Chemical Age

BRADFORD POLYMERS SYMPOSIUM

(page 325)

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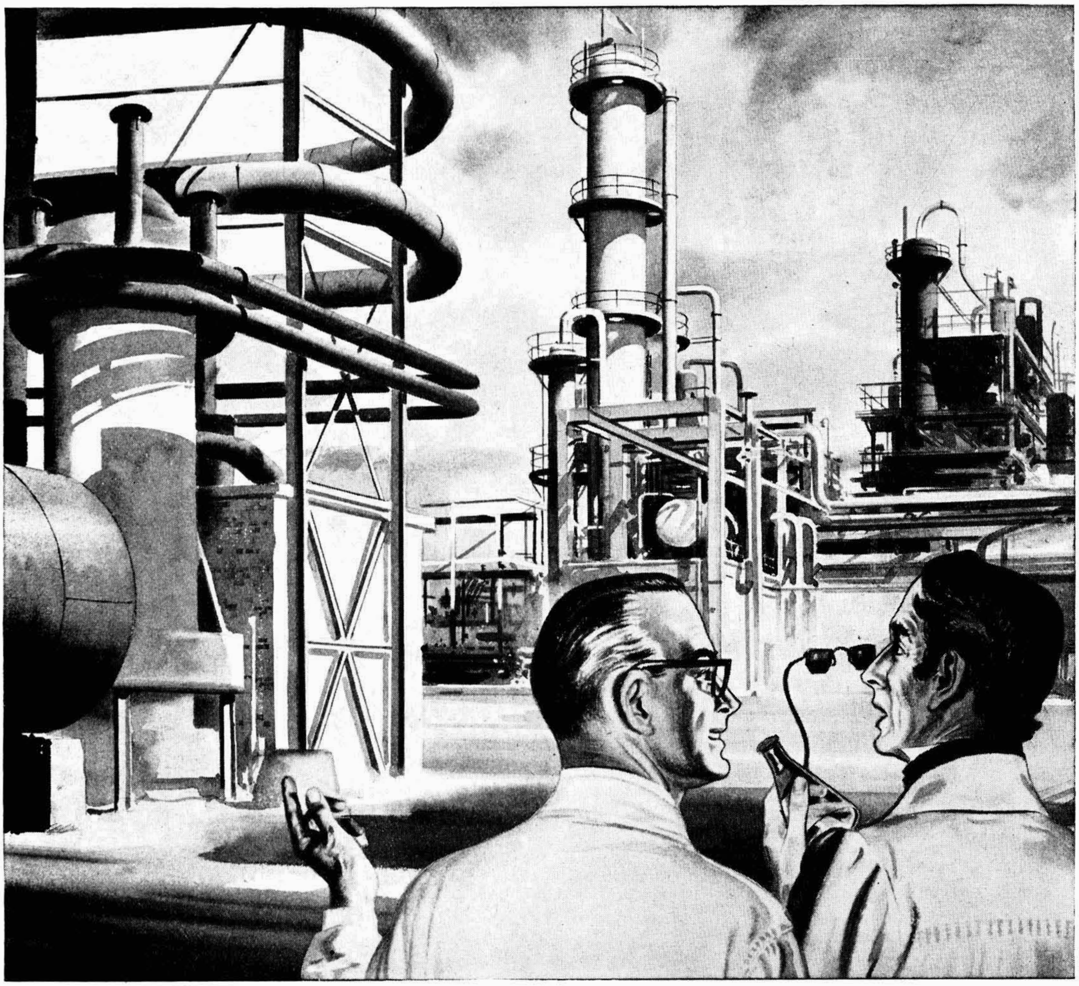

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The first figures refer to advertisement in **Chemical Age Year Book**, *the second to the current issue*

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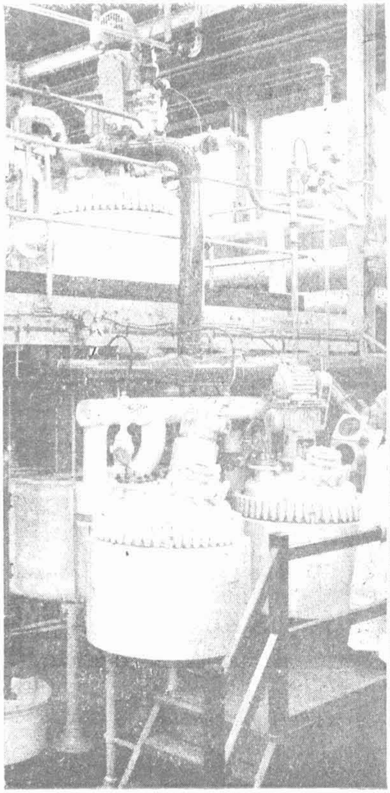

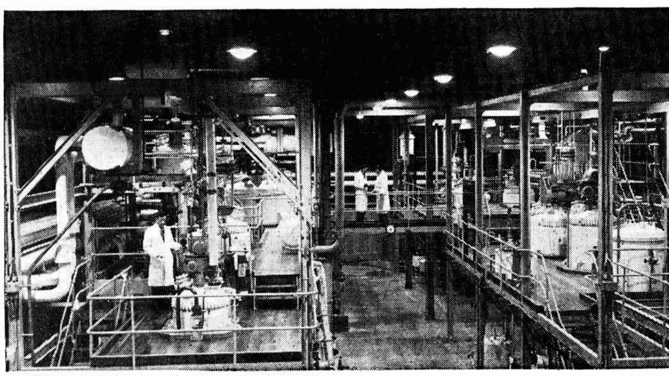

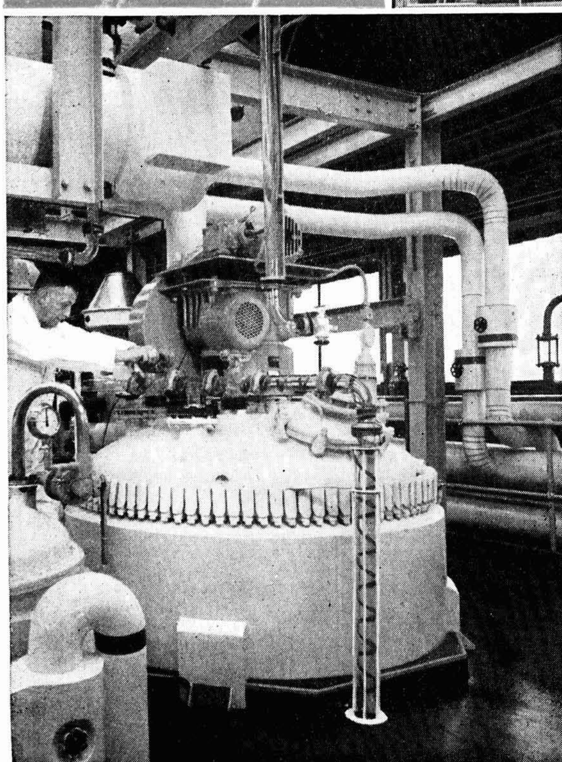

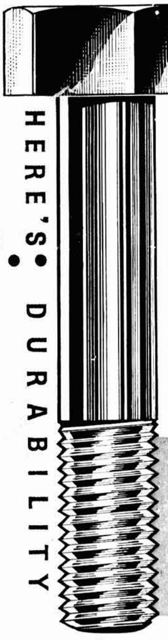

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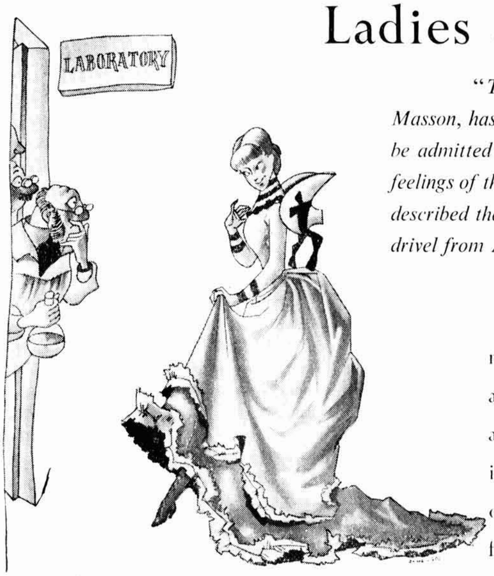

Ladies are to be admitted

"The 'Female Physicians' question, thanks to Professor Masson, has made a great stride during the past week. Ladies are to be admitted to study Medicine at Edinburgh University. Imagine the feelings of the non-contents when Professor Masson, in a final outburst, described their argumentation as 'rampageous mysticism, dashed with drivel from Anacreon!" (*Nature, 1869, 1, i, 25*)

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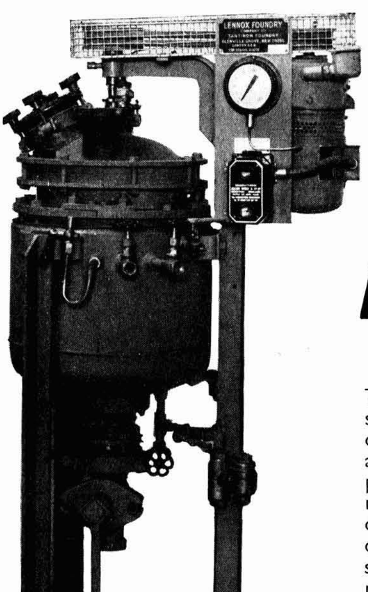

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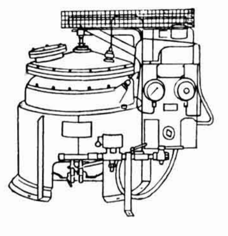

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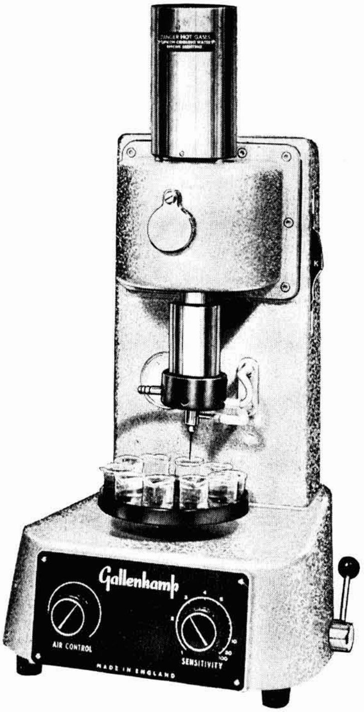

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IN THIS ISSUE

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FREE TRADE

THERE can be little doubt in the minds of British chemical manufacturers that it would be fatal to their export trade if Britain were to remain outside any European free trade area. The vast European market—for many chemical producers their most remunerative overseas market—would be lost to West German, Italian, French and Dutch interests with Britain shut off by high tariff walls if that were to happen.

But there is more to a free trade area than the rather negative advantage of taking part because the UK is afraid to stay out. A common market in Europe would open vast new export opportunities for the British chemical industry, while not impairing its markets elsewhere in the world. It is likely, however, that the US industry, finding itself cut off from Europe, would intensify its competition in other world chemical markets.

In the past few days three prominent chemical figures—two British and one German—have expressed themselves on the free trade project. First, Professor Balke (see page 323) has supported the view that economic integration must be complete with full British participation. Mr. Bernard Hickson, in his annual report as chairman of Hickson and Welch (see page 324), favours the idea of a common market and accepts the challenge which an unprotected home market would offer. He also sees that this development would stimulate increased efficiency and greater productivity.

The most forthright view came in the BBC TV programme Panorama this week from Mr. S. P. Chambers, an ICI deputy chairman (see page 324). He declared it to be absolutely essential that the British chemical industry should be associated with the common market.

In the industry the majority view appears to be to welcome a free trade area, given adequate safeguards. We believe that, while some safeguards, particularly against dumping and subsidies are vital, it would be a mistake to over-emphasise their importance and run the danger of rendering the advantages of free trade void. There is so much to be gained from a common market in chemicals that it would be a calamity to lose the substance of free trade for the sake of the protectionist shadow.

The outlook for a European free trade area has changed completely since our Parliamentary correspondent referred to the subject in CHEMICAL AGE, 9 February, page 257. This change is due largely to the vigorous lead taken by the UK Government. The recently published White Paper (Cmd 72) did much to remove Continental suspicions as to our intentions. The liberal attitude of the Government—agricultural products excepted—has in fact surprised many political and industrial leaders at home and abroad.

As envisaged, the free trade area based on OEEC participation, would be large enough to rival the vast markets dominated by the US and the Soviet bloc. Mr. Peter Thorneycroft, Chancellor of the Exchequer, as OEEC chairman has the task of co-ordinating the three working groups that have been set up to negotiate a draft convention by July.

LINEAR POLYMER SYMPOSIUM

THIS ISSUE contains on page 325 a report of the annual symposium organised by Bradford Chemical Society in conjunction with the Department of Chemistry and Dyeing, Technical College, Bradford, and the Yorkshire Council for Further Education. This year the subject was 'Recent Developments in the Chemistry of Fibrous Linear Polymers.'

It will be noted that the lecturers at this symposium were from university, technical college, research association and an industrial research laboratory. The papers presented, while dealing with recent research developments and various theoretical considerations of fibrous linear polymer progress, in no way lost sight of the practical aspects and significance of the subject.

Thus, the industrial fibre chemist, Mr. I. Goodman, looking to the future, stressed that recent developments in synthetic fibre chemistry had severed dependence on the hydrogen bond and aromatic ring, expanding greatly the sphere open to thought and experiment. Undoubtedly, the advances in the structural theory of known polymer types with regard to block and graft copolymers, structural isomorphism and the recent stereo specificity, will assist the 'formation from available materials of a multiplicity of products of differing properties.' It is easily apparent that investigations today are all designed to lead to synthesis of fibres having any desired combination of properties.

The title of Dr. Moore's lecture, 'The Interaction of Fibrous Synthetic Polar Polymers and Liquids,' might well be considered, at first glance, to be unrelated to very practical aspects of polymer chemistry, but as he pointed out, many processes concerned in the manufacture of a fibrous synthetic polymer or which follow it necessitate treatment of the polymer with liquid, that is, for spinning, molecular weight determination, swelling or plasticising, dyeing and finishing.

Similarly, investigations on swelling and solution properties of natural fibres, particularly protein fibres, as discussed by Dr. Howitt and Mr. G. King, must also arouse interest for their relationship to dyeing, xanthation, weighting etc., and for their significance in development of synthetic fibres akin to wool etc.

Can there be read into the symposium at Bradford, heart of Britain's wool industry, a marked importance and future significance of fibrous linear polymer chemistry to this area? Casual observance of stores in Bradford will indicate that ranged alongside woollen materials are rayons, and varied nylons and Terylene materials.

Obviously, great care must be exercised in the development of new synthetic fibres. The oldest synthetic fibres, rayon and acetate, are now meeting with hard times and according to a US source, prices of these two synthetics barely support a commercial return on investments. Producers of synthetic fibres must therefore give careful consideration to developments for only the unique product with particularly desirable properties will succeed in getting established. Fortunately, it would seem that the research investigators in and around Bradford are working carefully and thoughtfully in order to obtain the clearest possible picture of linear fibrous polymer development.

NEW METHODS BRING CHEAPER TITANIUM

SUBSTANTIAL reductions in ICI prices of products made from titanium were reported last week. Wrought titanium and titanium alloy products have now been reduced by 10 per cent.

Increasing production efficiency is a major factor contributing to the price reductions. Another factor is that ICI's prices for raw titanium metal have also been reduced steadily throughout the past year. In fact, the company's new market price of 19s 6d per lb. is stated to be the lowest published price in the world.

At the end of 1956 the US price for titanium sponge was quoted at \$2.75. Typical mill products were priced at \$13.00 per lb. for sheet, \$11 per lb. for rod and \$9.00 per lb. for billet.

News from the US, however, suggests that high-quality titanium at a cost of less than \$1 per lb. is anticipated from a fused-salt electro-refining process about to be tried in a 10,000 to 20,000-amp., semicommercial cell now being installed at the Bureau of Mines' Boulder City station.

It is claimed that the process, by using cheaper raw materials than present chemical reduction processes and being adaptable to continuous operation, promises to cut refining costs. The process will also reduce refining costs of other metals. In fact, the Bureau has under way a \$110,000 research project to adapt electro-refining to recover zirconium from impure sponge metal, mill scrap and zirconium alloys. This work is being undertaken for the US Atomic Energy Commission.

In the new process, a 5 per cent divalent titanium complex (12.4 per cent Ti Cl_2) is used in fused sodium chloride as the electrolyte. The mix is produced by passing finely divided molten sodium droplets through $TiCl_4$ at 1,200° F in a tower reactor, and is essentially the first stage of the Bureau's two-stage reduction process first described in March of last year.

Almost any mixture of titanium-bearing metals can serve as the cell anode. The cathode is mild iron having an area one-fourth to one-half that of the anode. The operation is carried out under a helium atmosphere at 1,560° F. Titanium is produced as coarse granular crystals, which can be readily melted into ingots.

According to Dr. J. Taylor, an ICI director, about £10 million has been invested in the titanium industry in the UK. He reports that despite reductions in defence expenditure (titanium is widely used in modern aircraft manufacture), it is estimated that by 1960, UK new titanium requirements will be of the order of 2,000 to 3,000 tons a year. This does not take into account, however, the improved yields obtained in fabricating operations and the employment of titanium obtained from scrap.

CARBIDE IN ULSTER

PROBLEMS of production costs are raised by the decision of Carbide Industries Ltd., a British Oxygen Co. subsidiary, to set up a carbide and acetylene plant in Northern Ireland adjacent to the proposed Du Pont neoprene plant (see CHEMICAL AGE, 9 February, p. 241).

Determining factor in the cost of manufacture of carbide is normally thought to be the price of electricity and it would appear at first sight that it would be cheaper to import carbide from British Oxygen's Norwegian associate Odda Smelterverk. Hydroelectric power, which is comparatively cheap, is available in Norway, whereas Northern Ireland has to rely on coal powered generating stations using coal imported from Great Britain.

British Oxygen's answer is that with the high cost of freight the price of electricity is not a dominant feature.

(Continued in page 323)

West German Chemical Industry Finds Exports More Risky

GERMAN chemical manufacturers expect the upward trend of production and exports to continue this year at the rate of last year which was somewhat slower than in preceding years. It is pointed out that while total chemical sales in 1956 increased by 10 per cent only compared with 12-14 per cent by value, in the three preceding years, prices were slightly lower—by two per cent, according to the experience of one of the leading companies—so that in fact the volume increase was not slowed down. Moreover, the new plant commissioned in 1956 has hardly yet made any substantial contribution to output and should, with older plant still being used to full capacity, bring considerable relief.

As wages and other producing costs, however, are tending upward, leading producers agree that special efforts will be needed to counteract the narrowing of profit margins by increased mechanisation of production and development of new products which, at least at first, find more profitable markets.

Exports More Difficult

This holds good especially for exports which Professor Winnacker, of Farbwerke Hoechst AG, says are becoming increasingly difficult and risky. Nowhere, he said at a recent press conference, was world market competition keener than in the chemical sector; though prices obtainable in foreign markets were deteriorating constantly, exports were essential because of their big share in total sales, the more so as domestic prices would have to be raised considerably if exports did not remain at an adequate level.

Leading exporters, including Farbwerke Hoechst, suffered a contraction of their sales in some important overseas markets such as India and China.

