets had been affected.

Ashe Chemical Ltd.

Net group trading profit of Ashe Chemical Ltd. for the year ended 31 December 1956 amounted to £75,402 (£92,369). Directors' remuneration, depreciation, and other expenses totalled £17,054 (£15,921) and taxation amounted to £45,557 (£49,040). After adding balance of group profits at 1 January there was a balance of £19,228 (£30,001).

A final dividend is proposed of 7 per cent (9 per cent), making 10 per cent (15 per cent), payable 28 June 1957.

Cape Asbestos Co. Ltd.

Record group trading profit of £1,707,000, before charging depreciation and tax, for the year 1956, is reported by the Cape Asbestos Co. Ltd. Group net profit before tax was £1,154,000 (£1,038,000), the highest since 1951. After charging over £500,000 for depreciation, there was an approximate net increase of £400,000 in the value of fixed assets, representing over £900,000 investment in fixed assets during the year.

A final ordinary dividend of 12½ per cent was declared, making 15 per cent (12½). Annual meeting will be held on 12 June.

Hickson and Welch

Hickson and Welch (Holdings) announce an interim of 4 per cent on capital increased by 3-for-11 scrip issue (same, but on smaller capital).

Powell Duffryn Ltd.

Powell Duffryn Ltd. announce the following dividend: 2⅜ per cent actual, less tax, on the 3,600,000 4¼ per cent cumulative preference shares of 10s each for the six months ending 30 June 1957. Payment will be made on 1 July 1957 to holders registered on the books of the company at close of business on 31 May 1957.

Shawinigan Water

Net profit of the Shawinigan Water and Power Co. of Canada for the first quarter of 1956 amounted to $2,986,220, equal to $1.08 per common share ($2,637,672 or 98 cents per share in 1956). Higher sales are also reported for Shawinigan Chemicals and Associated Canadian Resins and Chemicals.

NEW COMPANIES

ATHUR D. LITTLE LTD. Capital £50,000. Analytical and consulting chemists etc. Directors:— F. N. Woodward (director of Institute of Seaweed Research, Inveresk) R. Stevens and L. W. Bass (president and vice-president of Arthur D. Little Inc. of Cambridge; Massechusetts). Secretary: R. H. G. Duggan. Registered office: 24 Bernard Street, Leith, Edinburgh.

BARTY INDUSTRIAL DEVELOPMENTS LTD. Capital £1,000. Manufacturers of and dealers in materials for the engineering, chemical, nuclear power, plastics, and related industries, and finished products manufactured therefrom; research into and development of high temperature materials and lubricants etc. Directors:— N. F. Barty, (chairman), G. A. Collins, and H. C. Barty. Registered office: 28 Mackenzie Street, Slough, Bucks.

BURN WATSON LTD. Capital £5,000. Manufacturers of and dealers in chemicals, gases, drugs, medicines etc. Directors:— J. W. N. Barclay and R. G. Burn. Solicitors: March Pearson and Green, 1 Central Street, Manchester 2.

DETEREX LTD. Capital £10,000. Manufacturers of and wholesale and retail dealers in chemical products etc. Subscribers (each with one share):— B. E. Mileham, and N. C. Kyle Henney. First directors to be appointed by subscribers. Registered office: Commonwealth House, 1-19 New Oxford Street, London WC1.

P. R. MASEK (RESEARCH LABORATORIES) LTD. Capital £100 in £1 shares. Manufacturers of and dealers in and agents for raw materials and goods of all kinds; manufacturing chemists; research laboratories; chemical and technical engineers etc. Directors:— Peter R. Masek, Wolf Brauer, and Gerald J. Hague. Secretary: H. L. Bloom. Registered office: 155 Fenchurch Street, London EC3.

M.F.W. (VALVES) LTD. Capital £2,000. To acquire the business of engineering agents and consultants and chemical engineering merchants carried on by John V. Fletcher at Kemmel Works, Lugsdale, Widnes as 'The M.F.W. Trading Co.' etc. Directors:— J. V. and M. O. Fletcher, and I. G. Laowndes. Registered office: 59 Warrington Road, Penketh, near Warrington.

MORTGAGES & CHARGES

DURSLEY PLASTICS LTD. London N. 15 April, £5,000 debentures, to Northern and Commercial Finance Ltd.; general charge.

PHOTOCHEMICAL CO. LTD., London W. 13 March, £1,000 debentures, to Associated British-Pathe Ltd.; general charge.

CHANGES OF NAME

WILLIAM HILL (CHEMISTS) LTD., 60 Russell Square, London WC1, changed to Ace Litho (Chemicals) Ltd.

WALLACE GENERAL MERCHANTS LTD., 198 Finchley Road, London NW3, changed to Wallace Manufacturing Chemists (Exports) Ltd.

Silicones for Industry Exhibition

A 'SILICONES IN INDUSTRY' exhibition was arranged by Midland Silicones Ltd. at the St. Andrews Halls, Glasgow, from 13 to 17 May inclusive. It was opened by Sir David Anderson, Principal Royal College of Science and Technology, Glasgow. Midland Silicones Ltd., are now building the first plant to manufacture silicones for industrial purposes at Barry, Glamorgan. When completed it will be the largest in Europe.

Exhibits included Silaster rubber, silicone greases and the silicone insulating compound MS_4 which retains its grease-like consistency over a full working range of −50°C to +300°C. New silicone materials were shown which enable the baker to treat his baking pans so that the bread may be easily turned out. Frothing and boiling over of molasses can be prevented by addition of a silicone. Waterproofing of leather is also possible.

At an 'Architects evening,' Mr. J. B. Gourley, B.Sc., gave a talk on the use of silicones in the building industry.

In the questions which followed this talk, the speaker was asked what was the effect of treating buildings in Edinburgh with silicone preparations, as frequently rain was driven by winds with a velocity of over 20 miles an hour. Mr. Gourley said that silicone paints and other materials applied to buildings could stand up to such conditions.

BRITISH CHEMICAL PRICES

General Chemicals

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £97; 80% pure, 10 tons, £103; commercial glacial, 10 tons, £106.

Acetic Anhydride. Ton lots d/d, £136.

Alum. Ground, f.o.r., about £25. MANCHESTER: Ground, £25.

Aluminium Sulphate. Ex-works, d/d, £15 10s. MANCHESTER: £15 15s to £18 10s.

Ammonia, Anhydrous. Per lb., 1s 9d to 2s 3d.

Ammonium Chloride. Per ton lot, in non-ret. pack, £29 2s 6d.

Ammonium Nitrate. D/d, in 4-ton lots, £31.

Ammonium Persulphate. MANCHESTER: per cwt., in 1-cwt. lots, d/d, £6 2s 6d; per ton, in min. 1-ton lots, d/d, £112 10s.

Ammonium Phosphate. Mono- and di-, ton lots, d/d, £106 and £97 10s.

Antimony Sulphide. Per lb., d/d UK in min. 1-ton lots: crimson, 4s 5d to 4s 10½d; golden, 2s 8½d to 4s 1¾d.

Arsenic. Ex-store, £45 to £50.

Barium Carbonate. Precip., d/d, 4-ton lots, bag packing, £41.

Barium Chloride. 2-ton lots, £49.

Barium Sulphate (Dry Blanc Fixe). Precip., 2-ton lots, d/d, £35.

Bleaching Powder. Ret. casks, c.p. station, in 4-ton lots. £28 12s 6d.

Borax. Ton lots, in hessian sacks, c.p. Tech., anhydrous, £66; gran., £45; crystal, £47 10s; powder, £48 10s; extra fine powder, £49 10s; BP, gran., £51; crystal, £56 10s; powder, £57 10s; extra fine powder, £58 10s.

Boric Acid. Ton lots, in hessian sacks, c.p. Tech., gran., £74 10s; crystal, £82 10s; powder, £80; extra fine powder, £82; BP gran., £87 10s; crystal, £94 10s; powder, £92; extra fine powder, £94.