The progress of the common market project is being welcomed by the German chemical industry, but it is pointed out that the economic integration so far achieved is not wholly satisfactory. 'Now that the British attitude to European issues has changed,' argues Professor Balke in *Die Chemische Industrie* (January, 1957, **9**, 11), 'we should pursue an economic policy which meets British wishes at least as much as French wishes.

'Seen thus, the economic integration in Europe is to be welcomed as a short-term objective even though it does not finally solve all common tasks. All partial forms of integration however must still be categorically rejected, and we must help to supplement incomplete European organisations by British participation.'

The German chemical industry, he adds, could not in the long run feel at ease in the narrow confines of a community of six States.

Farbwerke Hoechst, one of the three big IG Farben successors, reports total sales of DM1,481 million for 1956, an increase by 16.6 per cent over 1955. Exports contributed 30.2 per cent, an insignificant change compared with the preceding year. Capital expenditure at DM 240 million was almost unchanged. Since 1952 close on DM 800 million has been invested in new and modernised plant while the labour force rose by over 50 per cent to nearly 40,000. Research expenditure last year amounted to DM 81 million, equal to 5.4 per cent of total sales. Half the 1,550 members of the staff with university or equivalent training are engaged on research.

The increase in the labour force by just under 10 per cent last year compares with a rise in the outlay on wages and salaries by 20 per cent; and the working time has been reduced by three to 45 hours a week. Professor Winnacker claimed that wages were quite as high as the company could afford to pay; more was now taken out through higher wages and shorter working hours than was added by rationalisation and modernisation.

The output of coal derivatives showed a comparatively modest increase in 1956. The production of coal-tar rose to 1,904,000 metric tons, i.e., by 5.0 per cent, crude benzole to 545,000 tons, by 7.1 per cent, and ammonium sulphate to 505,800 tons, by 4.0 per cent. A number of new installations were put into operation, including two continuous tar distillation plants with a monthly output of 12,000 and 6,000 tons, two benzole pressure refining units, a phthalic anhydride plant with an initial capacity of 6,000 tons a year which Gelsenkirchener Bergwerks AG erected at Bochum in conjunction with Badische Anilin- und Sodafabrik AG, and extensions to the synthetic phenol plant of Phenolchemie GmbH which has now a capacity of 16,000 tons a year, to the alkyl benzole plant of Rheinpreussen AG, and the phthalic anhydrid and maleic anhydrid units of Ruhröl.

Most coal-tar products were disposed of without difficulty. An exception was naphthalene of which larger stocks accumulated owing to reduced demands from the US. Some of these plants have been designed for the use of both coal derivatives and oil refinery products. Thus the alkyl benzole plant of Rheinpreussen AG uses both coke-oven benzole and propylene from oil refineries. This company is also using phenol and phthalic acid derived from coal and ketones from its own petroleum chemicals plant for the production of plastics.

The former hydrogenation and Fischer-Tropsch synthesis plants increased their throughput of crude petroleum further last year but had to cut back after the Suez interruption of normal supplies. One of them, Scholven-Chemie AG, has just announced plans to extend its plant capacity from 750,000 to 2,000,000 tons throughout a year at a cost of about DM 100 million.

Degussa, Frankfurt, reports for 1956 that the work on exceedingly pure metals as needed for nuclear reactors was continued on an intensive scale. The company expects to be entrusted with supplying uranium for the reactor to be erected at Karlsruhe and has installed several new technical units for research and development in this field which, it is claimed, will enable the company to pursue new paths in research.

Record Output and Exports of UK Plastics in 1956

THE British plastics industry had another record production and export year in 1956, it is announced by the British Plastics Federation. Output, which has been more than doubled since 1950, reached about 335,000 tons, an increase of more than 10,000 tons compared with the 1955 total of 324,000 tons. The increase is at a slightly reduced rate compared with 1955, output for 1954 having been 274,000 tons.

Thermoplastics materials including p.v.c. polythene and polystyrene, were again responsible for more than 50 per cent of the output. Expansions now in progress are expected to result in still higher production capacity for various plastics this year and subsequently.

Exports of plastics materials alone in 1956 amounted to nearly 98,000 tons, valued at over £26 million, a rise of nearly 13,000 tons, valued at over £3 million, compared with the 1955 figures, the previous highest. The increase in exports is at a slightly higher rate than in 1955 (1954 exports, over 73,000 tons, value £20½ million).

CARBIDE IN ULSTER

(continued from facing page)

The capital investment to set up additional hydroelectric power capacity in Norway would be considerable. Local limestone will be used, some of which can be recycled, thus giving further economies. Coke, however, will come from Great Britain.

There is the further point that the Northern Ireland Government, under its policy of encouraging industrial development, may be willing to subsidise the supply of electrical power to enterprises of this nature. Besides providing employment and bringing money into the country there is the possibility that any excess of acetylene will be used to reinforce supplies to local industry.

One question is still unanswered: Why has British Oxygen not found it profitable to produce carbide in this country? It would appear that if the process is economic in Northern Ireland it would be even more so in Great Britain.

Correspondence

DR. PHILLIPS QUERIES FIGURES ON TOXICITY OF FLUOROACETATES

SIR, In Mr. P. Cooper's very interesting article, Toxic Hazards in Industry, (CHEMICAL AGE, 1957, 9 February, page 247), it is stated that fluoroacetates are very toxic to man and that a dose of 50 mg. can cause death within five hours.

We find it a little difficult to follow Mr. Cooper here; 50 mg. for a man of 140 lb. weight is rather less than 0.1 mg./kilo, and since no experiments have ever been performed to determine the toxicity to man, this must be guesswork. In fact, The LD 50 of sodium fluoroacetate to rats is between 1 and 3 mg./kilo, (Phillips and Worden, unpub.), for monkeys about 15 mg./K and man is stated to be less sensitive to sodium fluoroacetate than other mammals (A. E. Adrian took a dose sufficient to produce a urine toxic to guinea pigs and was himself unharmed—'It seems that man also is relatively insensitive' (Peters, *Endeavour*, July 1954, page 152).

By extrapolation, we would think that the LD 50 for man might be between 25 and 50 mg/kilo., that is between 1.5 and 3 g. for a 10 stone man.

It is also important to differentiate between fluoroacetates and fluoroacetamide; the latter is not a fluoroacetate by which is implied esters and salts of fluoroacetic acid itself; fluoroacetamide has an LD 50 for laboratory white rats of 15 mg./kilo. (Worden and Phillips, *Lancet*, 6 October 1956, page 731) and so is about 1/7 to 1/10 less toxic than sodium fluoroacetate. Moreover, the action of fluoroacetamide is milder than that of fluoroacetates and is indeed so slow that it is possible to administer an antidote, acetamide or 1-cysteine, within 30-60 minutes of a lethal dose being administered. The toxicity of fluoroacetamide is the subject of a forthcoming publication by the above named authors.

It might also be of interest to record here that calcium and barium fluoroacetates have been prepared and have proved to be powerful rodenticides, considerably more toxic and rapid acting than sodium fluoroacetate.

Yours etc.

M. A. PHILLIPS,
Chief Chemist.

Associated Fumigators Ltd.,
London E16.

Mr. Cooper Replies

SIR, I am very interested in the additional information given by Dr. M. A. Phillips, on the human (estimated) toxicity of fluoroacetic acid and its derivatives. The literature I have been able to consult offers no clear guide. Thus, Kaye (*Emergency Toxicology*, 1954) gives the (estimated) MLD of the sodium salt as 50 mg., and states that 'death may occur within 5 hours.' Thienes and Haley (*Clinical Toxicology*, 3rd edition 1955) are vaguer, stating that the toxic dose is 'said to be 7 milligrams and the fatal dose 70 milligrams.' Spector (*Handbook of Toxicology*, Vol. I, 1956) quotes a wide range of animal species and an equally wide range of oral LD 50 doses. It seems that different species of mouse vary from an oral LD 50 of 0.5 mg/kg. to 17 mg/kg. of fluoroacetate. The corresponding dose for horses is 1 mg/kg. and for sheep 2 mg/kg., while dogs succumb to 0.066 mg/kg.

Such an array of data is not helpful, though it serves to demonstrate the extreme species variation in fluoroacetate toxicity. However, fluoroacetates act both as myocardial depressants and as central nervous stimulants, and it seems probable to me that their toxicity depends upon the preponderance of one or other of these principal toxic effects in any animal treated with them. The effect on the myocardium would produce rapid death by cardiac arrhythmia, and might presumably depend for its magnitude upon the individual human victim; cardiac toxins are notoriously variable in effect in human cases.

On the other hand, central stimulation would cause epileptiform convulsions which might or might not be fatal. The only detail of human poisoning I have found is quoted by von Oettingen (*Poisoning*, 1954). A child of two years swallowed 'a few crystals' of fluoroacetate (sodium), which produced persistent vomiting, convulsions, stupor and coma. Despite otherwise effective therapy, the convulsions persisted for several days. Full motor functions were recovered after the fifth to sixth day.

It is worth mentioning here that the MLD, quoted in toxicological works written from the clinical angle, although not so scientific a datum as the LD_{50}, is probably of more use to the clinician, who is dealing with an individual and wishes to make some sort of prognosis regarding the chances of recovery.

PETER COOPER

Southmead Hospital,
Bristol.

Corrosion Problems and DSIR Group

SIR, Our attention has been drawn to what is presumably an inadvertant omission from your leading article of last week. Your readers will no doubt be aware from your references to this laboratory in the past that the Corrosion of Metals Group of the DSIR Chemical Research Laboratory has been actively engaged for many years on both fundamental and applied investigations related to control and prevention of corrosion.

Yours etc.,

FRANK WORMWELL

Corrosion of Metals Group,
DSIR Chemical Research Laboratory.

'Association with Free Trade Area is Vital to UK Chemical Industry'

IT IS ABSOLUTELY essential that the British chemical industry should be associated with the common market. Europe is our best and largest single market. That view was expressed by Mr. S. P. Chambers a deputy chairman of ICI Ltd.

S. P. Chambers, an ICI deputy chairman, who gave his views on free trade in a TV interview

on the BBC TV programme Panorama on Monday this week. Qualified support for the common market project (the subject of our leading article) came from Mr. Bernard Hickson, chairman of Hickson and Welch (Holdings) Ltd., in his annual report to shareholders.

Mr. Chambers, taking part in a discussion on the UK Government's White Paper said: 'If we do not go in, we should be faced with our goods going in to Europe and paying high tariffs, while German goods, for example, paid no tariff at all. That would mean that much of our existing business would be lost.

'We must go in for if we are on the right side of the tariff barrier, then US competition in Europe, which is now one of the most important factors with which we have to deal, will be on the other side of that barrier—we shall be on the right side. We would rather be on even terms with the West German chemical industry by taking this step.

'On balance, I feel that Britain depends so much on exports to the rest of the world as well as to Europe, that even if some resources have to be transferred from industries not capable of dealing adequately with European competition, we should still have a sounder economy.'

Mr. Hickson in his annual statement, published this week, said that Hickson and Welch directors had considered the free trade proposals carefully. 'Provided certain safeguards are incorporated in any agreements made by the British Government . . . . we consider that such an arrangement would be to the ultimate benefit of the nation and that we ourselves could accept the challenge which an unprotected home market offers.

'We realise, however, that increased efficiency and greater productivity will be called for, but the opening of our home markets to European competition will be offset by the opportunity for us to sell our products in markets at present denied us by high tariffs, import licensing systems or complete prohibition.'

LINEAR POLYMER SYMPOSIUM

Bradford Lectures and Exhibitions Cover Recent Developments

LAST weekend (15 February to 16 February) the seventh annual symposium to be held in Bradford at the Technical College, this year dealt with 'Recent Developments in the Chemistry of Fibrous Linear Polymers.' This symposium was arranged by the Bradford Chemical Society in conjunction with the Department of Chemistry and Dyeing, Technical College, Bradford, and the Yorkshire Council for Further Education.

Lecturers at this symposium were: Mr. I. Goodman (Imperial Chemical Industries Ltd. Fibres Division), whose subject was 'Synthetic Fibre Forming Polymers: Some Novel Structures and Properties'; Professor F. S. Dainton, (Leeds University) who lectured on 'Addition Polymerisation: Mechanisms and Kinetics'; Dr. W. R. Moore (Technical College, Bradford), who dealt with 'The Interaction of Synthetic Fibre Forming Polymers with Liquids'; and Dr. F. O. Howitt and Mr. G. King (Wool Industries Research Association) who each read a paper on 'Swelling and Solution Properties of Natural Fibres.'

The chair at the lecture on the Friday evening (15 February) was taken by Dr. W. Cull Davies, chairman, Chemistry Advisory Committee, Yorkshire Council for Further Education, who also opened the Symposium on Saturday. The chair was taken in the morning by Dr. W. R. Moore and in the afternoon by Mr. J. W. Edge, president of the Bradford Chemical Society. Dr. R. L. Elliott, head of the Department of Chemistry, who was to have taken the chair at all the lectures on Saturday, was indisposed.

Two exhibitions were also held at the Bradford Technical College in conjunction with this symposium. The exhibition of chemical and physico-chemical apparatus and the exhibition devoted to fibres and fabrics were opened by Alderman Revis Barber, chairman of Bradford Education Committee on Friday, 15 February. Descriptions of both these exhibitions are included in this issue.

The papers read at the Symposium are reported below.

Synthetic Fibre Forming Polymers by Mr. I. Goodman

IN his paper Mr. Goodman reviewed some aspects of progress during the past decade in the field of synthetic fibre-forming polymers. He dealt in particular with some developments which are bound up with structure-properties relationships. Melting points of polymers were considered especially and some unsuspected relationships between melting points and chemical structure shown.

Three distinct phases in the history of synthetic fibre chemistry were referred to, namely, the prime exploratory steps combined with the growing new science of macro molecular chemistry which led to the discovery of polyhexamethylene adipamide (nylon-66), the first synthetic fibre-forming polymer of technical importance.

Further developments from the same body of fundamental principles and from the simultaneous growth in the vinyl polymer field, had led to production of the other synthetic fibrous substances now commercially available, notably, the polymers of hexamethylene adipamide, aminocaproic acid, ethylene terephthalate and acrylonitrile.

The third phase which had been in being for about a decade, had been the search for novel classes of fibre-forming polymers, i.e. polymers outside such series as the polyamides, polyesters and polyureas.

Mr. Goodman stressed that not all the desired properties, such as high strength (in wet and dry conditions), stability to heat and light, resistance to chemical attack, moths, mildews, abrasion and an element of dimensional stability—the property of pleat retention and wrinkle resistance, are met in equal degree in all synthetic fibres. Therefore, the performance of any new synthetic fibre must measure up to standard already regarded as normal and to gain widespread acceptance, show additional advantages over and above those enumerated above.

A foremost requirement in a fibre should be adequate melting point, and the lecturer considered that a melting point of 200°C represented the typical level below which the uses of a fibre would be considerably restricted. The significance of a polymer melting point was, however, more fundamental and consideration of crystallinity was the one requirement which most clearly differentiated fibres from non-fibre forming polymers.

A characteristic feature of fibre-forming macro molecules was the ability for the molecular chains of units to become aligned and for interchain attractive forces to come into play. The energy needed to break down such regular assemblies found a direct reflection in the melting points of the crystalline polymers. Determination of crystallite melting point, therefore, could provide some insight into the inter-molecular forces in a crystallite polymer and was, in fact a very important property.

Melting points of a large number of linear aliphatic polymers were summarised by the lecturer on a slide which clearly indicated how the replacement of methylene groups in a paraffin chain by such groups as the ester or the amide linkage may lower or increase the melting point. Side chain branching by alkyl groups tended to lower the melting point in a polymer series and in a homologous series, e.g. polyesters of a given diol or polycarboxamides of a given amine, an alteration in melting point between adjacent members such as is known in simple terminally bifunctional compounds could occur.

It was noted that all the aliphatic polyesters had melting points lower than that of polymethylene and this series provided a particularly dramatic one in which to show the effect of replacing an aliphatic chain by an an aromatic group..

Effect of p-phenylene link on polyester melting points

Polymer repeat units	*M.pt. (°C)*
$-O(CH_2)_2\ O.CO.(CH_2)_6\ CO-$	61
$-O(CH_2)_2\ O.CO\,C_6H_4\,CO-$	260
$-CO(CH_2)_4\ CO.O(CH_2)_6O-$	56
$-CO(CH_2)_4\ CO.O\,C_6H_4\,O-$	235

So far as polyesters were concerned this effect of elevation of melting point had been profound, bringing this class of condensation polymers into the realm of practical importance, evidenced by the case of polyethylene terephthalate (Terylene, Dacron).

An intermediate level of melting points was obtained with mixture of aliphatic and aromatic functions in the same molecular repeat units. In the aromatic polyester field introduction of groups not symmetrically substituted led to departure from linearity or maximum symmetry and had a deleterious effect on melting point.

It had been suggested that insertion of a p-phenylene group produced a 'chain stiffening' action, and that conjugation between the benzene ring and the carbonyl group in polyesters increased the polarity of the latter thereby enhancing the attraction between ester groups in adjacent chains or between ester groups and nearly aromatic rings. Mr. Goodman stated that while he believed these attractive forces might be present, he considered that their contribution to the cohesion of molecular chains could not be uniquely isolated and that the principal factor is a geometrical one. A recent development supporting this view was Batzer's work on crystalline, fibre-forming, polyesters prepared from non-aromatic components.

The lecturer referred to selection of the right isomers whereby polyesters may be obtained whose melting points are similar to those of the aromatic compounds.

Some aspects of co-polymer research, with special reference to condensation polymers, were then considered such as incorporation of second monomer components into polymers to improve dyeing behaviour.

Block copolymer and the somewhat related variant of the 'graft' copolymer, are considered to provide additional flexibility in the approach to new forms of organisation of matter. Synthesis of true block copolymers is stated to call for the availability of suitable starting polymers of relatively low molecular weight and with appropriately reactive end groups.

Melting Points

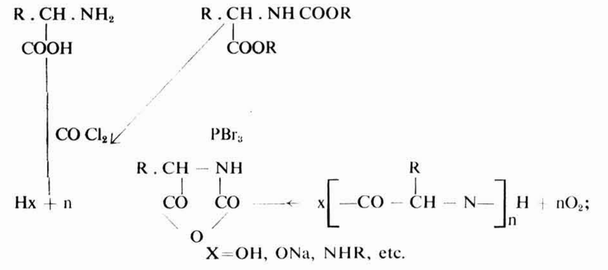
Reference was made by Mr. Goodman to melting point and random polymerisation. By progressive addition of the foreign component, the melting point is lowered until a minimum is reached. He stressed that melting point depression was, however, determined by the *molar* and not by the weight proportion of the disturbing species. Where this was of a high molecular weight a substantial proportion might be introduced without drastically lowering the melting point of the parent polymer.

In concluding his account of recent copolymer research, Mr. Goodman referred to an instance of anomalous melting behaviour in a random copolyamide system. Thus, when the melting points of a complete range of hexamethylene sebacamide/terephthalamide polymers were determined, the normal eutectic type curve was obtained, but in the hexamethylene adipamide/terephthalamide copolymer system, a continued rise from the melting point of the lower homopolymer to that of the higher occurred. This unusual behaviour had been ascribed to the closely similar molecular lengths of the terephthaloyl and extended adipoyl units which it had been suggested, might without difficulty replace one another in the crystal structure.