Calcium Chloride. Ton lots, in non-ret. pack: solid and flake, £16.

Chlorine, Liquid. In ret. 16-17-cwt. drums d/d in 3-drum lots, £38 5s.

Chromic Acid. Less 2½%, d/d UK, in 1-ton lots, per lb., 2s 0⅝d.

Chromium Sulphate, Basic. Crystals, d/d, per lb., 8⅛d; per ton, £75 16s 8d.

Citric Acid. 1-cwt. lots, per cwt., £10 15s.

Cobalt Oxide. Black, per lb., d/d, bulk quantities, 13s 2d.

Copper Carbonate. Per lb., 3s 8d.

Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £84 17s 6d.

Cream of Tartar. 100%, per cwt., about £11 12s.

Formaldehyde. In casks, d/d, £37 5s.

Formic Acid. 85%, in 4-ton lots, c.p., £86 10s.

Glycerine. Chem. pure, double distilled 1.260 s.g., per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons, £10 1s 6d. Refined pale straw industrial, 5s per cwt. less than chem. pure.

Hydrochloric Acid. Spot, per carboy, d/d (according to purity, strength and locality), about 12s.

Hydrofluoric Acid. 60%, per lb., about 2s 6d per lb.

Hydrogen Peroxide. Carboys extra and ret. 27.5% wt., £128 10s; 35% wt., d/d, £158.

Iodine. Resublimed BP, under 1 cwt., per lb., 14s 2d; for 1-cwt. lots, per lb., 13s 5d.

Iodoform. Under 1 cwt., per lb., £1 2s 3d.; for 1-cwt. lots, per lb., £1 2s 6d.

These prices are checked with the manufacturers, but in many cases there are variations according to quality, quantity, place of delivery, etc.

Abreviations: d/d, delivered; c.p., carriage paid; ret, returnable; non-ret. pack, non-returnable packaging; tech, technical; comm, commercial; gran, granular.

All prices per ton unless otherwise stated

Lactic Acid. Pale tech., 44% by wt., per lb., 14d; dark tech., 44% by wt., ex-works, per lb., 9d; chem. quality, 44% by wt., per lb., 12¼d; 1-ton lots, usual container terms.

Lead Acetate. White, about £154.

Lead Nitrate. 1-ton lots, about £135.

Lead, Red. Basis prices: Genuine dry red, £126 15s; orange lead, £138 15s. Ground in oil: red, £145 15s; orange, £157 15s.

Lead, White. Basis prices: Dry English in 5-cwt. casks, £134 5s. Ground in oil: English, 1-cwt. lots, per cwt., 194s.

Lime Acetate. Brown, ton lots, d/d. £40; grey, 80-82%, ton lots, d/d, £45.

Litharge. In 5-ton lots, £143.

Magnesite. Calcined, in bags, ex-works, about £21.

Magnesium Carbonate. Light, comm., d/d, 2-ton lots, £84 10s under 2 tons, £97.

Magnesium Chloride. Solid (ex-wharf), £16 10s.

Magnesium Oxide. Light, comm., d/d, under 1-ton lots, £245.

Magnesium Sulphate. Crystals, £16.

Mercuric Chloride. Tech. powder, per lb., for 5-cwt. lots, in 28-lb. parcels, £1 3s; smaller quantities dearer.

Mercury Sulphide, Red. 5-cwt. lots in 28-lb. parcels, per lb., £1 9s 3d.

Nickel Sulphate.—D/d, buyers UK, nominal, £170.

Nitric Acid. 80° Tw., £35.

Oxalic Acid. Home manufacture, min. 4-ton lots, in 5-cwt. casks, c.p., about £131.

Phosphoric Acid. Tech. (s.g. 1.700) ton lots, c.p., £100; BP (s.g. 1.750), ton lots, c.p., per lb., 1s 4d.

Potash, Caustic. Solid, 1-ton lots, £93 10s; liquid, £34 15s.

Potassium Carbonate. Calcined, 96/98%, 1-ton lots, ex-store, about £74 10s.

Potassium Chloride. Industrial, 96%, 1-ton lots, about £24.

Potassium Dichromate. Crystals and gran., per lb., in 5-cwt. to 1-ton lots, d/d UK, 1s 1½d.

Potassium Iodide. BP, under 1-cwt., per lb., 10s 3d; per lb. for 1-cwt. lots, 9s 9d.

Potassium Nitrate. 4-ton lots, in non-ret. pack, c.p., £63 10s.

Potassium Permanganate. BP, 1-cwt. lots, per lb., 1s 10½d; 3-cwt. lots, per lb., 1s 10d; 5-cwt. lots, per lb., 1s 9½d; 1-ton lots, per lb., 1s 9¼d; 5-ton lots, per lb., 1s 8¾d. Tech., 5-cwt. in 1-cwt. drums, per cwt., £9 8s 6d; 1-cwt. lots, £9 17s 6d.

Salammoniac. Ton lot, in non-ret. pack, £45 10s.

Salicylic Acid. MANCHESTER: Tech., d/d, per lb., 2s 8½d.

Soda Ash. 58% ex-depot or d/d, London station, 1-ton lots, about £16 8s.

Soda, Caustic. Solid 76/77%: spot, d/d 4-ton lots, £32 6s 6d.

Sodium Acetate. Comm. crystals, d/d, £91.

Sodium Bicarbonate. Ton lot, in non-ret. pack, £17.

Sodium Bisulphite. Powder, 60/62%, d/d, 2-ton lots for home trade, £42 15s.

Sodium Carbonate Monohydrate. Ton lot, in non-ret. pack, c.p., £57.

Sodium Chlorate. 1-cwt. drums, c.p. station, in 4-ton lots, about £85.

Sodium Cyanide. 96/98%, ton lot in 1-cwt. drums, £113 5s.

Sodium Dichromate. Crystals, cake and powder, per lb., 11¼d. Net d/d UK, anhydrous, per lb., 1s 1d. Net. del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride. D/d, 1-ton lots & over, per cwt., £5; 1-cwt. lots, per cwt., £5 10s.

Sodium Hyposulphite. Pea crystals, £35 15s; comm., 1-ton lots, c.p., £32 10s.

Sodium Iodide. BP, under 1 cwt., per lb., 14s; 1-cwt. lots, per lb., 13s 2d.

Sodium Metaphosphate (Calgon). Flaked, paper sacks, £133.

Sodium Metasilicate. D/d UK in ton lots, loaned bags, £25.

Sodium Nitrate. Chilean refined gran. over 98%, 6-ton lots, d/d station, £29 10s.

Sodium Nitrite. 4-ton lots, £32.

Sodium Percarbonate. 12½% available oxygen, per cwt., in 1-cwt. kegs, £8 6s 9d.

Sodium Phosphate. D/d, ton lots: di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate. 75-84° Tw. Lancs and Ches., 4-ton lots, d/d station in loaned drums, £10 15s; Dorset, Somerset & Devon, per ton extra, £3 17s 6d; Scotland & S. Wales, extra, £3. Elsewhere in England, not Cornwall, extra, £1 12s 6d.

Sodium Sulphate (Desiccated Glauber's Salt). D/d in bags, £18.

Sodium Sulphate (Glauber's Salt). D/d, £9 5s to £10 5s.

Sodium Sulphate (Salt Cake). Unground, d/d station in bulk, £6. MANCHESTER: d/d station, £7 10s.

Sodium Sulphide. Solid, 60/62%, spot, d/d, in drums in 1-ton lots, £33 2s 6d; broken, d/d, in drums in 1-ton lots, £34 2s 6d.

Sodium Sulphite. Anhydrous, £66 5s; comm., d/d station in bags, £25 5s-£27.

Sulphur. 4 tons or more, ground, according to fineness, £20-£22.

Sulphuric Acid. Net, naked at works, 168° Tw. according to quality, £10 7s 6d-£12; 140° Tw., arsenic free, £8 12s 6d; 140° Tw., arsenious, £8 4s 6d.