This did not occur with the sebacamide copolymers due to non-equivalence of the structural units concerned. The lecturer considered, however, that this concept of isomorphic replacement was weakened somewhat by the absence of similar effects in the terephthalate/adipate copolymer series.

Mr. Goodman referred to a topic of surpassing interest in the polymer industry, namely, thermal stability of polymers, for this was of great importance in the production of fibres from polymers by melt spinning, where sometimes the gap between melting point and the temperature at which serious decomposition occurs, was very small. It was, therefore, imperative to identify the effects of mis-processing in order to reduce or eliminate them.

Only recently had any light been thrown on the thermal degradation processes of nylon-66 and of polyethylene terephthalate. The complex pattern of nylon-66 thermal degradation had proved to be an instance of a general reaction of substituted adipamides. By and large, it was a synthetic reaction giving a product of increased molecular complexity which is irreversibly cross-linked and intractable.



Polypeptides from N-carboxy-amino acid anhydrides.

During the last two or three years it had been demonstrated that minor proportions of cyclic oligomers were present in several fibre-forming synthetic polymers. It was known, for instance, that nylon-6 contained oligamides up to the level of a cyclic tetramer, while from nylon-66 could be extracted the relatively simple monomeric hexamethylene adipamide as well as a cyclic dimer. The largest molecule of this class yet discovered as a polymer congener occurred in polyethylene terephthalate which contains about 1 per cent of a substance suggested to be a cyclic trimer of ethylene terephthalate.

Mr. Goodman stated that Imperial Chemical Industries Ltd., at Harrogate, have fully confirmed this structure for the compound, which was now known to be a strainless 30-membered macrocycle. The occurrence of such substance was of interest to polycondensation kineticists and exemplified the growth of knowledge relating to detailed chemical structure of commercially important synthetic fibres.

Future Discoveries

The prospect of future discoveries of industrial importance among the polyamide and polyester polymers might be considered small, although considerable efforts were still being devoted to this field. The lecturer reported, however, that this type of activity was beginning to be overshadowed by the study of quite novel types of polymer structure. The following were then described.

One development has been the revival of interest in the Leuch's reaction which gives synthetic polypeptides originally thought to have molecular weight of several millions.

It was now accepted, however, that polymers and copolymers so prepared have molecular weights in the range 10,000 to 100,000 rising to a maximum of 500,000.

Products of this class obtained in film and fibrous form showed, when stretched, X-ray diffraction patterns resembling those of α- and β-proteins. Mr. Goodman considered their study would undoubtedly continue to throw light on the fine detail of structure and behaviour of natural protein fibres, as had recently been done in the polypeptide synthesis described by Noguchi and Hayakawa.

The resulting poly (glycol-L-alanine) closely resembled in its X-ray and infrared characteristics the crystalline part of Bombyx mori silk fibroin.

Another approach to synthesis of fibre-forming polymers was met in the polyaminotriazoles of J. W. Fisher (*J. Appl. Chem.*, 1954, **4**, 212). Lower members of this series were water-soluble but practical importance was attached to poly(octamethylene aminotriazole), formed from sebacic acid, which can be melt spun to fibres which could be cold drawn and were readily dyeable. Mechanical properties were in the nylon-Terylene range but the polymer was sensitive to acidic conditions. This defect had been overcome in a novel class of polymers obtained by polymerising substituted oxetanes with catalysts of the Friedel-Crafts type. Polydichlormethyl oxetane, in particular, was crystalline and could be melt spun to tenacious fibres having considerable chemical and thermal stability.

The lecturer's last example of a novel polymer derived from the field of stereospecific vinyl polymerisation which has been investigated by Prof. Natta, of Italy. Stereospecificity conferred the ability to crystallise, raised the polymer melting point and lowered the solubility of the polymer.

Mr. Goodman said that he was confident that this latest development in polymer chemistry would provide much more information of special interest to synthetic fibre science. The existing picture would appear to indicate that there are now possibilities of synthesising a fibre having any desired combination of properties although it was not yet possible to make reliable predictions of the likely tensile strength of a new fibre. However, in due course, he felt that the combination of fundamental and applied science would provide this knowledge.

Trace Elements in Plant Nutrition

Professor T. Wallace, C.B.E., M.C., D.Sc., F.R.I.C., V.M.H., F.R.S., professor of horticultural chemistry, University of Bristol, and director, Long Ashton Research Station, will deliver the Fernhurst Lecture before the Royal Society of Arts, John Adam Street, Adelphi, London WC2, on Wednesday 6 March 1957 at 2.30 p.m.

Applications for tickets should be addressed to the secretary of the society.

Interaction of Fibrous Synthetic Polar Polymers and Liquids

IN his lecture Dr. Moore considered some of the general principles governing the interaction of liquids with fibrous polar synthetic polymers and the application of these to some specific cases including cellulose acetate.

Thermodynamic requirements for solution of any substance to occur were evaluated.

The requirements of solvents and swelling agents for fibrous synthetic polymers may be summarised thus: For solution to occur, attractive forces between polymer chains and between solvent molecules must not be too different from those between polymer and solvent. Where relatively non-polar polymers and liquids are involved with absorption of heat during mixing, a convenient measure of such forces was the Hildebrand solubility parameter. For relatively non-polar polymers, it has been found that liquids will act as solvents if their solubility parameters lie within the appropriate range p ± 1.5. If the solubility parameter of the liquid lies outside this range, i.e., δ_1, the liquid will only swell the polymer. If strong interchain forces occur in a polar fibrous polymer a solvent or swelling agent must generally be capable of solvating the polymer. If solution is to occur the liquid must have a solubility parameter not too different from that of solvated polymer.

The solubility parameter of the polymer, solvated or not, Dr. Moore considered an important factor in determining which liquids will dissolve or swell the polymer for knowledge of it might be useful in predicting and choosing suitable solvents.

Because of non-volatility of polymers, solubility parameters cannot be obtained from latent heats of vaporisation. Molar attraction constants, however, allow estimation of δp from the structural formular of the monomer and density of the polymer.

According to Dr. Moore the method works well for not very polar polymers but does not take the influence of polar groups sufficiently into account. In some cases δp has been estimated from small molecular weight substances of similar structure. δp may be taken as midpoint of the range or alternatively, the polymer may be cross-linked so that it will only swell. Swelling is found to be greatest in the liquid with solubility parameter closest to that of the polymer.

For a polymer of high δp, difficulty may be experienced, the lecturer stated, in finding readily available solvents or swelling agents. However, the solubility parameter may be reduced by the introduction of other groups such as methyl, if this does not introduce undesirable properties. Copolymerisation may also reduce δp.

One interesting consequence of the importance of solubility parameters in polymer-solvent interaction is that a mixture of two solvents may have greater solvent power than either used singly. It has been found also that if the two solvents

Dr. W. R. Moore, author of this paper

have values on either side of that of the polymer, that of the mixture will be closer to it and the mixture will be a better solvent.

TABLE I
Solubility Parameters of Polymers

Polymer	*Solubility Parameter*
Polyacrylonitrile	15.4
Nylon 66	13.6
Polyethylidene chloride	12.2
Secondary cellulose acetate	11.0
Polyethylene glycol terephthalate	10.7
Polymethylacrylonitrile	10.7
Vinyl acetate-acrylonitrile copolymer	10.5
Vinyl acetate-vinyl chloride copolymer	10.4
Polyvinyl chloride	9.7-9.9
Polyvinyl—acetate	9.1-9.4

Solubility Parameters of Liquids 25°

Diethyl ether	7.4	Dioxan	10.0
Hexane	7.4	Nitrobenzene	10.0
Carbon tetrachloride	8.6	Methyl formate	10.2
		Pyridine	10.4
Toluene	8.9	Aniline	10.8
Ethyl acetate	9.05	m-cresol	11.5
Methyl ethyl ketone	9.15	Acetontrile	11.9
Tetrahydrofuran	9.2	Dimethyl formamide	12.1
Chloroform	9.3	Nitromethane	12.6
Tetrachlorethane	8.4	Ethanol	ca13.0
Chlorbenzene	9.5	Acetic acid	13.1
Methyl acetate	9.55	Methanol	ca14.0
Acetone	9.75	Formic acid	ca14.0
Cyclohexanone	9.9		

Polyvinyl Acetate. Its weakly polar nature makes it soluble in solvents such as benzene, toluene, esters and ketones. Chloroform and tetrachlorethane, which are acidic, are good solvents because of solvation.

Polyvinyl Chloride. Because of an acidic H in the —CH_2CHCl group this polymer may be solvated by ketones and esters and those with solubility parameters between 8.6 and 11.0. Chlorinated hydrocarbons with δp between 9 and 10 are also good solvents.

Copolymer of Vinyl Acetate and Vinyl Chloride. Chlorinated hydrocarbons and nitro paraffins with δ values between 9 and 12.6 and basic liquids such as lower ketones and esters with solubility parameters greater than 9 solvate this copolymer because of its basic acetate and acidic groups. It also provides an example of a mixture of two non-solvents which together form a solvent mixture, i.e., diethyl ether (δ = 7.4) and acetonitrile (δ = 11.9). Dr. Moore considered that it might be significant that these are basic and acidic respectively.

Polyvinylidene Chloride (Saram). This polymer has strong interchain bonds and solubility parameter of 12.1. Heat may therefore be necessary to effect solution and it may be solvated by basic solvents such as dioxan and cyclohexanone or acidic solvents such as chloroform and tetrachloretnane.

Cellulose Acetate. In the form of the secondary acetate it possesses both basic and acid groups and is soluble in acidic liquids such as cresols and nitromethane. Chlorinated hydrocarbons and higher nitro paraffins solvate the polymer but do not dissolve it.

Polyacrylonitrile. Liquids with a high solubility parameter are required because the polymer has a high solubility parameter itself (15.4). In such liquids at relatively high temperatures, the polymer is soluble but on cooling separation or gel formation occurs. For solution at room temperature, solvation seems to be necessary and liquids of high δp are solvents.

Polyamides (e.g. Nylon). These have high solubility parameters. Interchain attraction, due to hydrogen bonding, is strong and solvation by liquids capable of forming hydrogen bonds or other dipolar bonds with the polymer seems a requirement for solution. Solvents include acids such as formic, phenols and cresols with δp of about 13 and these are believed to solvate the basic O of the CONH linkage.

It is of interest to note, Dr. Moore stated, that hydrogen bond breaking substances such as lithium and calcium chlorides in methanol are solvents, as also Lewis acids such as antimony and arsenic trichloride which are believed also to solvate the basic O of the polyamide. Titanium chloride—methanol and stannic chloride—methanol complexes also have very good solvent properties for nylon. Infra-red spectroscopy has shown that complex formation occurs involving the basic O atoms. Dr. Moore also reported that Germans have recently found that 70 per cent aqueous chloral hydrate is a good solvent for polyamides.

Polyethylene glycol terephthalate. This polymer has a δp of about 11 with a strong interchain attraction. If this attraction is overcome, possibly by heating, it is soluble in liquids of solubility parameter not too far removed from 11. Thus lower esters and ketones, nitrobenzene (δ = 10) and benzyl alcohol (δ = ca 11) and dioxan (δ = 10) are solvents. It is also soluble in phenols and in phenol-tetrachlorethane mixtures.

Dr. Moore concluded his lecture with an aspect of polymer-solvent interaction in which the choice of a suitable solvent might be important. Viscosities of polymer solutions, which could easily be measured, were useful in determining molecular weights, either as a guide to the degree of polymerisation or degradation. He defined a suitable equation for viscosity and showed how constants for a particular polymer and solvent at a particular temperature can be obtained. He listed values obtained for several fibrous polymers. Variations of viscosity with solvent might be important, he felt, in spinning from solution and illustrated the importance of the choice of suitable solvents and of principles underlying such a choice.

CHEMICAL AND PHYSICAL APPARATUS EXHIBITION AT BRADFORD

IN conjunction with the Symposium on 'Recent Developments in the Chemistry of Fibrous Linear Polymers' at Bradford Technical College, two exhibitions were held, one of chemical and physical apparatus, illustrating new techniques and developments, and the second exhibition of fibres and fabrics, showing new developments and uses of synthetic and other fibres.

Research Utilities Ltd. exhibited a range of interchangeable standard joint apparatus. This company also produces a special range of micro apparatus. The series is completely interchangeable, using only A7, B7 and B10 cones and sockets throughout. An acute angle of the sidearm on flaskheads and stillheads has been introduced to assist drainage. Also available is a thermometer which can be supplied in three ranges. It is a solid stem type filled with a B7 cone.

Electronic Instruments Ltd. were demonstrating their new and very advanced Model 24 automatic volumetric and coulometric titrimeter. Two input sockets are provided, so that while one titration is being performed another can be set up. A control unit on which the desired end-point is set features a large dial calibrated in *p*H units (3 to 11) and in millivolts (+400 to −800). This company will shortly be introducing an entirely automatic analyser about the size of two small telephone kiosks. It will first be seen at the forthcoming Physical Society Exhibition.

Sunvic Controls Ltd. had a display of Nullmatic apparatus and instruments which ensure accurate control of plant processes. A high speed potentiometric recorder was also in action and for the purpose of this exhibition was linked up with the EIL Titrimeter, which was being demonstrated by Electronic Instruments Ltd.

Nuclear Instrumentation

Sunvic Controls Ltd. are co-operating with A.E.I.-John Thompson Nuclear Energy Company in the design and supply of instrumentation for the first commercial nuclear power station.

Quickfit and Quartz Ltd. had a complete range of new intermediates for glass blowers on display. Also exhibited was a semimicro molecular still and a new type cold Soxhlet extractor.

Joyce Lobel and Co. Ltd. have introduced a double beam automatic recording microdensitometer, Mark II, which is very compact and takes up very little space.

H. J. Elliott Ltd. were exhibiting a new oil immersion bottle (see CHEMICAL AGE, February 1957), some new hydrometers, and a new rapid dispenser with adjustable automatic volume control. It delivers rapidly, automatically measured pre-selected volumes up to 40 ml. including intermediate decimal quantities. The polythene bottle has a 500 ml. capacity. The volume required is set by adjusting the top of the inner tube to carefully calibrated etched graduations.

Also of interest is the E-Mil Bee-Ka thermometer which has a reinforced bulb and is designed chiefly as a stirring thermometer for small beakers. This company now has available amber glass apparatus for light-sensitive liquids.

Reynolds and Branson Ltd. had several interesting instruments for use in the textile industry, such as the 'Wira' fibre fineness meter, a new flammability tester which complies with British Standard Specification BSS 476, and an ultra-violet lamp with Wood's filter for fluorescent tests on textiles.

Griffin and George Ltd. were demonstrating a mechanical shaker having four arms with clamps. The simultaneous rocking and shaking can be controlled as desired. Other exhibits by this company included laboratory ovens, stirrers, balances and a skeleton framework for setting up apparatus.

Baird and Tatlock Ltd. introduced a new model of a bomb calorimeter. Also on show was an electrolytic analyser for quantitative analysis and a micro-furnace for analytical work.

Ralph Cuthbert Ltd., suppliers of Monax (borosilicate) glassware, also exhibited.

Of particular interest was the Exelo safety pipette (manufactured by W. G. Flaig and Sons Ltd.). A greased glass barrel with a small aperture in the cap is fitted to the open tops of these pipettes. In operation, a finger is placed over the aperture and the barrel is raised, drawing liquid past graduation mark. The barrel is pushed back to original position, removing finger. The flow of liquid at graduation mark is arrested on replacing finger. To allow pipette to deliver in normal way, the finger is again removed. A micro size safety pipette is also available.

Cambridge Instrument Co. Ltd. exhibited a variety of instruments. Particular mention was being made of the Cambridge polarograph, a direct writing instrument of high stability for rapid analysis of solutions by the Heyrovsky dropping mercury electrode method. It offers quick analysis of various metals and minerals and is now being used for organic work. The polarograms produced are characterised by great legibility and, of course, have the additional advantage of being immediately available for examination.

Other instruments displayed by this company included a surface and interfacial tension apparatus, the Cambridge polarograph unit, the Model DE electronic recorder, a direct reading *p*H indicator and the Cambridge textile extensometer.

Exhibition of Fibres and Fabrics

EXHIBITORS at the Fibre and Fabric Exhibition organised by the Bradford Chemical Society in association with the Technical College Departments in Chemistry and Dyeing at Bradford College were Imperial Chemical Industries Ltd., Courtaulds Ltd., US Carbide and Carbon Ltd., Gemec Chemical Co., a division of Union Carbide Ltd., British Celanese and Clayton Dyestuffs Co. Ltd. The exhibition was opened by Alderman Revis Barber, chairman of the Bradford Education Committee.

Imperial Chemical Industries Ltd. showed various specimens of Terylene filament yarn and Terylene fabrics. Photographs were also displayed of Superfine fibre and fibre glass cloth woven from CF yarn was shown. Fibreglass white wool, tissue faced fine fibre and staple tissue were exhibited. Staple tissue is being used for corrosion protection of steel pipes and for waterproofing and anti-corrosion treatment of roofs.

Courtaulds Ltd. exhibited various specimens of yarns such as strong 'fibro' alone and combined with cotton, Seratelle, Duracol 'fibro'-wool yarns, Acetate Marlspun, Ribbonstraw and Tenasco Super 70. Alginate yarn and its uses and Courlene X3 were also displayed.

US Carbide and Carbon Ltd. had an interesting display of Dynel fibre and garments made of this synthetic. This fibre is resistant to acids and alkali. It is now being used as a blended pile fabric for imitation fur coatings—specimens of which were exhibited. In conjunction with this display a wide range of dyed hanks of Dynel yarn was exhibited by *Clayton Dyestuff and Co. Ltd.* to illustrate the many varied dyes available.

The Gemec Chemical Co. also showed fur pile fabrics and blankets composed of Dynel. This fibre is said to be the nearest approach to wool yet achieved.

British Celanese Ltd., had a display of the various grades of Celacol, and garments composed of Tri-cel, triester fabric. A display board showed photographs of various sections of a cracking plant and held specimen bottles of products produced linked in a flow diagram, e.g. propylene, acetone, cellulose, cellulose acetate spinning solutions and yarns, ethylene, acetic acid and acetic anhydride.

In another part of the exhibition a coloured diagrammatic scheme illustrated the qualitative relation between structure and properties of some of the principal plastics, such properties of some of the principal plastics, such as the amorphous glasslike, crystalline fibre-plastics, the irregularity and regularity of molecular structure of plastics, and rubber-like structures.

BRADFORD SYMPOSIUM

Summaries of papers presented at the Bradford symposium by Professor Dainton and Dr. F. O. Howitt and Mr. G. King have had to be held over owing to pressure on space. These will be published in our next issue.

Yugoslav Chemical Output More Than Doubled Since 1939

Big Increases in Inorganic Chemicals

YUGOSLAVIA's chemical industry is considered in that country's production plans as a basic industry for which the greatest efforts are to be made. However, plans made immediately after the last war have not been realised because of numerous difficulties such as lack of power and technicians, and transport difficulties.

A marked expansion of Yugoslavia's chemical industry has taken place in recent years and production is actually about 2.5 times greater than it was before the war.