Tartaric Acid. Per cwt.: 10 cwt. or more, £14; 1 cwt., £14 5s.

Titanium Oxide. Standard grade comm., rutile structure, £182; standard grade comm., anatase structure, £167 (from 1st Feb.).

Zinc Oxide. Max. for 2-ton lots, d/d, white seal, £120; green seal, £113; red seal, 2-ton lots, £115.

Solvents & Plasticisers

Acetone. All d/d, small lots, 5-gal. cans: 5-gal., £125; 10-gal., cans incl., £115. 40/45 gal. ret. drums, spot: Under 1 ton, £90; 1 to under 5 tons, £87; 5 to under 10 tons, £86; 10 tons under, £85. Tank wagons, spot: 1 to under 5 tons (min. 400 gal.), £85; 5 to under 10 tons (1,500 gal.), £84; 10 tons & up (2,500 gal.), £83; contract rebate, £2.

Butyl Acetate BSS. 10-ton lots, £173.

***n*-Butyl Alcohol BSS.** 10 tons, in drums, d/d, £152.

***sec*-Butyl Alcohol.** 5-gal. drums, £159; 40-gal. drums: under 1 ton, £124; 1-10 tons, £123; 10 tons & up, £119; 100 tons & up, £120.

***tert*-Butyl Alcohol.** 5-gal. drums, £195 10s; 40/45-gal. drums: 1 ton, £175 10s; 1-5 tons, £174 10s; 5-10 tons, £173 10s; 10 tons & up, £172 10s.

Diacetone Alcohol. Small lots: 5-gal. drums, £177; 10-gal. drums, £167. 40/45-gal. drums: under 1 ton, £142; 1-9 tons, £141; 10-50 tons, £140; 50-100 tons, £139; 100 tons & up, £138.

Dibutyl Phthalate. In drums, 10 tons, d/d, per lb., 2s; 45-gal. drums, d/d, per lb., 2s 1½d.

Diethyl Phthalate. In drums, 10 tons, per lb., 1s 11½d; 45-gal. drums, d/d, per lb., 2s 1d.

Dimethyl Phthalate. In drums, 10 tons, per lb., d/d, 1s 9½d; 45-gal. drums, d/d, per lb., 1s 10½d.

Dioctyl Phthalate. In drums, 10 tons, d/d, per lb., 2s 8d; 45-gal. drums, d/d, per lb., 2s 9½d.

Ether BSS. 1-ton lots, drums extra, per lb., 1s 11d.

Ethyl Acetate. 10-ton lots, d/d, £145.

Ethyl Alcohol (PBS 66 o.p.). Over 300,000 p. gal. 2s 11¼d; d/d in tankers, 2,500-10,000 p. gal., per p. gal., 3s 1¾d. D/d in 40/45-gal.drums, p.p.g. extra, 1d. Absolute alcohol (75.2 o.p.), p.p.g. extra, 5d.

Methanol. Pure synthetic, d/d, £43 15s.

Methylated Spirit. Industrial 66° o.p.: 500-gal. & up, d/d in tankers, per gal., 5s 4d; 100-499 gal. in drums, d/d, per gal., 5s 8½d. Pyridinised 64 o.p.: 500 gal. & up, in tankers, d/d, per gal., 5s 6d; 100-499 gal. in drums, d/d, per gal., 5s 10½d.

Methyl Ethyl Ketone. 10-ton lots, d/d, £140.

Methyl *iso*Butyl Ketone. 10 tons & up, £159.

***iso*Propyl Acetate.** In drums, 10 tons, d/d, £137; 45-gal. drums, d/d, £143.

***iso*Propyl Alcohol.** Small lots: 5-gal. drums, £118; 10-gal. drums, £108; 40-45 gal. drums: less than 1 ton, £83; 1-9 tons, £81; 10-50 tons, £80 10s; 50 tons & up, £80.

Rubber Chemicals

Carbon Disulphide. According to quality, £61-£67.

Carbon Black. Per lb., according to packing, 8d-1s.

Carbon Tetrachloride. Ton lots, £81.

India-Rubber Substitutes. White, per lb., 1s 8¾d to 2s ½d; dark, d/d, per lb., 1s 3d-1s 5½d.

Lithopone. 30%, about £55.

Mineral Black. £7 10s-£10.

Sulphur Chloride. British, about £50.

Vegetable Lamp Black. 2-ton lots, £64 8s.

Vermilion. Pale or deep, 7-lb. lots, per lb., 15s 6d.

Coal-Tar Products

Benzole. Per gal., min. 200 gal., d/d in bulk, 90's, 5s; pure, 5s 4d.

Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 4d; 40/50-gal. ret. drums extra, per lb., ½d. Crude, 60's, per gal., 8s.
MANCHESTER: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s.

Creosote. Home trade, per gal., according to quality, f.o.r. maker's works, 1s-1s 9d. MANCHESTER: Per gal., 1s 2d.-1s 8d.

Cresylic Acid. Pale 99/100%, per gal., 6s 4d; 99.5/100%, per gal. 6s 6d. D/d UK in bulk: Pale ADF, per imperial gallon f.o.b. UK, from 7s 3d; per US gallon, c.i.f. NY, 95 cents.

Naphtha. Solvent, 90/160°, per gal., 6s 1d; heavy, 90/190°, for bulk 1,000-gal. lots, d/d, per gal., 4s 11d. Drums extra; higher prices for smaller lots.

Naphthalene. Crude, 4-ton lots, in buyers' bags, nominal, according to m.p.: £20 11s-£33 11s 6d; hot pressed, bulk, ex-works, £40 1s 9d; refined crystals, d/d min. 4-ton lots, £68.

Pitch. Medium, soft, home trade, f.o.r. suppliers' works, £9; export trade, f.o.b. suppliers' port, about £10 10s.

Pyridine. 90/160, per gal., 20s-£1 2s 6d.

Toluole. Pure, per gal., 6s 9d; 90's, d/d, 2,000 gal. in bulk, per gal., 6s.
MANCHESTER: Pure, naked, per gal., 5s 6½d.

Xylole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 6s-6s 8d.

Intermediates & Dyes (Prices Nominal)

***m*-Cresol** 98/100%. D/d, per lb., 4s 9d.
***o*-Cresol** 30/31°C. D/d, per lb., 1s.
***p*-Cresol** 34/35°C. D/d, per lb., 4s 9d.
Dichloraniline. Per lb., 4s 6d.
Dinitrobenzene. 88/99°C., per lb., 2s 1d.
Dinitrotoluene. Drums extra. SP 15°C., per lb., 2s 1½d; SP 26°C., per lb., 1s 5d; SP 33°C., per lb., 1s 2½d; SP 66/68°C., per lb., 2s 1d.
***p*-Nitraniline.**—Per lb., 5s 1d.
Nitrobenzene. Spot, 90-gal. drums (drums extra), 1-ton lots d/d, per lb., 10d.
Nitronaphthalene.—Per lb., 2s 5½d.
***o*-Toluidine.** 8-10-cwt. drums (drums extra), per lb., 1s 11d.
***p*-Toluidine.**—In casks, per lb., 6s 1d.
Dimethylaniline. Drums extra, c.p., per lb., 3s 5d.

Chemical Stocks and Shares

Hopes of a Lower Bank Rate Dwindle in the City

SENTIMENT in stock markets has continued to be governed in the main by divergent views on whether an early reduction is likely in the bank rate. A month ago there were growing hopes it would come down to 4½ per cent in the near future, but since then sterling has lost some of its strength and hopes of a change in the bank rate have dwindled.

Chemical shares displayed more activity, but lost part of last month's gains. Financial results that have come to hand have made a good impression, but on the other hand it is clear that, generally, rising costs and lower profit margins seem to offer little scope for higher earnings this year. A similar position exists in most industries. Imperial Chemical after advancing sharply to 46s 6d have come back to 45s 6d which compares with 45s 10½d a month ago. Salient factor emphasised by the full results is that though the group's sales last year rose from £411 million to the new high record of £435 million, group profits were lower at £53.4 million, compared with £56.5 million. This was because the company itself absorbed increased costs in accordance with its policy of keeping prices of its products as low and stable as possible. Sir Alexander Fleck's annual speech on 13 June will be awaited with considerable interest for news whether the policy in regard to prices is to be modified because of the continued rise in costs. There has been revived talk in the City that ICI may seek a New York quotation for its shares.

Laporte 5s shares have been active, and have risen on balance from 19s 9d to 22s though best prices were not held. Although 'ex rights' to the new shares, Lawes Chemical 10s shares rose from 19s 6d to 22s and the new shares were at a premium of 6s 10½d. Monsanto 5s shares were also a good feature, having advanced on the month from 22s 6d to 25s 7½d the highest price this year.

Reichhold Chemical 5s shares strengthened from 13s 9d to 14s 6d while elsewhere, Hickson and Welch 10s shares have been firm at 30s 9d 'ex' the free scrip issue. Fisons held steady at 60s and British Glues and Chemicals 4s shares moved up from 11s 6d a month ago to 12s 6d. Greeff-Chemical Holdings 5s shares were 18s 6d following publication of the results and maintained 16 per cent dividend. In other directions, William Blythe 3s shares changed hands around 10s. F. W. Berk 5s shares eased to 5s 10½d and Ashe Chemical shares changed hands around their par value of 1s while buyers put British Tar 5s shares up from 6s 10½d a month ago to 7s 4½d and Coalite and Chemical 2s shares were slightly higher at 4s 1½d. Hardman and Holden 5s shares have moved up a few pence to 8s 6d. Anchor Chemical 5s shares have held steady at 11s 6d.

New Edition of BS Standard for Filter Flasks

In a new edition of the British Standard BS1739:1957 which replaces the 1951 version, only dimensions essential to performance and interchangeability of filter flasks are given as mandatory. These are: minimum wall thickness; diameter of hole for detachable side-arm. Other dimensions, such as height, diameters etc., are given for guidance only. The standard provides for a tapered neck, or if required, a standard interchangeable conical of spherical joint may be fitted.

Eight sizes of flask, from 100 ml. to 20 litre nominal capacity, are specified, together with the quality of glass to be used and details of shape and general construction. Both integral and detachable side-arms are specified, with alternative olive and corrugated ends. A larger size of side-arm and grommet is provided for the 10 and 20 litre flasks.

Copies of the standard are obtainable from sales branch British Standards Institution, 2 Park Street, London W1, price 3s.

NEW PATENTS

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

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection on 26 June.

Vulcanising blends of butyl rubber and GR-S. Esso Research and Engineering Co. **776 735**

Device for utilising the sensible heat of the gas generated in gas producers. Koppers, H., Ges. **777 791**

Dyeing fibres of copolymers of acrylonitrile. Kunstzijdespinnerij Nyma, NV. **777 534**

Improving the softening point of hydrocarbon resins. Esso Research and Engineering Co. **777 535**

Propylene polymers and interpolymers. Du Pont de Nemours, E. I., and Co. **777 538**

Resin compositions. General Electric Co. **777 899**

Reaction column for the continuous treatment of liquids. Noblee und Thoerl Ges. **777 658**

Purifying and decolorising titanium tetrachloride. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. **777 539**

Refractory and/or chemically resistant bricks or shapes. Wester, H., and Wester, T. (trading as Westerwerke Fabriken Hochfeuerfester Erzeugnisse). **777 660**

α-β-Peltatin glucosides. Sandoz Ltd. **777 662**

Alkyl ethers of podophyllum glucosides and process for their manufacture. Sandoz Ltd. **777 900**

Heat resistant alloys. Nyby Bruks Aktiebolag. [Addition to 777 034]. **777 541**

Water soluble organic copper compounds. Farbenfabriken Bayer AG. **777 544**

Linear unsaturated polyesters. Chemische Werke Hüls AG. **777 793**

1:3-Dioxolane derivatives. Thomae, Dr. K., Ges. **777 794**

Resinous composition. American Cyanamid Co. **777 545**

Substituted iminodibenzyls. Geigy, J. R., AG. **777 546**

Liquid-containing and dispensing devices. Naamlooze Vennootschap Philips Gloeilampenfabrieken. **777 795**

Inhibiting evaporation of volatile non-aqueous liquid products. Standard Oil Co. **777 678**

Resin compositions capable of being hardened. Farbwerke Hoechst AG. **777 912**

Polyhydrophenanthrene compounds. Merck and Co. Inc. [Divided out of 777 681.] **777 684**

[Divided out of 777 682.] **777 685**

[Divided out of 777 682.] **777 686**

[Divided out of 777 682.] **777 687**

[Divided out of 777 682.] **777 688**

[Divided out of 777 683.] **777 692**

Cyclopentanopolyhydrophenanthrene compounds. Merck and Co. Inc.

[Divided out of 777 682.] **777 689**

[Divided out of 777 682.] **777 690**

[Divided out of 777 682.] **777 691**

[Divided out of 777 683.] **777 693**

Microbicidal compositions. Dunlop, S. (Permachem Corp.). [Divided out of 769 799.] **777 679**

Malonic, cyanoacetic and acetoacetic acid derivatives. Thomae, Dr. K., Ges. [Divided out of 777 813.] **777 814**

Hydroxy-phenyl ketones. Eastman Kodak Co. [Divided out of 777 811.] **777 812**

AMENDED SPECIFICATION PUBLISHED

Polyalkylene polyamino acid compounds. Dow Chemical Co. **750 481**

Open to public inspection on 3 July

Separation of plutonium and uranium from fission products. United Kingdom Atomic Energy Authority. **778 051**

Methods of producing elastic impression compositions. Schmitt, W., and Purrman, R. **777 932**

Removing hafnium from zirconium. Commonwealth Scientific and Industrial Research Organization. **778 192**

Production of hydrazine. Guggenheim, H. **778 294**

Monoazo-dyestuffs insoluble in water. Farbwerke Hoechst AG. **778 131**

Recovery of uranium from naturally occurring materials. United Kingdom Atomic Energy Authority. **778 061**

Complex esters. Esso Research and Engineering Co. **778 132**

Hydrazine derivatives of 2-alkylpyridine-4-carboxylic acids. Farbenfabriken Bayer AG. **778 062**

Antigen for the treatment of tuberculosis. Gonzalez, A. M., and Gonzalez, A. M. **778 199**

Process and installation for the production of naphthalene. Gelsenkirchener Bergwerks-AG, and Koppers, H., Ges. **778 063**

Material for semi-conductors. Standard Telephones and Cables Ltd. **778 383**

Ceramic material. Green, W. **778 200**

Charging catalysts into reactors. Ruhrchemie AG, and Lurgi Ges. fur Warmetechnik. **778 134**

Preparation of slurries to be used in the manufacture of cement. Farbwerke Hoechst AG. **777 940**

Water-insoluble threads of polyvinyl alcohol. Wacker-Chemie Ges. **778 201**

Wax compositions. Ruhrchemie AG. **778 203**

Distillation plants for aqueous liquid. Southern Gas Board, Hogg, J. C., and Eddlestone, T. **778 066**

Process for the manufacture of dispersions of powders. Dehydag Deutsche Hydrierwerke Ges. **778 297**

Manufacture and use of hardenable ternary condensation products from a compound of the aminotriazine group. Ciba Ltd. **778 204**

Dispensing apparatus for liquid fuel. Tokheim Corp. **778 171**

Apparatus for the synthesis of polyamides. Perfogit Soc. per Azioni. **777 943**

Electrolytic regeneration of aqueous solutions containing mercaptides. British Petroleum Co. Ltd., McNeill, E., and Robson, B. **777 944**