It is noted from a Yugoslav source that nearly 250 new chemical enterprises have been set up since 1946, and in every case the smallest increase in Yugoslav chemical production since 1952 is 20 per cent superior to the general increase in industrial production. The most recent production indexes relating to chemical industry are as follows:

1954	75
1955	100
1956	121 (8 months)

Encouraging new perspectives are possible with the announcement during the previous year of exploitation of some 4.5 thousand million tons of lignite situated near Kosovo Polje. The project of extracting 2.5 million tons a year will allow the production of 500 million kilowatts, which should increase electricity production in Yugoslavia by one-third. Also, other easily exploited deposits have been located near Zagreb.

These discoveries have encouraged the Yugoslav authorities to study the vast project of chemical evaluation of its own natural resources.

Among the manufacturing sections the most important is the production of inorganic chemical products, which furnish so many basic materials in increasing quantities.

Sulphuric Acid

Sulphuric acid, produced in three plants of which the most important is the Zorka Hemiska Ind. de Sahoe, is destined almost exclusively for fertiliser production.

Sulphuric acid production, which was 14,000 tons in 1939 and 60,000 tons in 1954, was almost 75,000 tons in 1955, due to extensions at the Zorka works. In 1956, production realised up to September last was over 40 per cent up on the previous year. Total production for 1956 is expected to pass 100,000 tons. However, this output is insufficient because of an important loss in local production of fertiliser and the growing needs of other sections of industry.

At Kosovaka Mitrovica a new plant is to be erected for the production of superphosphate and will produce 120,000 tons of sulphuric acid annually. Another sulphuric acid plant is to be constructed at Bor, in connection with a new copper refinery. The pyrites roasting process will be employed.

Nitric acid manufacture began in 1954 at the nitrogen fixation plant at Gorzda with an output of 2,500 tons. In 1955, production had passed the 12,000 ton mark.

The alkali field also reflects the rapid expansion of Yugoslavia's inorganic chemical industry. Thus, the three producers, located at Jajce, Lukavac and at Kastel Sueural in 1955, produced about 36,000 tons of sodium carbonate and 28,000 tons of caustic soda. During the first nine months of 1956, production of these alkalis increased by 26 per cent and 54 per cent respectively.

With regard to phthalic anhydride production, the Teslic company commenced production with an output sufficient for local needs.

The calcium carbide industry, badly damaged during the war, has gradually increased production to satisfy the needs of the local industries (fertilisers, plastics, etc.) which now consume more than 30,000 tons annually, and for export. Production in 1954 was 39,700 tons and 44,000 tons in 1955. During the first five months of 1956, production reached 21,000 tons.

Fertiliser Expansion

Considerable expansion has taken place in the fertiliser industry following the efforts realised to increase the country's agricultural production. Fertiliser consumption, which was of the order of 46,000 tons before the war, has now increased from 108,000 tons in 1953 to reach about 585,000 tons in 1956. The Government estimates that production should reach 1.5 million tons as soon as possible, about three times actual consumption. Projects are hindered by insufficient local production, which, however, has shown rapid increase: 120,600 tons in 1954, 200,000 tons in 1955 and about 265,000 tons in 1956, if the results of the first three-quarters of 1956 are to be considered where the total increase is 31 per cent.

Various plans are being realised: at Pencevo a nitrogen fertiliser plant will be constructed having a capacity of 360,000 tons annually, while at Gorzda a new plant produced 12,000 tons of ammonium nitrate in 1955.

For phosphate fertilisers, the Yugoslav Government envisages construction of a superphosphate factory at Prahovo, and another factory will be erected at Kosovska in Serbia. The first plant will be of most importance and will eventually have a productive capacity of more than a million tons a year.

Another important section of production in Yugoslavia is that of ground barytes. A modern plant for the transformation of chemical and oleic barytes came into operation at the end of 1956 at Tarcin. Its capacity is estimated at just over 30,000 tons a year. The Tarcin mills will be capable of producing various qualities of ground barytes and an immediate effect has been noted in exports, which were more than 1,350 tons in 1955 to 5,360 tons during the first eight months of 1956.

In the plastics industry, it is of interest to note that p.v.c. prodution in powder form was increased by nine per cent during the first nine months of 1956. Estimated production for the whole year is put at almost 3,500 tons. Some 40 per cent of p.v.c. production is exported.

The soap industry, on the contrary, remains stationary, monthly production being 2,120 tons. Formerly an importer of soap, the country is exporting at the present time, principally to the Near East.

Pharmaceutical production in Yugoslavia in 1955 was valued at 9.5 thousand million dinars and imports were 800 thousand million dinars. A plant to transform opium alkaloids, the 'Alkaloid' at Skopije, has been developed near the important poppy plantations. In 1955, about seven tons of alkaloid salts were produced and it is hoped that in 1957 production will reach 10 tons a year.

There are two important rubber factories, that of 'Sava' at Kranj and the combine at Borova. Production of car tyres at these two plants is 78,000 units which is insufficient to meet the country's consumption. Annual imports of car tyres are valued at more than $20 million. However, a new factory for Pirot tyres will soon be available and the Tigar factory will be rebuilt in 1957 at a cost of 715 millions dinars to produce 118,000 tyres and 147,000 inner tubes annually.

The Tigar factory will also produce 750 tons of rubber articles and 2,150,000 pairs of rubber shoes each year.

Water Gas from Oil Plant Under Construction

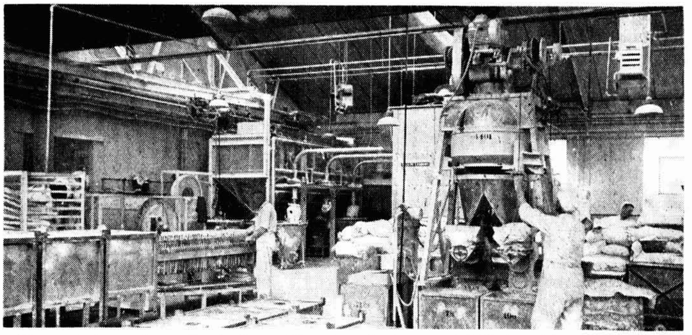
WATER GAS, to be used for the production of ammonia and nitric acid, will be made from oil in a £6 million plant now under construction at Shell Haven, Essex. To be operated by Shell Chemical Co. the new process was evolved by n.v de Bataafsche Petroleum Maatschappij cf the Royal Dutch Shell group, and can use any hydrocarbon ranging from gas to heavy fuel oil.

The first commercial unit in Europe is already operating successfully at Ijmuiden, near Haarlem, in the Netherlands.

Commissioning of the plant is expected to take place in August 1958 and it will use about 200 tons of raw material a day.

Ammonia produced will go direct to the fertiliser plants being built by Fisons Ltd. on the Thames Estuary. According to earlier reports (CHEMICAL AGE, 12 November 1955, page 1046) the Shell plant will have a capacity of 75,000 tons of ammonia annually, of which 60,000 tons will be used by Fisons and the remainder by Shell for the production of ammonium nitrate/limestone fertilisers for the UK market.

Nitric acid produced will be available commercially.



General view of mechanical handling installation at KLG Sparking Plugs Ltd., showing storage hoppers and micronisers (centre background), ball mills and filter press (left) and final mixing (right)

NEW HANDLING SYSTEM FOR KLG HIGH ALUMINA CERAMIC PLANT

KLG SPARKING PLUGS LTD. have introduced a new system of mechanical handling into its Treforest, South Wales, high alumina ceramic plant.

The process of manufacture involves milling or grinding in ball mills, filter pressing and subsequently granulating or otherwise preparing for fabrication.

Formerly production was carried out on plant which was designed for making another kind of ceramic. In the new process aluminium hydrate is fed directly from the delivery truck into a hopper of a vertical elevator which transfers it to overhead storage hoppers. All equipment is made of aluminium so that any contamination due to abrasion will be converted into aluminium oxide during calcination.

After calcination, which is carried out in a continuous tunnel kiln, the material is fed to micronisers and then to ball mills for a second milling operation.

Final mixing is done in an overhead batch mixer with self-feed and self empty. As a result of this mechanisation it is claimed that quality has been improved and the labour force reduced from 20 to six.

High Vacuum Cladding Process for Corrosion Resistance

VACUUM-BRAZED cladding is produced by a flux-free, high vacuum brazing process. Cladding materials which have been successfully brazed to low and medium carbon steel are stainless steels (chromium and chromium-nickel), nickel and high-nickel alloys e.g. Monel, Inconel and Hastelloy B and F.

According to an article on vacuum-brazed cladding in a recent issue of *Chemical Engineering* (January 1957, page 272), the most important advantage of this method is a uniform thickness of the cladding layer. Another advantage is claimed to be adaptability to the manufacture of most sizes or shapes of flat-clad plate that is easily made into tanks, pressure vessels etc. The surface finish is bright and free from contamination.

Tensile strengths of the finished plates obtained are within specified requirements for each particular cladding metal combination. High bond strengths with good ductility, formability, and corrosion resistance are obtained by control of bonding and heat treatment. Shear strengths of the vacuum-brazed plate depend on the metals joined together and range as high as 60,000 psi. with an average of 40,000 psi.

The combination of high interior vacuum and high temperatures during bonding are stated to cause breakdown of oxide films on the bonding surfaces of some types of metals, promoting the formation of strong uniform bonds. Oxidising gases evolved during this procedure are removed from the bonding interfaces due to the high vacuum conditions existing. Reoxidation of bonding surfaces apparently does not occur.

Vacuum cladding vessels in use in the petroleum industry are reported to have stood up to corrosion and service at temperatures up to 1,000°F for as long as five years or over. Chromium, chromium-nickel and monel claddings have been used in large reactors, 'crude' towers, fractionators, coking chambers, vacuum towers, atmospheric tower distillate drums, oily condensate drums etc.

In the chemical industry, fine silver-clad on chromium-nickel stainless steel vessels are used in urea manufacture as also Hastelloy B clad on carbon steel. This latter is also used in alkylator units.

For digesters, corrosion-resistant claddings are considered to permit the use of better processing methods, which involve higher temperatures, concentrations and pressures, without the high costs of solid alloy vessels.

In the US vacuum-bonded clad materials are being manufactured into various pressure and storage vessels and under development are new methods of cladding high-temperature metals such as titanium, zirconium, tantalum etc.

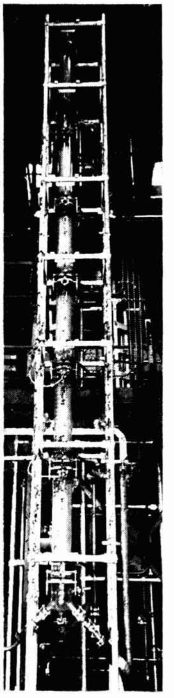
Plastic 'Blanket' Prevents Oil Losses

TO ELIMINATE LOSSES due to evaporation in oil storage tanks, a new type of 'floating plastic blanket' has been designed by an employee of British Petroleum's French associated company Société Française des Petroles BP.

The 'blanket' is described as a flexible carpet which floats on the oil by means of small floats on the under side, whatever the level in the storage tank. A vertical raised skirting round the edge forms an effective seal against the perimeter of the tank, and prevents vapours escaping.

Made of pure polyvinyl chloride sheet and completely impervious, the 'blanket' has already been fitted in a number of storage tanks at BP refineries in Europe.

ALL-GLASS RESEARCH PLANT



A plant made almost entirely of glass has been erected by the research works of Imperial Chemical Industries' Billingham division. Standing 25 ft. high, it will be used for work on one of the components of Terylene. Pyrex glass was chosen as the material of construction because of its heat and corrosion resistant properties. Control is largely by instruments and only one man per shift is required for supervision. Because of the nature of the work he need only enter the plant buiding once per shift

Titanium Corrosion-resistant Process

In a recently published British Patent (No. 762,199), R. Michel describes an improved process for depositing a corrosion-resistant and steam-resistant coating on a metal surface.

The process involves the electrolytic application of titanium and cadmium. The cleaned metal piece to be coated is immersed in a bath of titanium oxychloride and cadmium or cadmium salt. When treatment is completed, the metal piece is dipped in either a two per cent nitric acid solution for two seconds, or, alternatively, in a bath containing a chromic acid-based compound.

It is claimed that corrosion resistant sufficient to withstand more than 1,500 hours of exposure to brine mist is obtained with this process.

CORROSION PROBLEMS IN CHEMICAL FACTORIES—2

Non-Ferrous Metals as Protectives

By

F. R. Himsworth, Ph.D., B.Sc.,

and

J. G. Hines, Ph.D., M.A.

IN recent years improvements in fabrication techniques which may be applied to aluminium, together with increased availability of alloys which combine adequate strength and corrosion resistance, have led to the increasing use of aluminium in the chemical industry.

It has, of course, been used on a limited scale for many years. Many fatty acids, alcohols and similar organic products are condensed and stored in aluminium equipment, but it is often essential that a trace of water—say 0.1 per cent—be present. Many completely anhydrous organic compounds cause serious corrosion of aluminium alloys, particularly at high temperatures; however, a trace of water has a powerful inhibiting action. Aluminium alloys have also proved valuable in contact with ammonia and carbonated ammonia solutions, but they should be used with caution under conditions where an excess of ammonia is present. Aluminium alloys are also useful for heat exchangers, as their resistance to corrosion by waters is good as long as the water conditions are adequately controlled.

99.5 per cent Aluminium

Aluminium Alloys: The alloys most widely used are 99.5 per cent pure aluminium, the aluminium--1¼ per cent manganese alloy, and the alloys containing 2.5 to 3.5 per cent magnesium. The high strength precipitation hardening alloys are rarely used, as they have relatively poor corrosion resistance and cause difficulties when welding is required. Both 99.5 per cent and 99.8 per cent pure aluminium are widely used for handling concentrated nitric acid, which produces negligible corrosion. Opinions differ as to the minimum safe composition, which is variously stated as 65-95 per cent. The main trouble is localised corrosion at the welds, which is caused by accumulation of impurities; trouble can be avoided by using electrodes or filler wire of higher purity than the parent plate. Thus 99.9 per cent weldments are used with 99.8 per cent pure plate, or 99.8 per cent weldments with 98.5 per cent pure plate. It is essential that spillages be avoided, as the diluted acid is very corrosive.

Copper and Copper Alloys: Copper alloys are expensive and their corrosion resistance is not usually sufficiently attractive to justify the high cost. In the chemical industry their major use is in heat exchangers, where their resistance to corrosion and scaling in various waters is invaluable; copper condensers or coolers thus have good heat transfer characteristics and blockage of tubes is minimised.

Copper alloys are approximately as expensive as austenitic steels, but their corrosion resistance is generally inferior and they are more difficult to fabricate, particularly where welding of large sections is required. The austenitic steels are thus preferred for most conditions. However, as copper is a relatively noble metal, the corrosion resistance of copper alloys does not depend on the maintenance of a passive film (as does that of the austenitic steels), and oxygen is not necessary for corrosion resistance of copper alloys; in fact, the corrosion of copper alloys increases with oxygen concentration. Thus copper alloys are valuable for handling hot inorganic acid solutions under de-aerated conditions—copper is unattacked by, e.g. 5 per cent HCl at 180°C. Even ammoniacal solutions do not attack copper if no oxygen is present; it is, however, difficult to exclude all traces of oxygen indefinitely, so that it is safer not to rely on the maintenance of de-aerated conditions if a reasonable alternative exists. Copper is widely used to resist formic and acetic acids, but even in this field austenitic steels are becoming increasingly important.

Poor Mechanical Properties

Pure copper has poor mechanical properties, so that silicon or aluminium bronzes are widely used where strength and corrosion resistance are required. The various copper-nickel alloys are also used, but the brasses, with the exception of the aluminium brasses, suffer stress-corrosion cracking or de-zincification and are little used.

Nickel: In many ways nickel is similar to copper, but it is considerably more resistant to corrosion. It is also more expensive. Like copper, nickel is a relatively noble metal and oxygen is not essential for its corrosion resistance; however, its alloys are much more tolerant of oxygen than copper alloys. The nickel-copper alloys, such as Inconel, are resistant to many acids, while other alloys, which are analogous to the complex austenitic steels but with the percentages of nickel and iron reversed, have good resistance to sulphuric and phosphoric acids. The nickel-molybdenum alloys, which are now becoming available in wrought forms, are resistant to hydrochloric acid as long as temperature or concentration is not excessive.

Pure nickel is widely used for handling hot concentrated caustic soda, and is also used for storage of pure phenol, which, although it does not 'corrode' mild steel or many other metals, becomes coloured in contact with them.

Titanium: Titanium has only recently become available in quantity so that its use in the chemical industry is in the experimental stage. Its corrosion resistance under many conditions, particularly where chlorides are present, is excellent, and it has been used successfully for small parts where the conditions are particularly severe. It is, of course, expensive, and it is unlikely that it will ever be a competitor with the austenitic steels for full-scale plant of present design. However, its greatly superior corrosion resistance, particularly in contact with halides, may allow chemical processes which have hitherto been impracticable to be carried out, or allow radical alterations in present processes. In such cases, titanium could find use on a large scale.

Other Metals: Many other metals are used for particular purposes, where their resistance to a specific environment outweighs their great expense or inferior mechanical properties. Lead is widely used in contact with sulphuric acid of up to 80 per cent concentration, but at temperatures approaching 100°C it has poor mechanical strength. Chemical lead (contains 0.3 to 0.8 per cent copper) has the best corrosion resistance, and although many alloys with superior mechanical properties have been examined, no alloy has been found which combines adequate corrosion resistance with markedly higher strength. Homogeneous lead lining of steel has proved to be an effective, but expensive, solution to the strength problem.

High Silver Alloy

Pure silver and certain high silver alloys have good resistance to de-aerated mineral acids at high temperature, being better than copper in this respect. They are also useful in special environments, notably acetic and formic acids and some ammoniacal solutions.

The precious metals such as platinum, palladium, tantalum, rhodium etc., find a few special applications in spite of their high cost.

Protected Mild Steel: It was stated earlier that it is not usually worth protecting any metal more expensive than mild steel, as the methods of protection are expensive if they are to provide an appreciable degree of protection. The available methods may be divided into two groups, those which provide complete protection and palliatives which enhance the resistance of mild steel but are only useful if the direct corrosion of mild steel is not excessive.

The first group are typified by linings or the use of clad mild steel. Mild steel may be obtained clad with corrosion-resistant steels, nickel, Inconel, or copper, the cladding being usually 10 to 20 per cent of the total thickness. However, the cost of the clad plate is usually about 50 per cent of the equivalent solid alloy plate, and fabrication is expensive, particularly when welding is involved. Moreover it is impossible to avoid residual stresses caused by the differential thermal expansion of the cladding and the backing, so that stress corrosion cracking may occur in certain environments. Thus the use of clad plate leads to economies only for large simple vessels where the fabrication costs are relatively small.

Linings of thin sheet metal may be applied to the inside surfaces of vessels or tubes after erection. So long as the lining remains unbroken these may be very effective, but it is difficult to ensure that no liquor gets behind the lining in service, so that if possible linings are used only when stagnant liquor will not cause rapid attack. One-piece tubular linings of nickel and silver have been used under very severe conditions, but the cost of such special tubes is, of course, considerable. Linings of tile, rubber, plasitcs or vitreous enamel may be effective in suitable environments.

Palliatives include painting and the use of sprayed metal coatings. Painting is seldom useful except in gasholders and storage tanks, although stoving resins have been used for transport containers. Metal spraying is excellent for atmospheric corrosion, but useful inside plant only if the conditions are not too severe. The coating is porous, and is effective only if the conditions are relatively mild so that the pores become plugged. Furthermore, it is difficult to get a satisfactory sprayed coating on the inside of a storage tank, particulary if it is not new. Aluminium spraying is useful, however, in mildly sulphiding conditions. Galvanising and similar processes have only a limited value, and are in any case only useful on small items. Calorised mild steel is used to a considerable extent in high temperature sulphiding conditions, while chromising, siliconising etc., find a few special applications.