Producing carbon black and synthesis gas. Cabot, G. L., Inc. **778 207**

Processes and materials for effecting adhesion. Aero Research Ltd. **778 041**

Prevention of mist formation in alkaline baths for electrolytic application or removal of metal layers. Dehydag Deutsche Hydrierwerke Ges. **778 208**

Method and apparatus for the characterisation of odours. Airkem Inc. **778 210**

Process for the production of permselective membranes and the membranes thus produced. Nederlandse Organisatie Voor Toegepast-Natuurwetenschappelijk Onderzoek ten Behoeve van Nijverheid, Handel en Verkeer. **778 001**

Methods of bulk storage of flour and other non-free flowing powdered materials. Simon, H., Ltd. **778 215**

Impregnating compositions for use in electrical cable manufacture. Middlesex Oil and Chemical Works Ltd. **778 216**

Electrodeposition of titanium, zirconium, hafnium, vanadium, tantalum and niobium. Horizons Titanium Corp. **778 218**

Manufacture of cellulose triacetate yarns. British Celanese Ltd. (Cognate application 5413.) **778 395**

Cracking of crude petroleum. Esso Research and Engineering Co. **778 220**

Allyl-phosphites. United Kingdom Atomic Energy Authority. **778 077**

Desulphurisation of phenolic materials. British Tar Products Ltd. **777 961**

Separation of acid alkyl phosphates. Johnson, D. I. O., and Milward, G. L. **778 081**

Polymeric materials. Monsanto Chemicals Ltd. (Cognate applications 22581 and 12416.) **778 225**

Reducing corrosion of metals by strong caustic soda solutions during dehydration. Imperial Chemical Industries Ltd. **778 226**

Method of and apparatus for dehydrating aqueous solutions and suspensions of relatively low solids content. Commonwealth Engineering Co. of Ohio. **778 301**

Polyvinyl butyral. Celanese Corp. of America. **778 275**

Tetrabisazo-dyestuffs. Ciba Ltd. **778 233**

Fluoronitriles and their preparation. Du Pont de Nemours, E. I., and Co. **778 351**

Gasoline composition. California Research Corp. **778 305**

Methods of and apparatus for bringing liquids into contact with granular materials. Permutit Co. Ltd. **778 236**

Aqueous emulsion copolymerisate compositions. Glidden Co. **778 237**

Separating coal hydrogenation products. Union Carbide and Carbon Corp. **778 238**

Trihydroxy-polyoxyalkylene ethers of glycerine. Dow Chemical Co. **777 978** and **778 239**

Lubricant. Murrant, K. B. **778 240**

4-0.0-Diphenylphosphorylamidopyrazolones. Soc. des Usines Chimiques Rhone-Poulenc. **778 309**

High-molecular weight derivatives of hydroxyl group-containing steroids. Aktiebolaget Leo. **778 142**

Recovering nitrous gases as ammonium nitrate. Oesterreichische Stickstoffwerke AG. **778 244**

Oxidation products of tetralone. Institut Francais du Petrole, des Carburants et Lubrifiants. **778 311**

Polymer oil additive. Esso Research and Engineering Co. **778 246**

Esters of hydroxyacetylenes carrying amino groups with substituted carbamic acids. Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler. **778 314**

Production of carbon black. International Carbon-Black Co. Ltd. **778 247**

Fractionation of crude petroleum or fractions thereof. Ges. fur Forschund und Patentverwertung AG. **778 316**

Fluorine by the electrolysis of fused salts. Imperial Chemical Industries Ltd. **778 248**

Grease compositions containing metal phthalamates. California Research Corp. **778 249**

Method for assuring the adhesion of polyethylene coatings to surfaces. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. **777 984**

Stable neomycin compositions for oral administration. Upjohn Co. **778 148**

Production of di-calcium phosphate. Soc. d'Applications et de Recherches Industrielles. **778 252**

Manufacture of ϵ-caprolactam. Inventa AG fur Forschung und Patentverwertung **778 253**

Method for adding a liquid to a viscous spinning solution. Algemene Kunstzijde Unie NV. (Addition to 756 590.) **777 990**

Processes and materials for effecting adhesion. Aero Research Ltd. (Divided out of 778 041.) **778 042**

Processes for the manufacture of leather and leather products tanned by zinc sulphur compositions. American Zinc, Lead and Smelting Co. **778 153**

Compositions for synthetic textile fibres, and the fibres produced therefrom. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. **778 254**

Adhesive compositions and polymeric products for use therein. Styrene Products Ltd. **778 102**

Production of artificial filaments, threads, bands and the like. Courtaulds Ltd. (Addition to 614 506 and 701 645.) **778 257 778 258**

N-(β-diarylamino)-ethylpiperidines. Farmaceutici Italia. **777 994**

Cation exchange resins of the carboxylic type. Montecatini Soc. Generale per l'Industria Mineraria e Chimica. **778 104**

Allopregnan-3, 6, 11, 20-tetrone. Farmaceutica Italia SA. **777 995**

Lysergic acid amide. Lilly, E., and Co. **778 103**

Steroid compounds. Merck and Co. Inc. **777 996**

Modified polysiloxanes. Union Carbide and Carbon Corp. **777 997**

Phosgenation process for the manufacture of diphenylene-4:4′-diisocyanate. Imperial Chemical Industries Ltd. **778 261**

Mono azo dyestuffs containing heavy metal and their use. Geigy, J. R., AG. **778 262**

Dithiocarbamic acid ester sulphonic acids or salts thereof. Dehydag Deutsche Hydrierwerke Ges. **778 263**

Synthetic resins with anion exchanging properties. Farbenfabriken Bayer AG. **778 264**

Ribofuranosylpurines which are organic compounds. American Cyanamid Co. **778 106**

Styrene-acrylonitrile copolymers. Monsanto Chemical Co. **778 265**

Manufacture of insulating refractory products and the products produced thereby. Union Chimique Belge SA. **778 109**

Stereospecific chlorination of △ 5-steroids. Glidden Co. **778 334**

Production of alumina. Universal Oil Products Co. **778 266**

Producing pure carbides of the metals tungsten, chromium and molybdenum. Philips Electrical Industries Ltd. **778 267**

Titanium-containing ferrous alloys. Sintercast Corp. of America. **778 268**

Antacid preparation. Merck and Co. Inc. **778 096**

Dialkyl aluminium hydrides. Ziegler, K. **778 098**

Alkylating benzene or a mono-alkyl benzene or a mixture thereof in the liquid phase. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 014**

Producing a transition metal and carbon tetrafluoride. Horizons Titanium Corp. **778 344**

Composition of matter. Olin Mathieson Chemical Corp. **778 020**

Production of titanium. Farbenfabriken Bayer AG. **778 021**

Aryl mercury acetates. Heyden Chemical Corp. **778 271**

Organosilicon compounds. Midland Silicones Ltd. **778 272**

Paint vehicle bases. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 026**

Receptacles of light metal for liquefied gas, particularly adapted for recharging liquefied gas lighters. Nationale Soc. Anon. **778 274**

Method of and an apparatus for separating foreign substances from a pulverous or granular material. Smidth, F. L., and Co. Aktieselskab. **778 117**

Glass pressing device. Owens-Illinois Glass Co. **778 027**

Bonding silicone rubber to solid materials. Midland Silicones Ltd. **778 348**

Carbon electrodes made from coke. Esso Research and Engineering Co. **778 119**

Reactive magnesium carbonate. Magnetrit AG. **778 120**

Ethyl chloride manufacture. Ethyl Corp. **778 029**

Crystal production. Standard Telephones and Cables Ltd. **778 123**

Dispensing pulpy or pasty substances from a container. Centromint Co. Establishment. **778 124**

Titanium-oxygen-carbon alloys. Horizons Titanium Corp. **778 354**

Homogeneous, transparent copolymers from a styrene and acrylonitrile. Badische Anilin- und Soda-Fabrik AG. **778 035**