Risk of Perforation

An important factor in all uses of protected mild steel is the risk of perforation through mechanical damage. Thin coatings are, therefore, used only if there is no reasonable alternative. Vitreous enamel coatings are unpleasantly fragile, but the dangers must be accepted if alternative materials are not available.

Chemical Methods of Protection: The damage produced by corrosion may be reduced chemically by the use of inhibitors or by cathodic protection. If inhibitors are to be useful, the results of a temporary drop in inhibitor concentration must not be disastrous and if the inhibitor is used on the process side it must be tolerable in the product or easily removed from it. Inhibitors are rarely used deliberately in important processes, the tendency being to keep them in reserve in case trouble develops in an existing plant. Cathodic protection is very effective if correctly applied, but it is difficult to apply to most chemical plant unless the design is modified to allow for it; thus its use is usually confined to simple items such as storage tanks, and it is usually used only for protecting mild steel from aggressive waters.

Special Types of Corrosion: In the above account of the place of the various materials available for the construction of chemical plant, no account has been taken of the possibility of special forms of corrosion which are caused essentially by purely physical factors. Examples are contact (or galvanic) corrosion, crevice or deposit attack, erosion, corrosion fatigue or stress-corrosion cracking.

Deposit or crevice attack and erosion may be avoided by eliminating sharp or blind corners from the design, and by controlling liquor velocities so that the flow is neither so slow that suspended solids tend to be deposited nor so fast that turbulence occurs. Galvanic corrosion may be eliminated by ensuring that electrical contact between dissimilar metals does not occur, while corrosion fatigue is best countered by using a more resistant material; thus stainless steels are often used for parts subjected to fluctuating stresses in conditions such that mild or low alloy steels would have adequate static corrosion resistance.

Stress-corrosion cracking is more difficult to combat, and despite the large amount of work which has been done there is no universal solution. Most, if not all, metals and alloys suffer from stress-corrosion cracking in one medium or other. The austenitic Cr/Ni steels are particularly susceptible and it is probably true that more failures of austenitic steel equipment occur through stress-corrosion cracking than through any other single cause. Most service failures are caused by residual stresses, but in practice stress-relieving is not always effective; doubtless this is due largely to the practical difficulties involved in heat treating large and complex structures, and if stress-relieving is to be of value it is obviously essential that it be carried out at a late stage.

Chemical methods, such as the use of inhibitors or cathodic protection, have received attention but are not easy to apply in chemical plant. Possibly the most hopeful line of attack is to combine careful heat treatment of individual parts with localised cathodic protection of the regions where residual stresses may be produced during the later stages of fabrication.

Zirconium for Process Equipment

DEVELOPMENTS in the atomic field have stimulated great interest in the corrosion resistant and physical properties of zirconium metal. For use in atomic reactors high-purity zirconium is required. The commercial grade, however, has properties similar to the pure metal. Because of its light weight and good tensile properties this metal should find quite a few applications in the chemical industry.

The tensile strength of zirconium is in the titanium range of 50,000 p.s.i., but it tends to lose some of its strength at high temperatures (11,000 p.s.i. at 500°C). Zirconium's tensile properties, however, improve with cold working. At 0 to 10 per cent cold work, hardness and strength increase by over 90 per cent. Unfortunately since zirconium reacts with atmospheric gases it has to be welded in an inert atmosphere of argon or helium.

Zirconium is notable for its resistance to chemical attack. In fact, it is superior to titanium with regard to dilute. hydrochloric acid, concentrated phosphoric acid and oxalic acid. The metal shows almost complete resistance at room temperature to such organic acids as formic, acetic, oxalic, monochloroacetic, dichloroacetic, trichloroacetic, lactic, tannic, tartaric and citric.

Artificial sea water does not appear to affect it.

Corrosion data on zirconium (according to R. B. Norden, *Chem. Engng.*, 1957, **64**, No. 1, 268):

Reagent	Concentration % by weight	Temp. °C	Rating
Acetic acid	5, 99.5	60, 100	A
Aluminium chloride ...	20, 30	Room—boiling	A
Ammonium hydroxide	28	Room—100	A
Aqua regia	—	18—60	C
Calcium chloride ...	20, 30, 50	20, 49, 100	A
Carbon tetrachloride ...	100	Room—49	A
Chlorine saturated H_2O	—	Room	A
H_2O saturated Cl_2 ...	—	,,	C
Citric acid	10	Room—100	A
Cupric chloride ...	1—25	35	C
Chromic acid	10, 20, 30	20, 49, 100	A
Ethyl alcohol	95	Boiling	A
Ferric chloride	2.5 to 30	18—100	C
Formic acid	90	20, 49—boiling	A
Hydrochloric acid—			
Dilute		All temp.	A
Conc.		Room	A
Conc.		Boiling	A
Hydrogen peroxide ...	10	49	A
Mercuric chloride ...	1 (sat.)	35—100	A
Methyl alcohol	99	Boiling	A
Monochloro acetic acid	100	,,	A
Nitric acid	10	18 to 100	A
White fuming HNO_3 ...	—	Room to 00	B
Red ,, ,, ...	—	,, ,,	C
Oxalic acid	1—25	100	A
Phenol	25, 50, 100	20, 49—boiling	A
Potassium hydroxide ...	10, 20, 30, 40	Room—100	A
Phosphoric acid ...	10—-85	Room 10	A to B
Sodium chloride ...	3	35	A
Sodium hydroxide ...	10, 50	Room—100	A
Sulphuric acid	10	18—100	A
,, ,, ...	96	100	C
Tartaric acid	10, 25, 50	20, 49—boiling	A

A = corrosion of not more than 5 mil. penetration per year (m.p.y.).
B = rates of 5 to 10 m.p.y. C = more than 10 m.p.y.

West Germany as a Main Primary Plastics Exporter

Canadian Survey of Materials Markets

WEST GERMANY'S production of plastics raw materials has been increasing at a rate of 25 to 30 per cent in recent years. In 1955 output totalled 425,000 tons, an increase of 27 per cent over 1954. Production in 1947 totalled 23,000 tons. These figures are given in a survey of the plastics raw materials industry in a number of European and Far Eastern countries, conducted by the Canadian Department of Trade and Commerce. Markets in South-East Asia were reviewed in CHEMICAL AGE, 2 February, page 199.

The table below shows pre-war production and the rapid growth of this industry since 1950.

Right after the war West Germany imported large quantities of plastics raw materials; now the country is one of the world's main suppliers of primary plastics; in 1955 shipments totalled 87,500 metric tons, worth DM297 million, an increase of 43 per cent in volume and 35 per cent in value over 1954. Polymerisation products, such as polystyrene, p.v.c. and polythene, accounted for more than 58,000 metric tons. Output from recently expanded plants has made available much larger quantities of special grades of those products.

Newer Developments

Among newer developments are the production of polyester resins, silicones and high-viscosity polyamides. In the fluorocarbon group only polytrifluorochloroethylene is produced at present. Materials such as polyvinyl ether, polyisobutylene, polyvinyl carbazole and polyacrylonitrile are processed in Germany. Emulsion and suspension polymerisates of vinyl chloride are growing in importance.

Import licences are needed for polythene, polystyrene and alkyd resins, but there is little difficulty in obtaining them. No licences are needed for p.v.c. and ethyl cellulose. Rates of duty are: alkyd resins 15 per cent; polythene 19; polystyrene 15; p.v.c. 19; ethyl cellulose free; these items are subject to a 4 per cent turnover tax on the duty-paid value, except for reflection material which is 6 per cent.

Austria. Although production of primary plastics in Austria is expanding rapidly, the country depends on foreign supplies of polystyrene, polythene, polyurethane, acrylics, epoxies, polyamides, fluorine plastics, speciality coating resins and silicones.

From October last, Austria liberalised dollar imports of the following: cellulose acetate, polyisobutylene, polystyrene, polyamides, polythene, synthetic acrylic resins, acetophenone resins, cellulose acetate, butyrate, cellulose propionate, epoxy resins, ketone resins, polyvinyl ether, polyvinyl carbazol and unexposed films.

France. Growth of the French primary plastics industry has been phenomenal. In four years output of synthetic resins trebled and in 1955 reached 96,250 metric tons, or 27 per cent more than in 1954. This expansion has continued, particularly in p.v.c., polystyrene and polythene.

	Est. capacity	*Production (in 000 metric tons)*		
	1956	1955	1954	1953
Cellulose resins ...	9.0	4.8	5.0	4.0
Polyvinyl chloride (dry wt.)	38.0	32.2	24.0	16.0
Polyvinyl acetate ...	7.5	5.0	3.0	
Polyamides (nylon)† ...	5.5	3.2	0.8	0.5
Polystyrene	18.0	11.6	8.0	3.6
Polythene	9.0	4.0	1.8	—
Phenolic Resins ...	20.0	14.5	11.5	6.2
Aminoplastic resins ...	15.0	10.5	9.4	4.7
adhesives	—	7.8	7.0	—
moulding	—	2.7	2.4	4.7
Alkyd resins‡	20.0	7.8	7.8	7.7
Polyesters	3.5	0.9	0.07	—

† Excluding nylon for textiles.
‡ Plus 4,000 tons produced by paintmakers for own use.

France's 1955 imports totalled 22,000 metric tons and the US, West Germany and the UK accounted for 63 per cent of the total. Main products from each country were:

US—polystyrene, polythene, acetobutyrate.
West Germany—polyvinyl chloride and acetate, acrylics.
UK—aminoplastic resins, cellulose acetate.
Switzerland—aminoplastic resins, polyvinyl acetate.
Sweden—aminoplastic resins, alkyd resins.
Italy—p.v.c., polythene.
Canada—polystyrene, polythene.
Belgo/Luxembourg—alkyd resins, cellulose acetate

There is in France an important movement towards the manufacture of polythene by the low-pressure method (both Ziegler and Philips). Three new plants are expected to be built shortly; a fourth, producing high-pressure polythene, will start production early in 1958.

It is estimated that converters of vinyl resins used 14,300 tons of plasticisers in 1955, of which half consisted of dioctylphthalate. Second in importance was tricresylphosphate. Dibutylphthalate is in fourth position, but is being replaced by dioctylphthalate.

Greece. The Greek market for primary plastics is free from quantitative import and exchange restrictions. Principal imports are: polyvinyls and their copolymers, including vinylidene, cellulose acetate, acetate-butyrate, proprionate, ethyl cellulose, polystyrene and copolymers, polythene, acrylics, polyamide moulding compounds; phenolics and urea resin, melamine moulding powders, silicone, neoprene, polyesters.

Greek plastics manufacturers are experiencing difficulties in finding markets for their output and are in dire need of more capital.

Netherlands. With Dutch output of basic chemicals and monomers steadily increasing, Netherlands production of primary plastics will probably rise substantially in the near future. Melamine formaldehyde resins are not yet made in Holland because foreign patent rights do not expire until 1957.

Full scale production of polyester resins will start shortly; large scale production of polythene is scheduled for the latter half of 1957; production of polystyrene will start in the near future.

Imports are important, 1955 totals being: p.v.c. 7,000 metric tons; urea and melamine formaldehyde 3,000 tons; polythene 1,200 tons; polystyrene 1,000 tons.

Sweden. P.v.c., phenolic resins and moulding compounds, polythene and polystyrene are among the main plastics raw materials needed in Sweden. The country has a well-developed organic chemical and primary plastics industry using its vast cellulose resources. A drive for self-sufficiency has spurred research into cellulose-based synthetics, and Sweden's chemical industry already produces aliphatics and formaldehyde, pentaerythritol and trimethylol propane, butyl and octyl alcohol, ethylene glycols, butyl acetate, calcium cyanamide, vinyl chloride, melamine, urea, monochloracetic acid, and methylmethacrylate monomers.

A Good Market

With a rapidly expanding plastics goods industry, Sweden should continue a good market for imports of primary plastics; a scarcity of raw materials and lack of a petrochemical industry reinforce this view.

Switzerland. Production of plastics raw materials has expanded rapidly since 1950; by 1954 output of condensation, polymerisation and polyadditive products had more than doubled, as was the case with hard albuminoid derivatives; production of polymerisation, copolymerisation products increased threefold; and there was a 50 per cent rise in output of cellulose derivatives.

With the exception of melamine resins and to a lesser extent polyvinyl acetate, p.v.c., and certain speciality products, Swiss production still falls short of demand. Major suppliers are West Germany and the US. Principal German exports are p.v.c. and polystyrene. From the US comes polystyrene, polythene and p.v.c. the UK supplies large quantities of p.v.c. and polythene.

Australia. Although Australia is moving towards self-sufficiency, she imports small amounts of most primary plastics and in the case of p.v.c., polystyrene and polythene, the quantities are substantial.

Germany's Production of Plastics Raw Materials

	1936	1950	1951	1952	1953	1954	1955
			(1,000 metric tons)				
Cellulose dreivatives	31	28	31	29	39	47	50
Condensation products	44	40	81	80	97	130	175
Polymerisation products	2	30	56	81	104	148	200
Totals	77	98	168	190	240	325	425

(Continued on next page)

OEEC FERTILISER REPORT SHOWS FALL OFF IN PRODUCTION RATE

FIGURES for fertiliser production, consumption, prices and trade for the period 1954-57 are contained in the latest report published by the Organisation for European Economic Co-operation. Following the same main lines as the previous report (1953-56) it includes for the first time information on the fertiliser situation in Spain and the US.

During the fertiliser year 1955-56 there was a general levelling off of the rate of increase of fertiliser production. Output of nitrogenous and phosphate fertilisers rose by three per cent to 2.7 million metric tons of nitrogen and three million tons of P_2O_5, and potash fertilisers by two per cent to 2.8 million tons of K_2O.

In the current year an increase of the order of 15 per cent is foreseen for the production of nitrogenous fertilisers, and a lower rate (six per cent) for 1957-58.

Production on the whole in the US and Spain increased more rapidly than in OEEC countries. US output of nitrogenous fertilisers rose by 15 per cent to over two million tons of nitrogen, and potash by four per cent to 1.7 million tons of K_2O. Spain's production of potash was 213,000 tons in 1955-56, an increase of eight per cent over the previous year.

An eight per cent increase in production capacity for nitrogenous fertilisers was recorded in OEEC countries between 1 October 1955 and 1 July 1956, making a total of 3.3 million tons of nitrogen. For phosphate fertilisers there was a rise of four per cent to over four million tons of P_2O_5, and for potash an increase of two per cent to three million tons of K_2O.

A large part of the capacity for production of phosphate fertilisers remains idle in a number of countries. Less than three quarters of the total existing capacity is used in member countries as a whole.

Total consumption of fertilisers rose more than production in 1955-56. The trend towards expanding consumption is expected to continue during the current fertiliser year.

Consumption is increasing very rapidly in Spain where 30 per cent more nitrogenous fertilisers, 12 per cent more phosphate and five per cent more potash were used than in the previous year.

Fluoroacetic Acid added to Poisons List

THE FOLLOWING changes in the Poisons List and Rules are proposed:

Sodium monofluoracetate will be deleted from Part 1 of the Poisons List and the first schedule of the Poisons Rules and fluoroacetic acid and its salts will be added to Part 1 and to the first, seventh, eighth and sixteenth schedules. In addition, Rule 16, which now relates to the sale of strychnine, will be amended to impose similar restrictions on the sale of fluoroacetic acid and its salts.

Existing references in Part 1 and the first and fourth schedules to dithienylallylamine compounds and their salts will be amended to dithienylallylamines, dithienylalkylallylamines and their salts.

Formic acid will be added to Part 2 and to the second schedule, with exemption under Group 2 of the third schedule for substances containing less than 5 per cent, weight in weight, of formic acid.

Fluoroacetamide and fluoroacetanilide will be added to Part 2 and to the first, fifth, seventh, eighth, ninth and sixteenth schedules, with exemption under Group 2 of the third schedule for substances containing them not being preparations for use in agriculture or horticulture, or for the destruction of rats and mice, and for solutions containing not more than 1 per cent of fluoroacetamide or fluoroacetanilide in association with acetamide, a bitter principle and a dye.

Change of Address

Base Metals Products Ltd. have moved from Wembley to Maylands Avenue, Hemel Hempstead, Herts (Boxmoor 5681).

New Glass Dispersions by Acheson Colloids

GLASS DISPERSIONS which minimise oxidation and provide lubrication have been developed by Acheson Colloids Ltd., 18 Pall Mall, London SW1. The glass, in an extremely fine form, may be dispersed in solvents and resin solvents. Tests have been made with the glass dispersed in both volatile and non-volatile carriers and synthetic liquids such as silicones, in mineral oils and in lacquers. Best results have been achieved with dispersions in ethyl or isopropyl alcohols applied as an exceptionally thin coating to cold metal before the pre-heat stage.

Much experimental work has resulted in a product designated 'dag' 1205B (semi-colloidal glass in isopropanol) which appears to give protection to a number of the titanium alloys.

News of this development is announced in the first issue of *Prospects*, a new broadsheet to be published periodically by the company.

Cotton and Rayon RA's To Co-operate

AGREEMENT has been reached by the councils of the British Cotton Industry Research Association and the British Rayon Research Association to co-operate in all branches of research where possible. Steps are to be taken to eliminate any possible overlapping in their work. This agreement follows discussions that have been taking place for more than two years and suggestions that there might be serious overlapping in work of the two research bodies if they continued to operate independently.

Chemical Wholesale Prices Steady in January

WHOLESALE PRICE index of the Board of Trade for January shows that prices of chemical and allied products remained generally steady. The following is an extract from the index (30 June 1949 = 100):

Product	Jan. 1957	Dec. 1956	Jan. 1956
Chemical & allied products	141.9	141.3	136.6
Dyes & dyestuffs	143.1	143.3	138.0
Disinfectants	126.5	126.5	123.6
Insecticides, weed-killers, fungicides	135.5	135.5	135.7
Synthetic resins & plastics materials	124.1	123.5	123.1
General chemicals	161.7	161.1	154.3
Benzole, pure (BS136/1950)	217.1	212.7	182.9
Caustic soda liquor 100°Tw	157.6	157.6	151.9
Soda ash, light, d/d ...	164.5	164.5	159.6
Soda, ash, light, for works...	173.4	173.4	167.3
Sulphuric acid, BOV ...	173.7	173.7	173.7
Sulphuric acid, ROV, 94/95 per cent	181.8	181.8	181.8
Soap, candles & glycerine ...	124.2	122.7	118.8
Ethyl alcohol, industrial BS 507/1933	156.7	156.7	146.7
Carbon black	131.8	131.1	130.2
Fertilisers	200.9	199.9	195.2
Pyrites, c.i.f., UK ports ...	175.8	175.8	178.1
Sulphur, crude, for acid making, c.i.f.	190.1	176.6	178.6

Multiwall Sack Order Leads to Production Record

A PRODUCTION record was achieved by William Palfrey Ltd., 24 City Road, London EC4, when they completed an order from Imperial Chemical Industries for 20,000 Palfsacks (multi-wall paper sacks) as salt containers. The order, from Tasmania, was placed on 28 December with the request for urgent delivery by 8 January as the ship on which they were to be consigned closed on 11 January. The special 5 ply 1 cwt size sacks were made to order by 7 January, rushed to Chester by road, filled and aboard well before closing date.