Stable preparations of essential oils. Reckitt and Colman Ltd. **778 280**

Olefinically unsaturated carbonylic compounds and alcohols, and the resulting carbonylic compounds and alcohols. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 125**

Glass compositions. Pittsburgh Plate Glass Co. **778 355**

Mixture for the prevention of bloat in ruminant animals. Midland Silicones Ltd. (Dow Corning Corp.). **778 356**

Explosion-proof enclosures. Westinghouse Electric International Co. **778 040**

4-Substituted 1, 2-diaryl-3, 5-dioxopyrazolidines. Geigy, J. R., AG. **778 128**

Cooling and granulating petroleum pitch. Gulf Research and Development Co. **778 129**

Stabilised conc. hydrazine and method of stabilising same. Olin Mathieson Chemical Corp. (Addition to 738 441.) **778 357**

Pesticidal petroleum composition. Esso Research and Engineering Co. **778 358**

Cobalt-chromium base alloy. Deloro Stellite Ltd. **778 359**

CHEMICAL PIONEERS—Jean Chaptal

(Continued from page 891)

which was as successful as his *Elements*, and which exerted great influence in many countries. By 1811 Chaptal was again in favour and Napoleon, who had now assumed the Imperial Crown, created him Compte de Chantaloup. Chaptal continued his efforts to promote the application of scientific methods in industry, interesting the Emperor himself in the advantages to be gained. On one occasion he persuaded Napoleon to accompany him to Delessert's beet sugar works where that inventor's process was being worked with great success. Bonaparte, who knew well how to make the dramatic gesture, was so excited by what he saw, that he unfastened the Cross of Honour from his own breast and pinned it on the overwhelmed Delessert. But Napoleon's course was nearing its end and with it the influence of his scientific minister. During the Hundred Days, that strange final episode presided over by the sinister genius of Fouché, Duke of Otranto, Chaptal became minister of state and director of commerce and manufactures.

After the restoration of the monarchy in France, Chaptal retired into private life. With D'Arcet he carried on chemical manufacture at a factory in Marseilles where, all notions of producing natural alkali abandoned, he made soda by the LeBlanc process at a rate of about two tons a day, the product finding a ready market in the soaperies of the district. In 1819, presumably as the combined recognition of a man who had served his country well and a gesture of reconciliation, Louis XVIII admitted Chaptal to the chamber of peers. Impoverished by the unfortunate speculations of his son, Chaptal, one of the most important pioneers of the chemical revolution in France, died in Paris on 30 July 1832.

Exemptions from Key Industry Duty

THE Board of Trade are considering the renewal for the period 19 August 1957 to 18 February 1958 of the exceptions from Key Industry Duty set out in the Safeguarding of Industries (Exemption) Orders Nos. 2, 3 and 4 1957, and in any further exemption order which the Treasury may make before 18 August 1957, under section 10 (5) of the Finance Act 1926, as amended by subsequent enactments.

Lists of the articles—mainly chemicals—exempted from KID until 18 August 1957 by the above orders were published in Statutory Instruments 1957, Nos. 195, 417, and 698, and will be found in the *Board of Trade Journal* for 15 February, 15 March, and 27 April 1957.

Any representations arising out of this announcement should be sent to the Board of Trade, Tariff Division, Horse Guards Avenue, London SW1, not later than 12 June 1957.

ICI SPENT MORE ON INVESTMENT AND RESEARCH IN 1956

ICI SALES, both in value and volume, again created new record levels last year. The value of the group's consolidated sales at £435 million (£411 million last year) was also a record. The consolidated sales showed an increase of 5.9 per cent over 1955, against an increase in 1955 of 16.7 per cent over the previous year.

This is stated in the annual report of the directors. Their review of operating activities is reported in page 881.

Continued absorption of increased costs in pursuance of a policy of keeping prices as low and stable as possible, led to a reduction in profit margins, despite the increase in sales. The group manufacturing and trading profits totalled £53.4 million (£56.5 million); parent company's manufacturing and trading profits were £38.2 million (£42.1 million).

ICI income before tax was £37.4 million (£42.1 million) and of the group £50.1 million (£53.5 million). Tax took: ICI, £18.1 million (£18.2 million), group, £23.7 million (£23.9 million). ICI income after tax was £19,293,139 (£23,977,163).

As stated in CHEMICAL AGE, 4 May, page 774, a final dividend of 6 per cent is recommended on ordinary stock, making a total of 10 per cent (same).

Expenditure on the company's UK construction programme last year totalled £43,785,566 (against a figure of £33 million shown last year). The unexpended balance at the end of 1956 on all existing sanctions for capital expenditure for the operating divisions and Wilton works amounted to about £83 million. Since the end of 1945 the company has spent £267 million on new fixed assets.

Capital Spending Overseas

Capital expenditure by overseas subsidiaries last year amounted to £12,469,391, making with UK expenditure, a group total of more than £56 million.

More than £12 million (£9.4 million) was spent on research and development. About 40 per cent of the total went on improving existing products and processes; 40 per cent was spent on the discovery and development of new products and processes; the balance of 20 per cent was spent on the provision of basic scientific and technical information.

The f.o.b. value of ICI exports increased by £2 million to £73.1 million, of which £7.7 million represents exports to North America. An important proportion of the total exports is now represented by new products of high value; for example, exports to Europe, totalling £18.7 million, increased by £9 million, and of that increase £7.5 million was on account of newer products.

Except for the leathercloth and metals divisions, all the ICI manufacturing divisions shared in the increased sales. Some of the newer products, notably Terylene fibre and titanium, made a significant contribution to this increase.

Most raw materials were easy to get and prices generally only increased slightly. There was a striking reduction in the case of copper, from a March peak of £437 to £270 a ton by December. The company was faced early in the year with rising costs in respect of railway and road haulage, coal and coke, and wages. These higher costs were only partly offset by increased efficiency and the company had to raise the prices of a number of products.

At the time of the report there had been no increase since the end of last June in home trade prices of chemicals, dyestuffs, explosives, fertilisers, fibres, pharmaceuticals, paints and plastics. This follows the Chancellor of the Exchequer's appeal to help the fight against inflation. Provided there are no major increases in the cost of freight or fuel, this 'standstill' will be maintained until 30 June this year.

A 'further great advance' was recorded in accident prevention in 1956, there were only 0.646 lost-time accidents for every 100,000 man-hours worked (roughly a man's working life) compared with 0.989 in 1955. This reduction of 28 per cent is the biggest ever made in the company in a single year.

FOR YOUR DIARY

TUESDAY 28 MAY

Het Koninklijk Instituut van Ingenieurs, De Koninklijke Nederlandse Chemische Vereniging, Institution of Chemical Engineers and Society of Chemical Industry—London: Church House, Westminster SW1, 9 a.m. Joint symposium on 'Scaling-up of chemical plant and processes'. Also on 29 May.

Society of Instrument Technology—London: Manson House, Portland Place W1, 6 p.m. Annual general meeting followed by an address by Sir Harold Hartley, the new president.

THURSDAY 30 MAY

Royal Society—London: Burlington House, Piccadilly W1, 10 a.m. Discussion on 'Initiation and growth of explosion in solids' opened by Dr. F. P. Bowden.

FRIDAY 31 MAY

SAC—Cheltenham: Queen's Hotel, 6.30 p.m. Joint summer meeting of Western and Midlands Sections. 'Recent advances in the analysis of plastics' by Dr. J. Haslam.

SATURDAY 1 JUNE

SAC—Cheltenham: Queen's Hotel, 9.30 a.m. Joint summer meeting. 'Analysis of titanium, zirconium, and their alloys' by W. T. Elwell; 'Analysis of the rarer elements of group III', by A. R. Powell. 3 p.m. Visit to Dowty group headquarters, Arle Court. 7.30 p.m. Dinner.

Market Reports

DEMAND CONTINUES STRONG

LONDON The industrial chemicals market has shown no new feature on the week. Delivery specifications against existing contracts have covered good quantities and fresh buying on home account has been on a fair scale. Overseas demand for a wide range of chemicals continues at a good level.