Need for Everyday Language

Chemical technology has outstripped the evolution of language declared Mr. Osmond Turner of Osmond Turner Mead Associates speaking at a meeting on 13 February of the Presentation of Technical Information Group at London University. He said that technical terms were fine within the 'golden circle,' but they conveyed nothing outside that circle. Chemists should experiment to express themselves in terms of the ordinary man's everyday experience.

PRIMARY PLASTICS

(Continued from page 333)

New Zealand. Except for caseins, all primary plastics are imported. With one or two minor exceptions, the tariff on synthetic raw materials is 3 per cent for all countries. Although an affiliate of Polymer Corporation Pty. Ltd., Australia, is setting up a plant to produce a wide range of synthetic resins, the need for imports will increase for some time.

South Africa. Only p.v.c. is produced in the Union by an ICI subsidiary. Most basic plastics materials are exempt from duty. Consumption of p.v.c. and polythene is increasing, particularly for the production of pipes and tubes.

Overseas News

DOW CHEMICAL DEVELOP NEW COATING PROCESS FOR MAGNESIUM

A NEW protective coating process for magnesium has been developed by Dow Chemical Co., US. The coating, an abrasion-resistant refractory ceramic, is applied by electrolytic action and is insoluble in water, resists alkaline solutions and some dilute acids. It is stated to withstand temperatures up to 650°C.

Magnesium parts to be treated are suspended from magnesium hangers which are equally distributed along heavy copper conductors. An alternating current is used. The parts are then lowered into a tank of heavy-duty alkaline cleaner (sodium hydroxide) to remove any oil film. A five-minute rinse in warm running water follows. The parts are then immersed in a tank containing the ceramic in solution (Dow No. 17) and about 20 amp./sq. ft. of surface is applied, although an alternating current is in operation and the total surface is divided by two. As the coating builds up, electrical resistance increases and therefore the voltage increases to maintain a constant amperage until a set voltage (70 volts for sheet stock) is reached.

Anodising is stated to require about five minutes in the tank. After removal from the tank, the parts are rinsed in cold running water for five minutes, then oven dried or blown dry with compressed air. The coating obtained is approximately 0.002 in. thick

New Phthalic Acid and Anhydride Plant

Now in production after a constructional period of 18 months is the phthalic acid plant at Carolinenglück Colliery, Bochum, a joint installation of the Gelsenkirchener Bergwerke AG and Badische Anilin-und Soda-Fabrik AG.

The plant has been so designed that the initial capacity of 600 metric tons of phthalic anhydride per month can be increased within a short time without difficulty. Naphthalene, which is the raw material of the production process, is provided by a modern method of tar distillation at the Bochumer Bergbau AG.

New Vulcanising Agent by the M. W. Kellogg Co.

A new vulcanising agent which permits the controlled curing of elastomers and resins capable of being cross linked with organic polyamines has been developed by the M. W. Kellogg Company.

HMDA Carbamate, as the new product has been named, is described as inner salt of ω-amino hexyl carbamic acid. First developed for use in vulcanising Kel-F Elastomer, it has proved useful as an efficient curative for other rubbers of the reactive halogen or acrylic ester types. A notable advantage of HMDA-Carbamate is stated to be that of controlled reactivity; normally active amine groups are shielded until curative and polymers are thoroughly mixed. Premature reactions are thus minimised and a more even distribution of cross links between elastomer molecules is effected.

The new compound is described as a free-flowing white powder, readily soluble in water but insoluble in non-polar solvents.

Allied Chemical and Polythene Research

It is expected in the US that detailed announcements of research investigations on low pressure polythene by the Allied Chemical and Dye Company will be issued shortly. The investigations which have been carried out for two years, are considered to be ready in the near future for full scale commercialisation.

Australia Increases Imports

Australia is to issue special import licences to allow increases of up to 100 per cent on a number of goods in the current quarter. Included are chemicals, dyestuffs, paints and colours, metal powders and graphite.

Yugoslav Exports Widened

During 1954-56, Yugoslavia's main exports to Indonesia comprised calcium carbide, calcium cyanamide and salonite sheets. Now the range has been extended to include ammonia and caustic soda, tanning extracts, lithopone and copper sulphate. Yugoslav exports to China under an extended agreement, include certain chemicals.

Biscycloheptadiene, a Reactive Hydrocarbon

Although designed by Shell Chemical of the US to be an insecticide component, biscycloheptadiene has been found to be a reactive hydrocarbon. The compound is a highly-strained diolefin and is said to react under more moderate conditions than ordinarily applied to ordinary olefins. Thus the nortricyclene structure is easily produced via an addition reaction. By treating the bicyclo compound with benzyl alcohol using p-toluene sulphonic acid as catalyst, 3-(benzyloxy)-nortricyclene is formed.

Addition of 1-hexanethiol to biscycloheptadiene produces the mercaptan, 3-(hexylthio) nortricyclene. No catalyst is required. Norcamphane structures have also been produced by Shell Chemical, as well as cycloheptadiene. This latter is formed by direct isomerisation of biscycloheptadiene at 450° to 500°C.

New Company to Exploit Bauxite in French Guinea

World interests are co-operating in the exploitation of bauxite deposits in Fria, French Guinea. A new company with an initial capital of Fr.1,000 million has been formed in Conakry. Entitled Cie Internationale pour la Production d'Alumine it is backed by Pechiney and Ugine of France, Olin-Mathieson Chemical Corporation of the US, British Aluminium and the Swiss concern Aluminium Industrie-Aktiengesellschaft. A plant to produce 480,000 tons of alumina a year is to be set up.

Belgian Nitrogen Output Cut

Shipping difficulties led to a 35 per cent cut in the production of nitrogen fertilisers in Belgium by the end of last year. Output in December totalled 13,000 tons, against 18,400 tons in the previous month. As a result, there was a marked fall in the country's normally large exports to the Far East.

Search for Radio-active Minerals

Special equipment designed at Harwell will be used by Northern Rhodesia geologists in an intensive search for radioactive minerals to be made this year. It will include special light-weight detectors as well as a specially equipped vehicle.

The project will form part of a commonwealth-wide scheme to stimulate the search for radioactive minerals. Similar equipment will be available to other member territories of the Federation of Rhodesia and Nyasaland.

Acid Plant for Uranium Refining

Work has begun on the building of a large acid plant for Mary Kathleen Uranium Ltd. on its field in North Queensland, Australia. The acid will be stored in steel tanks and used to refine uranium from the Mary Kathleen field.

Diisobutylene Plant opened at Port Arthur

Facilities have been completed by the Texas Company at Porth Arthur for the production of diisobutylene, which is used in the manufacture of plastics, elastomers, lubricating oil additives, and other chemical products. Initial capacity will be 8,000,000 pounds a year, but provision is being made for expansion as needs increase. Completion of the di-isobutylene facilities marks another step in Texaco's current petrochemicals expansion, which includes construction of a lubricating oil additive plant at Port Arthur and an ammonia plant at Lockport. Illinois.

Future Trend in US Chemical Industry

Spring meeting of the American Institute of Chemical Engineers will be held at Greenbrier Hotel, White Sulphur Springs, West Virginia, from 3 to 6 March. Symposia have been prepared on the general theme 'Future trends in the chemical industry.'

There will be a discussion of the human aspect of engineering--'decision making'. A symposium will discuss the future of coal chemicals, synthetic fibres, drugs and biochemicals, plastics, inorganic chemicals, raw materials for organic chemicals, chemical process trends, and selling. The future role of the computer in industry will be dealt with under the heading 'Computers for chemical industry control.'

Australia Sells Zirconium Treatment Process to US

Overseas rights to the CSIRO's process for producing pure zirconium have been sold by Australia to National Distillers Products Corp. of the US for $250,000. The process is said to considerably reduce the cost of separating hafnium, an unwanted metal element, from zirconium by eliminating the cumbersome extraction step.

Chlorine and Caustic Plant

A new chlorine and caustic soda plant now being built at Strömbruk in central Sweden is expected to start production this year. It is being built for Ströms Bruks AB wood products, pulp and wallboard manufacturers.

New US Formaldehyde Plant

Chemical Division of the Borden Co., has opened a new formaldehyde plant with an annual output of 36 million lb. at Kent, Washington.

Selenium Output Soars

According to recent official data, the production of selenium in Mexico rose from 6,629 kgs in 1954 to 60,318 kgs in 1955. The entire output was exported to the US.

East German Trading at Leipzig Fair

Intended purchases and sales to be made by the East German Democratic Republic at the Leipzig Spring Fair have been announced.

Materials to be bought include: Organic and inorganic products, e.g. phosphate fertilisers, borax, dyes and pigments, acetyl cellulose, photo-gelatine, pharmaceutical products, oils, laboratory and analytical chemicals, caoutchouc, various rubber articles, fatty acids, linseed oil, celluloid etc.

Sales planned include: Inorganic basic chemicals, e.g. potash, soot, inorganic dyes, pigments; organic basic chemicals including solvents, softeners; chemicotechnical products including black/white and colour film, negative and positive. insecticides, mineral oils and tar products; pharmaceuticals etc.

Danish Cryolite for Germany

Denmark is to grant export licences for delivery to West Germany of at least 4,000 tons of natural Cryolite and 6,000 tons of crude tar. This is covered in the third protocol to the Danish/West German Agreement, extending the agreement to 31 December 1957.

Higher Capacity for High Test Calcium Hypochlorite

A 25 per cent increase in capacity for the manufacture of HTH high-test calcium hypochlorite is planned by the Industrial Chemicals Division of Olin Mathieson Chemical Corporation, Baltimore. The new capacity will be obtained through modernisation and addition of equipment at the company's existing HTH plant at Niagara Falls, NY. Completion of the work is scheduled for early fall.

New Refinery for Angola

The Governor-General of Angola, Portuguese West China, has authorised the Companhia de Combustiveis de Lobito to construct an oil refinery at Sao Pedro da Parra, with the necessary port installations. Initial capacity will be one million tons of refined products annually, rising later to three million tons. The main contracts will be placed shortly by Petrofina in Brussels.

New Chemical Plant for New South Wales

Sulphide Corporation is to build an A£8 million plant at Cockle Creek, New South Wales for the production of zinc, sulphuric acid and superphosphates. When in stream in 1960, the plant will double Australia's superphosphate output to nearly 430,000 a year and will increase sulphuric acid tonnage from 30,000 to 45,000.

Four New Nonionic Surface Active Agents

A range of nonionic surface active agents for general industrial use is to be marketed under the name Poly-Tergent by the Industrial Chemicals Division of Olin Mathieson Chemical Corporation, Baltimore. Four lines are offered initially, with others to follow. All of the first group are alkyl phenol polyglycol ethers; they are liquids made from petroleum-base materials.

Poly-Tergent B200 is useful in solvent systems, as a detergent and dipersant, and where reduction of interfacial tensions will aid in wetting and spreading. As an emulsifier, it may be used alone or in combination with the more hydrophilic types to prepare insecticide emulsions, leather fat liquors, cosmetic creams, oil and grease removers and for sludge dispersion in fuel oi's.

Poly-Tergent B300 is said to possess outstanding properties as a wetting agent, detergent, emulsifier and dispersant. It is completely soluble in water up to temperatures of 52-56°C. and in some organic solvents. Poly-Tergent G200 is intended primarily as an emulsifying agent and associate emulsifier. It is useful in many solvent systems to increase detergency, dispersibility and wetting action and is of value as an 'active soap' in dry cleaning solvents. It is compatible with cationic compounds.

Poly-Tergent G300 is completely soluble in water up to 62-70°C. and in a number of organics. Highly stable chemically, it is a good wetting agent, detergent and dispersant over a wide range of conditions. It gives good emulsions with aromatic solvents, chlorinated paraffins and vegetable oils.

Brazil to Acquire Uranium and Thorium Ores

The President of Brazil has forwarded to Congress a Bill authorising a credit of Cr $150 million to enable the National Commission of Nuclear Energy to purchase uranium and thorium ores and concentrates. He stated that as exports of radioactive materials had been officially suspended, the Government was obliged to acquire such material produced in the country. The Commission is studying the fixing of a ceiling to production and prices.

Soil Conditioner from Waste Bark

Armour Research Foundation, US, have developed a process to produce a soil conditioner formed by condensation of tannic acid from bark with formaldehyde. Although still in the research stage, the product is described as a more effective and economical type of soil conditioner.

Record Mineral Output for Southern Rhodesia

Southern Rhodesia's mineral output in 1956, valued at £23,260,574, was a record and was about £2,250,000 higher than in 1955 and more than £4 million above the 1954 figure. Asbestos was the main mineral with 1956 production valued at about £8,500,000, an increase of one-fifth above 1955. Gold production was valued at £6,750,000, coal more than £3,600,000, chrome more than £2,600,000, copper and lithium each more than £400,000.

An era of greater expansion will reach full momentum with completion of the Kariba hydro-electric scheme in 1960, said the Minister of Mines last week.

PARLIAMENT HEARS PLANS FOR UK NUCLEAR RESEARCH INSTITUTE

THE GOVERNMENT has now decided to set up a National Institute of Research in Nuclear Science. Lord Bridges has been appointed independent chairman of the governing board; the other governors will be announced in due course. A statement to this effect was made in the House of Commons last week by Mr. J. Enoch Powell, financial secretary of the Treasury.

Main object of the Institute will be to provide, for common use by universities and others, facilities and equipment which are beyond the scope of individual institutions that carry out research in the nuclear field. The new Institute will not replace the research now being done in individual universities with Government financial aid; nor will it affect the Government participation in the international scheme for common facilities in Geneva.

The Government believe it will satisfactorily fill a gap which would otherwise exist in this country's power to keep in the forefront of nuclear progress.

The Institute will be mainly financed by grants through the Atomic Energy Authority and from the Lord President's atomic energy vote; provision will be taken in estimates accordingly. Expenditure of the universities will be confined to the payment of the salaries and expenses of their own academic staff utilising the research facilities provided by the Institute.

The governing board will be appointed by the Lord President of the Council and the Chancellor of the Exchequer. It will comprise representatives of the universities, the Atomic Energy Authority, the University Grants Committee, the Royal Society and DSIR.

European Nuclear Research

On Monday this week, Mr. H. Nicholls, parliamentary secretary to the Ministry of Works, said that substantial progress had been made in the construction of the buildings and apparatus of the European Organisation for Nuclear Research. Staff now numbered about 480. The organisation's research activities were intended to be complementary to those of member countries.

2 per cent of Gross National Product Spent on Research

Proportion of the gross national product spent in 1955 on scientific research and development, excluding market research and capital development, was estimated at about 2 per cent. That figure was given in the House of Commons last week by Mr. J. Enoch Powell, financial secretary to the Treasury. He added that between one-third and one half of that work was done in Government laboratories and nationalised industries. A large part of the remainder was financed by the Government.

The Advisory Council on Scientific Policy was now considering the whole question of the extent to which the country's resources were devoted to research. The results of that investigation would be forthcoming.

Government should Control Composition of Detergents

A PROPOSAL that the Government should take powers at once to exercise immediate control over the composition of synthetic detergents in the event of any deterioration in the present position has been made by the health committee of the Association of Municipal Corporations.

In a memorandum to Mr. Henry Brooke, Minister of Housing, the committee suggests that there should be an enquiry into whether detergents containing surface active materials which would respond to biological oxidation would prove satisfactory for washing purposes. The committee says it appears that if an effective detergent of such composition could be produced many of the present difficulties would be removed.

Export Enquiry For Herbicidal Chemicals

The Stores Department, South African Railways, seeks supplies of 200,000 lb. sodium chlorate and 120,000 lb. sodium trichloracetate. Bids in endorsed Tender E.6454, for herbicidal chemicals should be addressed to the chairman, Tender Board, PO Box 7784, Johannesburg. Photo-copy of tender documents is available for 4s. from Room 805, Export Services Branch, BoT, Lacon House, Theobalds Road, London WC1.

Chemicals for Water Treatment

Stores Department of South African Railways also require 2,609 tons of chemicals for water treatment in briquette and powder from. Bids, marked Tender E6412. Chemicals for water treatment should be sent to the chairman of the Tender Board, PO Box 7784, Johannesburg to reach him by 15 March. Tender documents are available from Room 805. Export Services Branch, BoT, Lacon House, London WC2.

Gas By-Products Output

In the six months ended September 1956 industrial sales of gas increased by three per cent and commercial sales increased approximately two per cent.

Coke breeze production for the first half of the financial year 1956/57 was up by one per cent. Output of crude tar also showed a one per cent increase while crude benzole production increased by 16 per cent.

Extra Citric Acid Capacity Ready Ahead of Schedule

FIRST STAGE of the £250,000 expansion scheme, started last year and designed to increase their output of citric acid by 70 per cent has just been completed by John and E. Sturge Ltd., Wheeleys Road, Birmingham. The increased output was planned to meet growing demand from both home and overseas, and progress has been so rapid that the first stage is completed well ahead of schedule, making available extra supplies of citric acid for the coming summer season.

Completion of the final stage has also been brought forward—from January 1959, to March 1958—and it is claimed that next year the extra citric acid available to UK consumers will reduce considerably the need to pay the higher prices prevailing abroad.

Mr. A. L. Wilson, chairman, at a recent meeting of the company said that during 1956, total exports of citric acid were 50 per cent greater than during the previous year and that shipments had been made to over 40 countries. In addition to the output of the company's French and Canadian factories, more than half the total production of citric acid and other chemicals from the UK factories was directly exported.

Two Nuclear Instrument Companies Merge

TWO NUCLEAR instrumentation companies—Isotope Developments Ltd., London and Aldermaston, and R. A. Stephen and Co. Ltd., Mitcham—have merged. Mr. W. W. Hill-Wood, chairman of Isotope Development has become chairman of R. A. Stephen and Co. and Mr. H. A. Luss and Mr. G. A. Thick, joint managing directors of Isotope Developments have also joined R. A. Stephen's board.

The policy of R. A. Stephen and Co. will not be changed and it is stated that the merger will greatly extend the company's facilities for manufacture, research and development.

R. A. Stephen and Co. manufacture the radiation measurement device known as quartz fibre pocket dosimeter. Isotope Developments, in which AEI, Distillers, GKN, and Prudential Assurance hold interests, produce thickness gauges, package monitors and reactor and laboratory instruments.

Polythene for Hot Water

Mr. G. H. Incledon, chairman of Richard E. Du Pont Ltd., states that the company's Durapipe N, made in this country, is suitable for use with boiling water.

New Nitrogen Store

Universal Matthey Products Ltd., are having a new factory building and nitrogen store erected in Stockingwater Lane, Enfield, Middlesex.

Export loading from a Distec tanker

ARMOUR CHEMICALS NOW EXPORT BY SHIP TANKER LOADS

FATTY acid amines (Armeens) and other cationic Armour chemicals are now being exported in bulk in ships' tankers.

As the chemicals issue in continuous stream from the production plant into a holding tank they are sampled for analysis and then pumped directly into road tankers, which are heavily insulated. The chemicals stay liquid while in the road tankers, from which they are pumped into ships' tankers. As shipping lines insist on a quick turn-round of their ships and as filling has often to be completed in a matter of hours, buffer storage on the quay is filled from road tankers a few days before ships arrive. This allows simultaneous filling of ships' tanks from road tankers and from the buffer storage.

The cationic chemicals are produced for Armour and Co. Ltd., London by Hess Products Ltd., at its factory in Littleborough, Lancs. Hess Products is responsible for all land transport arrangements, for which it uses its fleet of six-axled road tankers. This fleet is also used by Hess for distributing its Distec brand of fatty acids.

Armour's decision to export in bulk came after careful studies had been undertaken not only into the economics of packaging and shipping, but into construction materials of the tanks, the optimum temperature to be maintained during the voyage and into many other details. This research, says the company, led to the conclusion that bulk shipments are not only feasible but are economical whenever large quantities have to be handled.

Russell Constructions to Market Resilon

UNDER A NEW agreement with Mendip Chemical Engineering Ltd., Russell Constructions Ltd., chemical plant engineers, Russell House, Adam Street, Adelphi, London WC2, will act as sole selling agents for Resilon. This material is a synthetic resin bonded reinforced plastics from which important items of chemical plant are produced, such as fume ducting stacks, scrubbing towers, drainage effluent systems, storage tanks, pipelines, tank covers, process vessels and vacuum filters.

Various grades of Resilon are available to meet most acid conditions, even hydrochloric acid at constant boiling mixture and *aqua regia* at satisfactory temperatures. The handling of strong alkali solutions is said to present no problems and marked success has been attained in processes involving free chlorine at 'higher temperatures than any other known application.'

Sales Office Moves

The North Eastern area sales office of Midland Silicones Ltd. has moved to 5/7 New York Road, Leeds 2 (telephone Leeds 26768).

Helium Drier and Adsorber at Harwell

A SOURCE of danger in the Dido heavy water-cooled research reactor at Harwell is the accumulation of deuterium and oxygen resulting from the splitting up of heavy water by radiation. In time an explosive atmosphere might be formed in the reactor.

To overcome this difficulty British Oxygen Engineering Ltd. has supplied a helium drier and adsorber. Helium is used in a closed circuit and consequently it has to be purified.

Radioactive helium, containing deuterium and oxygen, emerges from the reactor at around ambient temperature and is pre-cooled. It is then passed to a liquid nitrogen cooler which, together with the adsorber, is encased in a stainless steel cylinder. The adsorber, activated charcoal, is arranged in tandem for batch operation, only one section being used at a time.

Size of the plant is 5 ft. 6 in. by 4 ft. by 10 ft.

Change of Address

The London sales office of Miniature Bearings Ltd. has moved to 39 Parliament Street, Westminster SW1 (telephone TRAfalgar 3386-87-88).

FOR YOUR DIARY

MONDAY 25 FEBRUARY

RIC—London: Woolwich Polytechnic SE18, 6.45 p.m. 'Organic Chemistry in the Photographic Industry' by Dr. J. D. Kendall.

CS & SCI—Leeds: Chemistry Lecture Theatre, University, 6.30 p.m. 'Steric Hindrance and Analytical Chemistry' by Dr. H. M. N. H. Irving.

CS—Oxford: Physical Chemistry Laboratory, 8.15 p.m. 'Polonium' by Professor W. Fernelius.

TUESDAY 26 FEBRUARY

SCI (Plastics & Polymer Group)—London: 14 Belgrave Square SW1, 6.30 p.m. 'Structure and Reactivity of Phenol-formaldehyde Condensates' by R. W. Hall, D. Fraser, A. L. J. Raum and P. A. Jenkins.

Hull Chemical & Engineering Society—Hull: Church Institute, 7.30 p.m. 'Manufacture of Antibiotics' by D. Daniel.

WEDNESDAY 27 FEBRUARY

SCI (Food Group)—London: 14 Belgrave Square SW1, 6.45 p.m. 'Sucrose Crystal Studies' by H. E. C. Powers.

Royal Society of Arts—London: John Adam Street, Adelphi WC2, 2.30 p.m. 'Synthetic Detergents—A New Pollution Problem' by Dr. B. A. Southgate.

THURSDAY 28 FEBRUARY

RIC & SCI—London: Caxton Hall SW1, 7.30 p.m. Buffet dance.

CS—London: Burlington House W1, 7.30 p.m. 'Application of Acidity Functions to the Mechanisms of Acid Catalysed Reactions' by Professor F. A. Long.

CS—Bristol: Chemistry Department, University, 5.15 p.m. 'Living Molecules' by Professor J. D. Bernal.

CS—Sheffield: Chemistry Lecture Theatre, University, 7.30 p.m. 'Reduction by Metal-Ammonia Solutions' by Professor A. J. Birch.

Fertiliser Society—London: Lecture Hall of the Geological Society, Burlington House, Piccadilly W1, 2.30 p.m. 'Smoothing Streams of Materials in the Manufacture of Fertilisers, including Proportioning' by A. C. Van Es.

FRIDAY 1 MARCH

CS—St. Andrews: Chemistry Department, St. Salvator's College, 5.15 p.m. 'Phosphorus Chemistry—Past, Present and Future' by Dr. D. S. Payne.

Society of Cosmetic Chemists—London: Royal Society of Arts, John Adam Street WC2, 7.30 p.m. 'Ion Exchange Resins' by Dr. T. R. E. Kressman.

New Plant at Caernarvon Planned

Ashburton Chemicals Ltd., Trafford Park, Manchester, has an option to purchase a 100-acre site at Glynllifon Park, about seven miles south of Caernarvon, Wales. An official of the company told CHEMICAL AGE this week that purchase of the site was subject to certain facilities, particularly water, being made available. It was unlikely, he added, that building would start for at least 18 months or two years.

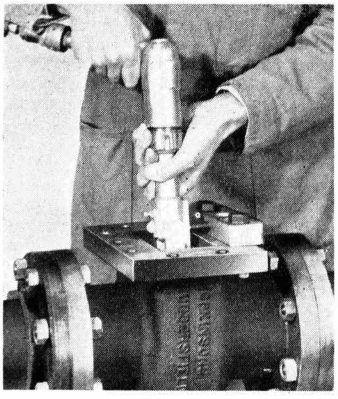
EQUIPMENT REVIEW

Chemical Plant : Laboratory Apparatus Safety and Anti-Corrosion Products

HOPKINSON'S LAPPING MACHINE

A NEW automatic lapping machine has been standardised by Hopkinsons Ltd., P.O. Box B. 27, Huddersfield, for the company's full-bore parallel-slide valves up to four in. bore. In common with the machine for larger sizes of valves up to 12 in. bore, this equipment enables valve seats to be lapped without taking the valve out of the pipe line. Similarly, lid studs in the valve body need not be removed during the lapping operation.

The machine, which weighs 8¾ lb., comprises a pneumatically driven motor operating at approximately 2,500 r.p.m.,



Using the automatic lapper

reducing to a suitable speed at right angles to the main shaft, where a driving bit readily engages with a corresponding slot in a lapping plate. A range of plates is available to suit various sizes of valves. The machine operates at 80 to 100 lb. p.s.i. pressure, the supply of air being controlled by a trigger in the hand grip.

The air supply can be taken in any form of flexible pipe to the desired location. An automatic push-grip coupling is supplied with the machine, one part being attached to the handle, the other available for fixing to the flexible pipe. Breaking the union automatically cuts off the air supply.

Mechanical loading of the lapping plate is impracticable in the smaller range of valves serviced by this machine which is therefore supplied with an adjustable fulcrum plate. This can be bolted to the lid flange of the valve. The fulcrum plate carries a centre screw which fits into a groove in the machine and acts as a pivot by which pressure is easily applied.

AUTOMATIC SELF-CLOSE NOZZLE

ALTHOUGH primarily designed for refuelling vehicle fleets, the T.D. automatic self-close nozzle, produced by The Equipment and Engineering Co. Ltd., 2 Norfolk Street, Strand, London WC2. may be used for filling any containers with a variety of liquids to a predetermined level, when the flow automatically ceases.

The cut-off action is fully automatic, being brought into operation when the fuel or liquid in the container being filled reaches a pre-determined level, governed by the depth of the nozzle delivery tube projecting into the tank. This is readily adjustable by a sliding 'depth stop' which can be easily positioned as required. The nozzle avoids waste caused by overfilling particularly prevalent when topping-up on an unknown quantity.

Made from aluminium or brass with neoprene valve seat, the nozzle is designed for petrol or similar hydrocarbon fluids which would have no harmful effects on these materials.

AUTOMATIC FLOW REGULATOR

EXCLUSIVE rights to manufacture and sell the Flostat automatic flow controller have been obtained by G. A. Platon Ltd., 323A Whitehorse Road, Croydon, Surrey. A self-acting flow controller, the Flostat needs no electric or compressed air supply for its operation.

It resembles a valve and fits directly in the pipeline. In its simplest form the Flostat is nonadjustable, being factory set for control of a certain fluid at a desired flow rate. In operation it is claimed to deliver fluid within one per cent of the set rate irrespective of variations of fluid pressure either upstream or downstream from the installation. For volume control the Flostat needs only to be used with a timing device and shut-off valve.

The Flostat can be made in materials suitable for handling nearly all industrial fluids.

ENGLISH ELECTRIC 'C' RANGE MOTORS

A NEW range of axially ventilated electric motors covering ½ h.p. to 50 h.p. ratings has been introduced by The English Electric Co. Ltd., Marconi House, Strand, London WC2.

These motors have standard fixing dimensions to the new British Standards draft specification CW (ELE) 6246. The use of Class 'E' insulation materials and wire enamels based on polyvinylformal and polyurethane resins permits a temperature rise of 65°C × on 40°C ambient temperature. Smaller, lighter and cheaper than before, these machines are also claimed to be more efficient.

The frame and end-shields of the machines are of cast iron, with four-bolt fixing and can be turned to any of four 90° positions to enable floor, wall or ceiling mounting to be made.

The stator windings are automatically impregnated in a continuous plant, which immerses the windings endwise, thereby ensuring penetration of the varnish along the entire length of the slots and windings, excluding all air pockets. This process is claimed to produce an efficiently protected unit which is highly resistant to moisture.

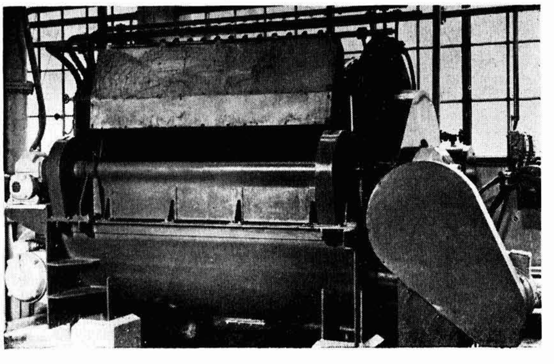
The rotor has die cast conductors and end-rings with high-grade 'insulined' laminations, and is rigidly fixed to the shaft. A super-sensitive electronic balancing machine ensures that each rotor is precision balanced to fine limits.

PAXMAN PRE-COAT FILTER

A PRE-COAT filter of the continuous vacuum drum type has been introduced by Davey, Paxman and Co. Ltd., Standard Ironworks, Colchester. Of an advanced design incorporating a number of features which have been proved to give long and trouble free service, the filter has been developed for the filtration of slurries with very low solids content and to produce clear filtrates.

The conventional filter media of cloth or gauze is replaced by a layer of diatomaceous earth. The scraper knife is arranged to advance automatically towards the drum and by shaving away a thin layer of earth, the filter presents a layer of clean filtering surface for filtration with each revolution of the drum.

This method of pre-coat filtration is said to prevent 'blinding' of the filter



Paxman 300 sq. ft. pre-coat filter

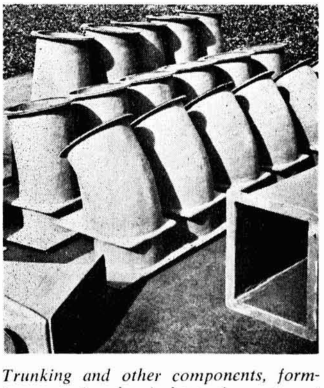
medium and at the same time produces a clear filtrate in a continuous manner with the minimum of supervision.

Filters are supplied in mild steel and austenitic stainless steels. They are also available in mixed materials, with rubber lined trough and stainless steel drum covering and scraper knife, for example. The backing cloth on which the pre-coat is built up is made of a material suitable to the nature of the slurry to be treated and may be nylon, Terylene, or glass fibre.

NEW COMPOUND LAMINATES

CHEMICAL plant is now being fabricated by Mendip (Chemical Engineering) Ltd., Feltham Road, Ashford, Middlesex, from compound laminates made from Bakelite epoxide and polyester resins reinforced with glass fibre materials.

The new laminates are said to offer several advantages compared with conventional materials used in the construction of chemical plant. One of their outstanding features is claimed to be their excellent chemical resistance, which enables them to be used for a wide range of purposes.



Trunking and other components, forming part of a chemical transfer system at a dyestuff factory

Because of the high strength/weight ratio of the laminates, structures made from them are light in comparison with other materials, making installation easier. Use of compound laminates is said to provide considerable freedom of design and to enable structures of complex shape to be produced.

TRANSISTORISED CRYSTAL OSCILLATOR

LATEST transistorised product by Venner Electronics Ltd., Kingston By-Pass, New Malden, Surrey, is the crystal oscillator type TS5.

This packaged oscillator provides two outputs, one sine and one square, at a frequency of 10 kc/s. An XY flexure quartz crystal is used to provide accurate control, a preset condenser being used external to the block initially to set the oscillator to frequency. The circuit is encapsulated in synthetic resin with the exception of the crystal, which is replaceable.

The oscillator may be used with two types of crystal, one having a zero temperature co-efficient between 15°C and 20°C so that maximum accuracy is obtained at room temperature, and the other a zero temperature co-efficient between 40°C and 50°C for applications where the ambient temperature is of this order. The stability of the oscillator at or about the point at where the zero temperature co-efficient occurs is of the order of three parts in 10^6.

The unit is suitable for directly feeding the Venner Decade Counter and Scaler, type TS10, and the binary unit, type TS2, from which many types of frequency and time reference, time delay and time measuring equipment can be constructed.

PARMEKO SAFETY TRANSFORMERS

A NEW range of portable safety tool transformers is being marketed by Parmeko Ltd., Percy Road, Aylestone Park, Leicester. Totally enclosed in a moulded rubber case, the transformer is designed for the operation at reduced voltage of portable tools and other types of equipment where liability to severe electrical shock must be avoided.

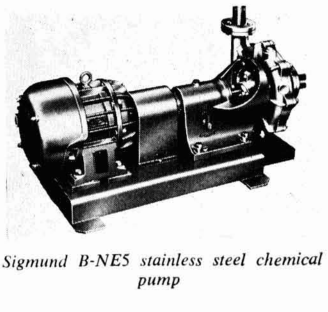
The transformer has an input of 230/250 volts and an output of 110 volts via a special fused plug. This winding is centre tapped (55-0-55 volts) and prevents any voltage greater than 55 volts to earth reaching the user even under the worst possible fault conditions.

A moulded rubber plug is provided with prongs of non-standard dimensions to avoid accidental connection to mains supplies. Fuses are fitted internally to each line.

STAINLESS STEEL CHEMICAL PUMPS

B-N stainless steel chemical pumps, produced by Sigmund Pumps Ltd., Team Valley, Gateshead 11, are available for outputs from 5 g.p.m. up to 200 g.p.m. against heads from 10 ft. up to 250 ft. To cover this range of duties only two support frame assemblies are used, but with these two support frame assemblies (comprising bearings, housing, shaft, shaft seal and stuffing box) a total of six different hydraulic units can be used. The impellers are designed so that a turned-down impeller gives, with the same casing, three or four different fields of duties and horsepower requirements.

Basic material for the pumps is 18/8/3 stainless steel. They are also available in all-iron or all-bronze construction, using the same support frame as for stainless steel pumps. In standard form the B-N pump handles liquids satisfactorily at temperatures up to 220°F.



Sigmund B-NE5 stainless steel chemical pump

OIL METER FOR LOW FLOWS

A NEW CM low-flow oil meter is announced by George Kent Ltd., Luton, Beds. Designed for installation in pipe-lines of between $\frac{1}{8}$ in. and $\frac{1}{2}$ in. bore, the meter is of the semi-positive, rotary-piston type, for flows up to 200 g.p.h.

Special features of the meter are said to include: accuracy within two per cent from 1.5 gal/hr. to 200 gal/hr.; compact design and simplicity of construction; all meter parts easily replaceable in the event of excessive wear or accidental damage; straight-reading counter with good dial clarity; high working pressures and low head loss. All components are manufactured from selected corrosion-resisting materials.

VANE TYPE FLOW INDICATOR

THE NEW Bowser Fig. 811 sight flow indicator is a single window, vane type indicator for use with clear or translucent liquids. The manufacturer, Liquid Systems Ltd., Union Road, Croydon, Surrey, claims that the indicator is ideally suited for use in cooling water lines to transformers; jacket water lines for Diesel engines; oil lines to hydro-electric turbines and generators; steel mill machinery and other equipment.

The vane, visible through the glass, is spring actuated—assuming a position at right angles to the centre line of the pipe when there is no flow, and moving at an oblique angle when liquid is flowing. The position of the vane provides an approximate indication of the quantity moving through the pipe.

The indicator can be supplied for the following pipe sizes: $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in., $1\frac{1}{2}$ in. and 2 in. and with springs of varying tension, to permit their use on either vertical or horizontal pipe lines, and are so designed that the flow may be either from the right or left, upwards or downwards.

WATER LOUVRE COOLER

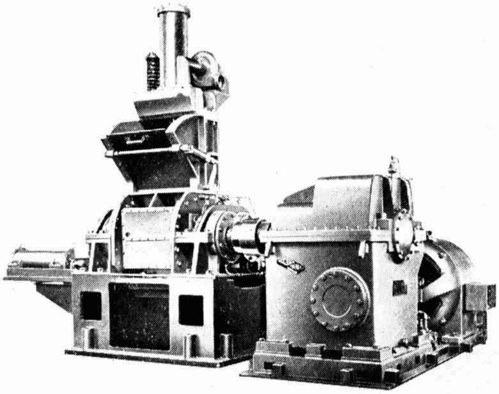
A WATER cooled rotary louvre cooler is being introduced by Dunford and Elliott Process Engineering Ltd., Linford Street, London SW8. Two drums, revolving slowly on a horizontal axis, are partially immersed in a water bath from which they collect water in the hollow tapering louvres. The collected water flushes along the louvres in contra flow to the movement of the material, so giving a high degree of heat transfer.

The water bath is split into stages, a water level control determining the flow rate of the cooling water through the unit. The water enters the bath at the end where the cooled material is discharged, leaving it at the opposite, or material feed end. Some evaporation occurs on the outside of the louvred drums which assists the cooling operation, the resulting vapour being discharged through a vent at the top.

Hot material is fed in through an opening on the centre line of the cooler and immediately takes position as a moving bed based on its angle of repose. The hollow louvres in each stage are deeper at the feed than discharge end, so that they not only assist positive movement of the material through the unit but provide the required head for flushing the water. It is claimed that there is no avalanching or cascading, friable materials being handled with minimum breakage.

The depth or quantity of material in the cooler determines its retention time, and this may be varied by adjusting the discharge vanes.

Manufactured in either one, two or three stages in a range of diameters and lengths, the rotary water louvre cooler is suitable for most crystalline or powdered materials provided they are not of a stick nature. When handling materials containing moisture which will evaporate during cooling, low-velocity air can be passed through the cooler, leaving it via the top vent.