Apart from the lower quotations for the non-ferrous metal compounds there have been no important changes in the price position. Zinc oxide white seal is now £104 per ton, green seal £102 per ton and red seal £99 per ton for 2-ton lots. Sulphate of copper is lower at £84 17s 6d a ton less 2 per cent f.o.b. Liverpool.

Pitch is in good request in a firm coal-tar products section.

MANCHESTER From the point of view of contract deliveries of the alkalis and other bread-and-butter lines of chemical products, steady trading conditions ruled during the past week, the textile and allied trades and other industrial users mostly giving a good account of themselves in this respect. A fair flow of new inquiries from both the home and export sections has also been in the market. Except in one or two lines current business in fertiliser materials continues on the quiet side. Creosote oil and carbolic and cresylic acids are meeting with a steady demand among the tar products.

GLASGOW During the past week business has been much more active in the Scottish heavy chemical market, particularly in regard to the textile and finishing trade. Deliveries against contract requirements have also been well maintained. There is still a satisfactory demand for agricultural chemicals.

Classified Advertisements

CLASSIFIED RATES: All sections 5d. per word. Minimum 8/-. Three or more insertions 4d. per word. Box Number 2/- extra. Up to mid-day Tuesday for insertion same week.

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COMPANY MEETINGS AND REPORTS: £12.12.0 per column. Three column measure (approximately 360 words).

EDUCATIONAL

A.M.I.CHEM.E.—More than one-third of the successful candidates since 1944 have been trained by T.I.G.B. All seeking quick promotion in the Chemical and Allied Industries should send for the T.I.G.B. Prospectus. 100 pages of expert advice, details of Guaranteed Home Study Courses for A.M.I.Chem.E., B.Sc.Eng,, A.M.I.Mech.E., A.M.I.Prod.E., C. & G., etc., and a wide range of Diploma Courses in most branches of Engineering. Send for your copy today—**FREE.** T.I.G.B. (Dept. 84), 29, Wright's Lane, London W.8.

SITUATIONS VACANT

ASSISTANT CHEMIST

required by

KUWAIT OIL COMPANY LTD.

The Company invites applications for the above post in KUWAIT from keen men between the ages of 23 and 28 years in possession of the Inter B.Sc. or its equivalent. Applicants should have at least 3 years' experience in laboratory work associated with the Oil Industry or related industries.

Total pay not less than £1,430 per annum including local allowance.

Write for application form giving brief details, quoting K.2165, to Box S/47 c/o 191, Gresham House, E.C.2.

THE FULLERS' EARTH UNION LIMITED
A MEMBER OF THE LAPORTE GROUP

require the following personnel for their Research and Technical Service Departments at Redhill, Surrey.

CHEMIST with at least 2nd Class Honours Degree, interested in research and development work, possessing considerable initiative, for solid state investigations broadly within the clay minerals field.

CHEMIST with at least 2nd Class Honours Degree and some research experience, with special interest in physical/organic research, capable of carrying out a full programme with minimum supervision. Experience in oils, fats and waxes an advantage but is not essential.

TECHNICAL REPRESENTATIVE with considerable experience of lubricating or vegetable oil refining for liaison with customers. Some travelling. Age limits 34/45 years. Degree not essential for this post.

Competitive salaries to applicants of suitable calibre. Pension scheme. Five-day week. Please apply in writing to The Fullers' Earth Union Limited, Patteson Court, Redhill, Surrey.

SITUATIONS VACANT: continued

RHODESIA—CHEMISTS

Applications are invited from Chemists by a large Copper Mining Company in Northern Rhodesia.

QUALIFICATIONS—Applicants should be under 45 years of age and should hold a University Degree or equivalent Diploma with Chemistry as major subject. Experience of ores analysis and knowledge of operations of the Spectograph, Spekker or Numetron an advantage.

EMOLUMENTS—Basic starting salary from £894 to £954, depending on experience plus variable bonus currently 60 per cent of basic salary and cost-of-living allowance currently £65 per annum.

LEAVE—44 days per annum may be accumulated up to 132 days. In addition, 5 days' casual leave granted annually after completion of a year's service.

PASSAGE—Employee's outward passage to Rhodesia paid by the company.

ACCOMMODATION—Single quarters only available on engagement. Married accommodation available 13 to 18 months, depending on number in family.

THERE ARE GENEROUS PENSIONS, LIFE ASSURANCE AND MEDICAL SCHEMES.

Apply in writing to R.24, Mine Employment Department, Selection Trust Limited, Mason's Avenue, Coleman Street, London, E.C.2.

ENERGETIC YOUNG MAN with progressive ideas is required as a chemical plant manager in a south west Lancashire factory. The person selected will be responsible for the operation of one or more plants. He should be either a qualified chemist or chemical engineer and preferably have a good working knowledge of labour control, cost control standard, and production planning. The position is permanent and is covered by a contributory pension and life assurance scheme. The initial salary will be dependent on age, qualifications and experience but within the range £750/950 p.a. Suitably qualified candidates are requested to send full particulars of education, qualifications and career to date to Personnel Manager, **BOX No. C.A. 3444, CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

OFFICIAL APPOINTMENTS

NORTH THAMES GAS BOARD

A SENIOR DRAUGHTSMAN, aged 30-45, is required at the Chemical Products Works, Beckton, E.6.

Candidates should have considerable experience in the design and layout of plant from flow diagrams and in the preparation of schemes and contract specifications both for development and maintenance work.

Starting salary will be within the range £790 to £940 per annum according to age, qualifications and experience. The successful candidate will be required to join the Staff Pension Scheme.

Applications, giving age and full particulars, to Staff Controller, North Thames Gas Board, 30, Kensington Church Street, W.8, quoting reference 666/324.

BOX NUMBERS: *Reply c/o "Chemical Age" • Bouverie House • Fleet Street • EC4*

OFFICIAL APPOINTMENTS: continued

WESTERN REGION OF NIGERIA

Assistant Government Chemist, Medical Department.

QUALIFICATIONS. Second Class Honours degree in Chemistry of a British University, or A.R.I.C.

DUTIES. Chemical and bacteriological examination of water supplies. General chemical analyses of foods and drugs. Examination of police exhibits including toxicological samples.

TERMS OF APPOINTMENT. On contract with emoluments in the scale £990-£1,944 p.a. Gratuity on satisfactory completion of contract. Outfit allowance. Free passages. Quarters provided at rental. Free medical attention. Generous leave. Income tax at local rates.

Apply to Director of Recruitment, Colonial Office, London, S.W.1. State age, qualifications and experience. Quote BCD 117/410/040.

FOR SALE

FOR SALE: Crude Hot-Pressed Naphthalene 100 ton lots. **H.M. KERSHAW, OXENHOPE, KEIGHLEY — TEL 2277 — HAWORTH.**

MORTON, SON AND WARD, LIMITED, STAINLESS STEEL VESSELS

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

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

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

These items can also be fabricated in mild steel.

JACKETED PANS

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

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

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

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

AIR RECEIVERS MADE TO REQUIREMENTS. PUMPS. Selection of new MONO and second-hand Pumps in stock—2 in. to 5 in.

Inquiries Invited.
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FOR SALE

6,000 lb. Silica Gel in 4 oz. linen bags, packed in airtight steel containers. Unused. Samples available. Offers to:—

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STORAGE VESSELS
We Specialise in all Types up to 10,000 Gal.
We also convert Lancashire Boilers 30 ft. by 8 ft. diam., and supply thoroughly scaled and ready for use. Ideal for Chemicals. Send us your enquiries.
MADEN & McKEE LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13

FOR SALE: continued

600

PLANT FOR THE MANUFACTURE OF MARGARINE

Four **HORIZONTAL STAINLESS STEEL BLENDERS** by Johnson, 5 ft. by 3 ft. by 3 ft., with welded steel jacket, bottom end outlet; split stainless steel lid with handles and two 10 in. diam. openings; Agitator of stainless steel tubular whisk-type with glanded bearings, direct coupled to 2 h.p. Brook motor 400/440/3/50 through Croft reduction gear 1,440 : 38. Jacket fitted thermometer pocket one end, bottom connections, and top overflow, 2,000 lb. working capacity.

2-TON CAPACITY CHILLING UNIT by Hardaker, comprising **STAINLESS STEEL CHILLING MACHINE,** direct expansion ammonia type, drum 4 ft. 6 in. face by 4 ft. diam., spray feed, doctor knife, etc. Drive by 8 h.p. totally enclosed motor 400/440/3/50. Discharging to **PORTABLE INCLINED FLAT BELT CONVEYOR** by Audley Engineering, 22 ft. centres with 18 in. wide balata belt. Thence to **STAINLESS STEEL TWIN-SCREW COMPLECTOR,** working temp. 44.5°F., driven by 40 h.p. motor 400/440/3/50, with 2 h.p. vacuum pump.

1-TON CAPACITY CHILLING UNIT by Johnson, comprising M.S. **CHILLING MACHINE,** drum 4 ft. 7 in. face by 2 ft. 10 in. diam., driven by 6 h.p. Brook motor 400/3/50. Discharging to **PORTABLE INCLINED FLAT BELT CONVEYOR** by Audley Engineering. 22 ft. centres with 18 in. wide balata belt. Thence to **STAINLESS STEEL COMPLECTOR,** details as for 2-ton plant.

MOTOR-DRIVEN STAINLESS STEEL EMULSIFYING PUMP by Hardaker, suitable for 1-ton chilling plant.

BULK PACKING MACHINE by Hardaker, fitted two cradles and wire cutting for 28 lb. and 56 lb. blocks, driven by 6 h.p. motor, 400/440/3/50.

WRAPPING MACHINE by Benhill. Model 27, ½ lb. capacity, speed 60 per minute.

6 JACKETED OPEN-TOP RECTANGULAR VATS by Harburger, 30 cwt. capacity, M.S. construction. 5 ft. 8 in. long by 3 ft. 7 in. wide and 3 ft. 2 in. deep, with side bottom 2 in. i.d. outlet, jacket suitable water and steam.

2 M.S. OPEN-TOP CYLINDRICAL DISHED BOTTOM PANS, 5 ft. diam. by 4 ft. deep, with 2 in. centre bottom outlet, and fitted split-hinged lid.

2 STAINLESS STEEL AGITATED MIXERS OR AGEING VATS by Cherry Burrell. Model P. No. 124, approx. 3 ft. 8 in. diam. by 3 ft. 8 in. deep, vertical propeller agitator supported from bridge across top. Vat insulated and fitted bottom side outlet.

JACKETED TEMPERING KETTLE OR MIXER, approx. 4 ft. by 4 ft. 2 in. deep, 1-ton capacity, riveted M.S. construction, fitted overdriven gate-type agitator driven from fast and loose pulleys. Side bottom outlet 2 in. i.d.

6 PORTABLE ALUMINIUM ALLOY OPEN-TOP TANKS, approx. 7 ft. 9 in. long by 4 ft. 5 in. wide by 2 ft. 7⅛ in. deep, flanged top and fitted bottom and outlet 2 in. i.d. Vessel mounted on two iron castors with end castor pivot.

6 PORTABLE ALUMINIUM ALLOY TOP TANKS, approx. 7 ft. 9 in. long by 4 ft. 5 in. wide by 1 ft. 9½in. deep. flanged top and fitted bottom end outlet 2 in. i.d. Vessel mounted on two iron castors with end castor pivot.

COMPLETE REFRIGERATING PLANT by Sterne, comprising Model 3U 4¾, 3-cylinder ammonia compressor, Vee-rope driven by 35 h.p. Brook slipring motor, 400/440/3/50, with Erskine Heap oil-immersed stator rotor starter, shell and tube condenser, ammonia receiver, etc.

COMPLETE REFRIGERATING PLANT by Sterne, comprising Model 3W 7¼, 3-cylinder ammonia compressor, Vee-rope driven by 70 h.p. Crompton Parkinson slipring motor 400/440/3/50, with Allen West oil-immersed starter, induced draught condenser, receiver, etc.

GAS-FIRED BOILER by Controlled Flame Boilers Ltd., type 6/H/S, No. 9688, tested 210 lb./sq. in.

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

PHONE 98 STAINES

42 in. Hydro 400/3/50 Underdriven (Lift out basket) (New) S.S. Jac. Pans 30 in. by 36 in. 40 w.p. (Two) (3) 2,000 gall. Cyl. Enc. Acid Tanks 35 w.p. S.S. Lined Autoclaves 6 ft. by 3 ft. 100 w.p. 26,500 gall. Sec. Cyl. Enc. Tanks 23 ft. 4 in. by 10 ft. deep. 'Z' & Fin Blade Mixers, Pans, Pumps, Condensors, Calorifiers, Refiners, Disintegrators etc. Complete lists available.

HARRY H. GARDAM & CO. LTD., STAINES.

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600

Triple Steel Roll **INCLINED MILL** by Buhler, 31½ in. by 13¾ in. diam. Water cooled rolls, bottom roll off set. Feed hopper and 3 in. diam. spiral cutter.

Horiz. Vacuum Drier, 15 ft. 9 in. by 36 in. diam., ½ in. steel plate constr., with glanded steam tube and agitator gear pulley driven. Drier has two 12 in. by 8 in. outlets.

10 cwt. Rotary batch type Drum Blender, by Sturtevant 60 in. diam. by 32 in., fitted int. lifting flights. Motorised 400/3/50, through spur gearing and countershaft. Drum speed approx. 18 r.p.m.

48 in. Underdriven Hydro Extractor by Broadbent. M.S. galvd. basket 48 in. diam. by 18 in. deep. Motorised 400/3/50. Three point suspension. Spring counterbalanced cover and safety interlock.

Steam jacketed **FILTER PRESS** by S. H. Johnson, with 20 recessed C.I. plates forming cakes 22 in. sq. by ½ in. Hand closing. Fitted two galvd. drip troughs, discharge trough and under base trough.

NEW STAINLESS STEEL STORAGE TANKS AND VESSELS, with capacities ranging from 8 gallons to 1,000 gallons.

NEW PORCELAIN AND SILEX LINED BALL MILLS, with capacities ranging from 9 gallons to 260 gallons.

GEORGE COHEN SONS & CO. LTD.,
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STORAGE VESSELS
ALL WELDED
CYLINDRICAL

Three 14 ft. by 8 ft. diam.
Two 21 ft. by 6 ft. diam.
One 22 ft. by 5 ft. 6 in. diam.
One 16 ft. by 4 ft. 9 in. diam.
One 16 ft. by 7 ft. diam.
Two 12 ft. by 4 ft. diam.
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RECTANGULAR
Three 12/15 ft. by 6 ft. by 3/5 ft.

MADEN & McKEE LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.

STAINLESS VAT, 200 gallons, with Revolving (Tinned) Coil.

STAINLESS "Z" MIXER, 29 in. by 27 in. by 22 in. with Trough Outlets.

PEERLESS 80 qt. 4-speed Electric Cake Mixer.

ALITE SIFTER-MIXER, 500 lbs. capacity.

HORIZONTAL RIBBON BLENDER, 8 cu. ft. Gas Heated.

MORTON No. 3 Duplex "Z" Mixer.

WINKWORTH MACHINERY LTD., 65 High Street, Staines. Telephone 1010.

FOR SALE
3 All-Welded 14 ft. by 8 ft. diam.
Working Pressure 65 lb.
Several from 15-22 ft. by 4 ft. 6 in./6 ft. dia.
Working Pressure 30 lb.
2—27 ft. by 6 ft. diam. 365 lb.
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