Bolling spiral-flow intensive mixer manufactured by Fawcett - Finney Ltd.

BOLLING PRODUCTS FOR UK

UNDER licence from Stewart Bolling and Co. Inc., of Cleveland, Ohio, Fawcett-Finney Ltd. of Berkley Street, Birmingham, is to manufacture and market the US company's range of Bolling products in the UK, Commonwealth and Europe.

These products comprise: Bolling spiral-flow intensive mixers for rubber and plastics; Bolling laboratory, experimental and production units from 6 in. × 13 in. to 22 in. and 26 in. × 100 in. rolls; Bolling calenders of two, three or four rolls capacity for crepe, plastics, mastics and gaskets; Bolling vulcanisers from 20 in. to 36 in. standard and 42 in. × 72 in. specials with lengths as required.

The spiral-flow intensive mixer is said to excel on polythene and on butyl rubber where much higher than normal temperatures are required. Temperatures up to 400°F can be catered for when flood lubrication is employed.

Other advantages of the patented spiral-flow mixer are said to include faster mixing and dispersion, longer effective life, lower maintenance costs, accessibility to a remarkable degree and 20 per cent less horse power consumption by means of the specially designed rotor.

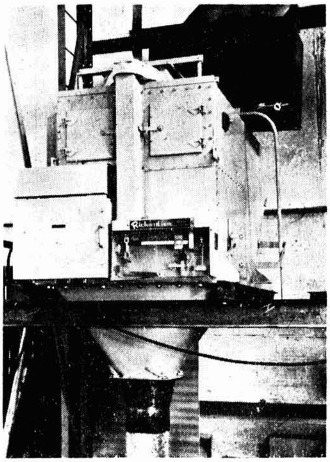
AUTOMATIC FERTILISER SCALE

TEST weighings on the new HA-39 automatic fertiliser bagging scale, made by Richardson Scale Co., Clifton, N.J., US. have passed the one million mark, with no mechanical or electrical failure and no adjustment required, reports the company.

Continuous tests were carried out for five weeks and the company states that during most of that time the scale was unattended. At the one million point it was weighing at a speed of 28 weighings a minute. Accuracy is reported at sigma 2.8 oz. on the 50-lb. of fertiliser).

The test was set up to confirm the scale's rugged construction plus durability of such components as an integral belt-driven feeder, dust-free stainless steel hopper and contact parts, pneumatic discharge cylinder and electrical interlocks.

Only maintenance required during the test period was weekly lubrication of the hopper door fitting. This was necessary because of test plastics degradation and resulting excessive dust, during the course of the test. Under field conditions such maintenance would be reduced.



HA-39 fertiliser scale

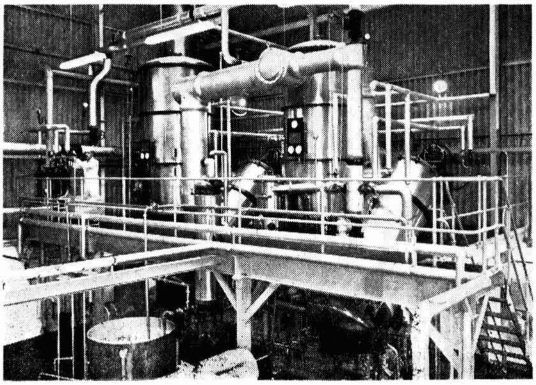
DOUBLE EFFECT EVAPORATORS

ONE OF the latest type double effect evaporators produced by Bennett, Sons and Shears Ltd., 9-13 George Street, Manchester Square, London W1, is shown in the photograph. Features of this plant include provisions for minimising entrainment losses and easy facilities for cleaning.

The photograph was taken in a West Midlands condensary and illustrates a patent double effect evaporator of the external recirculation. This was designed to handle 1,500 gallons of whey per hour when concentrating to 55 to 60 per cent solids. Ease of access to the tubes and tubeplates for cleaning is afforded by hinged doors on the top and bottom of the calandrias. The evaporator is constructed of stainless steel, polished internally and externally, all welds being ground smooth inside, and all crevices removed to conform to the latest hygienic standards.

Apart from satisfying the requirements of economy in steam consumption, the question of reducing entrainment losses was of importance. The latter was achieved by using a sloping calandria in conjunction with a centrifugal type side separator.

The evaporator is a continuous one, and the concentrate is continuously extracted with a Howard rotary pump.



New type double effect evaporator

CHEMICAL PIONEERS

3 Lord Dundonald and the Loshes

The third article in this series on the pioneers of the chemical industry deals with Lord Dundonald and the brothers Losh, the founders of the alkali industry in Britain. The author, Dr. D. W. F. Hardie, is well known as a historian of the Industrial Revolution and of the chemical industry.

WHEN ARCHIBALD COCHRANE (1749-1831) became ninth Earl of Dundonald his family fortunes were at a low ebb. He was to spend the remainder of his life in a series of unsuccessful attempts to retrieve them. In Scotland, where he had an impoverished estate at Culross on the River Forth, the first phase of the Industrial Revolution was stimulating the thoughts and activities of such men as Black, Watt, Roebuck, and the Macintoshes; it was a time of very evident potentialities. Dundonald felt hopeful of achieving his object in this world of exciting change.

While serving in the Navy, Dundonald had observed the great quantities of wood tar, imported from America and the Continent, employed to protect the wooden hulls of the ships. For at least a century attempts had been made in this country to produce tar from coal, in order to obviate dependence on the costly imported product of wood distillation.

Patent Granted

In 1781 Dundonald was granted a patent for 'making tar, essential oils, volatile alkali (i.e. ammonia), mineral acids, salts and cinders from pit coal,' and on his Culross estate he put his invention into operation. Technically, he was entirely successful, and even anticipated William Murdoch in discovering the illuminating power of coal gas. The Admiralty, however, failed to take advantage of this new and indigenous source of tar. It is said that their Lordships of Whitehall were influenced in their attitude by the ship-repairers, who saw commercial danger from this cheaper and all too effective protective agent!

In order to place his venture on a secure financial basis, Dundonald, in 1782, formed the British Tar Company, which sought to find an outlet for its by-product coke by erecting tar-works in the neighbourhood of foundries. Dundonald's personal fortunes, however, remained stubbornly unimproved. It may have been during a retreat from the importunity of creditors that Dundonald, in 1784, was living at Woodside, near Carlisle, the home of his friend John Losh, with whom he engaged in chemical experiments.

The family of Losh (or Arlosh) had been established in Cumberland since Tudor times, and for many years carried on a calico printing works in Carlisle. John Losh, 'the Black Squire of Woodside,' renowned combatant with Scots freebooters, had four sons—John, James, George, and William. John (Dundonald's friend) and James, born in 1756 and 1763 respectively, were educated at Sedbergh School and Trinity College, Cambridge, receiving at the latter some instruction in chemistry from the absentee Bishop of Llandaff, Dr. Richard Watson. George (b. 1766) and William (b. 1770) received commercial training at Newcastle, and William for a time studied in Hamburg, where he began a lifelong friendship with Friedrich, Baron von Humboldt.

In 1794-5, Dundonald invented and patented two processes for producing alkali by double-decomposition reactions of salt with natural potash and of potash with soapers' salts or sandiver, these last being very impure sulphate wastes from soap and glass manufacture. John Losh and Dundonald established a small experimental alkali works at Bell's Close, near Newcastle, and, in September 1797, they took a 20-year lease of a site at Walker-on-Tyne, with the object of producing their artificial alkali on a larger scale.

Original Process

At Walker, the original process consisted in furnacing Russian potash (purchased at £40 a ton) with an equal weight of salt and slaked lime, and finally extracting the mass with water. On crystallisation, potassium chloride first separated, then soda. The potassium chloride furnished a valuable credit, being sold at £12 to £20 a ton to Charles Macintosh and the Marquis of Normanby for alum manufacture. Dundonald and his partner attempted for a time to link alkali-making with the Tyneside lead industry. Since Scheele had found that common salt could be oxidised with litharge, various experimenters had tried to develop commercial processes for producing caustic alkali in this way. Dundonald and Losh's alkali-lead process included production of white lead pigment. It is unlikely that the process was very efficient and, no doubt, its economics rested heavily on the commercial value of the co-produced pigment. Thomas Doubleday, a Tyneside soap-maker, was also persuaded to try the process, but after an expenditure of £1,000, abandoned it.

According to Lonsdale, biographer of the Loshes, 'Dundonald and Losh in their new venture were in part groping in the dark, or trusting to what they could gather from workers in the same groove of inquiry at home or abroad, and chiefly from the latter source.' At a fairly early stage in the alkali-making operations at Walker, John Losh retired to his estate, leaving the management in the hands of his brother William. Both William and his younger brother George, who had intermittent associations with the alkali-making enterprise, had continental contacts.

In 1802, availing himself of the interruption of hostilities following the Peace of Amiens, William visited Paris 'to ascertain what was doing in chemistry.' It may have been as a consequence of this scientific reconnaissance or of a communication from George Losh, also a visitor to France, that Dundonald and the Loshes began to produce soda by a process not significantly different from LeBlanc's. It is not entirely improbable that, knowing the prior art in this country, Dundonald and his associates re-invented the LeBlanc Process for themselves.

From its outset alkali synthesis at Walker-on-Tyne was favoured by remission of the notorious salt duty to a mere thirteenth of its then standard rate. Despite this consideration on the part of the Government, production before 1820, estimated at 100 per cent carbonate, never much exceeded 200 tons a year. The market to be supplied was limited mainly to the local glass factories. There was no soap industry on the Tyne, at that time, comparable to that then rising on the Mersey. It was only in 1821 that Losh & Co. thought it necessary to erect sulphuric acid chambers at Walker; prior to that date they had purchased their acid requirements from Tennant's St. Rollox works.

Dundonald, whose interest shifted from chemical industry to agriculture, appears to have severed his connection with alkali manufacture on the Tyne before or possibly at the time of the entry of Wilson and Bell into partnership with the Loshes. The new concern of Losh & Co. continued to make alkali until the middle of last century. Management after 1831 was in the hands of William Septimus Losh, nephew of John and son of James Losh, Recorder of Newcastle. Although this chemical enterprise on the Tyne never attained the importance of the enterprises of Tennant on the Clyde and Muspratt on the Mersey, it represented the most sustained, determined, first really successful attempt to establish alkali manufacture in this country. Its success, such as it was, entitles Archibald Lord Dundonald, the energetic, aristocratic dilettante, and his associates, the brothers Losh, to be regarded as the effective founders of the alkali industry in Britain.

New Fibrous Wadding by Courtaulds

A NEW resilient fibrous wadding developed by Courtaulds Ltd., bonded Fibroceta, is now being produced commercially by leading British manufacturers of this type of wadding.

It has diverse uses as a filling or padding and as a heat or sound insulant.

Advantages claimed for the product include ease of handling, ability to be welded to other materials by modern radio frequency methods and good insulating properties. The price of Fibroceta compares favourably with that of similar materials in common use.

People in the NEWS

● The appointment of Mr. J. R. Mills to the position of assistant manager of the Research and Development Division has been announced by Mr. R. D. Perry, vice-president and general manager of the Consolidated Mining and Smelting Co. of Canada Ltd. Mr. Mills has held the post of chairman of the company's Research Board since 1951.

Born in England, Mr. Mills graduated from Manchester University with a B.Sc. in chemistry and physics in 1924. He joined Cominco in 1926 and progressed to supervisory positions in the company's chemical and research operations. In 1954 he was loaned to the atomic energy section of the National Research Council. In recognition of his services he was awarded the M.B.E.

● Mr. W. Broomfield, a technical officer (chemist) in the analytical control section of Imperial Chemical Industries' Billingham division, has completed 40 years' service with the company.

● Mr. Cyril Poynton, assistant sales manager, Chemicals Trade Sales Department of Newton Chambers and Co. Ltd. has resigned from the company after being with them for nine years.

He joined Newton Chambers as a representative in April 1948 and in 1951 was appointed supervisor of the Northern Circuit where his work included field supervision and the training of representatives. Four years later he was appointed assistant sales manager.

At an informal leave-taking ceremony, Mr. F. R. James, trades sales manager paid tribute to Mr. Poynton's work in the Sheffield area, and presented him with a travelling clock and a document case on behalf of his colleagues and other members of the staff.

● Head Wrightson and Co. Ltd. announces the following appointments to the board of Head Wrightson Teesdale Ltd. (formerly the Engineering Division of Head Wrightson and Co. Ltd.): Mr. R. H. Sturges (managing) and Mr. R. Purnell.

● Mr. H. W. Graesser-Thomas, F.P.I., honorary treasurer of the British Plastics Federation, has become the first serving member of the executive of the Federation and the first Fellow of the Plastics Institute to be a Warden of the Worshipful Company of Horners. He has been elected Renter Warden.

Mr. Graesser-Thomas was chairman of the British Plastics Federation in 1944 when a link was established between the Horners, representing an ancient craft, and the modern plastics industry, making to-day many of the articles previously made in horn.

● The Huddersfield, Yorks, Labour Party has announced that Dr. R. H. Wilson, an ICI research chemist, will be prospective Labour candidate in the Almondbury Ward for the municipal elections in May.

● Presenting watches to 34 long-service employees of Associated Lead Manufacturers Ltd., Newcastle-on-Tyne, Mr. R. Cookson, a director, referred to the good relations between the firm and its employees. He stated that in the 26 years he had been with the firm, there had never been a strike or more than a few hours' stoppage, at the firm's Hayhole Lead Works, Howdon, or the Howdon antimony works.

● Mr. P. T. Nash, at present sales manager for the south eastern sales area of Fisons Ltd. has been appointed joint managing director of Fisons (Pty) Ltd., South Africa, with effect from 1 May.

● Dr. Frank W. Hurd has been appointed director of research of Union Carbide Nuclear Co., a division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York. Dr. Hurd has been identified with Union Carbide's activities in the atomic energy field since 1943 when he joined the Manhattan Engineering District project at Columbia University as a senior research scientist.

● Mr. Herbert Winning has resigned his appointments of general manager of the glass laminate division of Tenaplas and that of technical manager of the company. Mr. Winning will shortly start consulting work in the name of Herbert Winning and Associates, 39 Brightwalton, Newbury, Berks. This new consulting partnership will be engaged in the engineering plastics field.

● Dr. Maurice Cook has been appointed chairman of the Metals Division, Imperial Chemical Industries Ltd. He has been succeeded as joint managing director by Mr. St. J. Elstub. New directors of the Metals Division are Dr. W. H. Lake and Mr. W. N. Ismay. Dr. J. S. Gourlay, former managing director of the Plastics Division has been appointed chairman of the Paints Division. Mr. J. C. H. McEntee, new chairman of the Wilton Council of ICI, has been succeeded as joint managing director by Mr. R. E. Newell, formerly chief engineer of the Wilton Council.

● Mr. Stewart M. Ritchie, in charge of medical promotion administration, for Menley and James Ltd., Coldharbour Lane, London, SE5, was presented with a diploma in management studies at the dinner last week of the Polytechnic Management Association. Mr. Ritchie joined Menley and James as a representative in 1947.

● Dr. C. Loyal W. Swanson has been appointed agronomist in the research and technical department of the Texas Company. In addition to technical service activities, Dr. Swanson will direct Texaco's research in experimental applications of synthetic plant nutrients.

● Mr. D. N. C. Steedman and Mr. J. D. Allen have been appointed to the board of Wright, Layman and Umney Ltd., chemical manufacturers.

Edward O'Neal, Jr., who, as stated last week, has been appointed chairman of Chemstrand Ltd. He is president of Chemstrand Corporation, Decatur, Alabama, the parent company

● Mr. J. E. C. Bailey, chairman and managing director of Baird and Tatlock (London) Ltd., Hopkins and Williams Ltd., and W. B. Nicolson (Scientific Instruments) Ltd. is now on a short tour of Africa. He is visiting Johannesburg, Durban, Salibury, Ndola, Nairobi and Kampala, to discuss general matters relating to the export of scientific equipment and chemicals with the companies' representatives and agents.

● Colonel John Phillips Hunt, managing director of Staveley Coal and Iron Co. Ltd. since 1954, has joined the board of Newton, Chambers and Co. Ltd., Thorncliffe, near Sheffield. For 20 years, until the end of 1953, Col. Hunt was managing director of Hallamshire Steel and File Co. Ltd., Sheffield, having succeeded his father, Mr. J. E. Hunt at the age of 27. Col. Hunt remains a director of that company.

Technical Films Meeting

Three films were shown at a technical film meeting held by the British Association of Chemists on 13 February. They were: The World that Nature Forgot, (Monsanto Chemical Co.). Operation Hurricane (Ministry of Supply, Harwell), and Nagana, (The Geigy Co. Ltd.),

BRITISH CHEMICAL PRICES

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; cp, carriage paid; ret, returnable; non-ret. pack, non-returnable packaging; tech, technical; comm, commercial; gran, granular.

General Chemicals

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £91; 80% pure, 10 tons, £97; commercial glacial, 10 tons, £99.
Acetic Anhydride. Ton lots d/d, £132.
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 1⅞d.
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, £62 10s; gran., £42; crystal, £44 10s; powder, £45 10s; extra fine powder, £46 10s; BP, gran., £51; crystal, £53 10s; powder, £54 10s; extra fine powder, £55 10s.
Boric Acid. Ton lots, in hessian sacks, c.p. Tech., gran., £71; crystal, £79; powder, £76 10s; extra fine powder, £78 10s; BP gran., £84; crystal, £91; powder, £88 10s; extra fine powder, £90 10s.
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 0⅜d.
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., 4s 6d.
Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £91 10s.
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 SG, 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. 59/60%, 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 10d; for 1-cwt. lots, per lb., 13s 11d.
Iodoform. Under 1 cwt., per lb., £1 3s 5d.; for 1-cwt. lots, per lb., £1 2s 6d.
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., ex-works, 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, £142 15s; orange lead, £154 15s. Ground in oil: red, £162 15s; orange, £174 15s.
Lead, White. Basis prices: Dry English in 5-cwt. casks, £147 15s. 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, £144 15s.
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., 11s 2d; per lb. for 1-cwt. lots, 10s 8d.
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., 15s 1d; 1-cwt. lots, per lb., 14s 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 Salts). 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, £165.
***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 9¼d; 45-gal. drums, d/d, per lb., 1s 10¾d.
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, £135.
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, £130; 45-gal. drums, d/d, £136.
***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, 6s; pure, 6s 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-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., 6s 7½d.
Xylole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 7s-7s 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

MARKETS LOSE BUOYANCY AFTER CUT IN BANK RATE

FOLLOWING the reduction in the bank rate from 5½ per cent to 5 per cent, which confirmed expectations, stock markets lost some of their buoyancy, and moderate declines were recorded both in British Funds and industrial shares. Sentiment has been affected partly by the recent reaction in Wall Street markets, but also by a tendency to await the Budget, which is bound to have an important influence on the outlook.

Although there are doubts whether major tax concessions will be possible, there is continued talk in the City of a cut in income tax as an incentive measure to stimulate industry. If this hope were borne out, it would mean a strong stimulus to higher prices in stock markets. A factor which has tended to slow down activity in markets in the past few weeks has been the knowledge that important new issues are pending which will absorb large sums of investment money.

In accordance with the prevailing trend in stock markets, chemical and kindred shares have not held best prices recorded in the past few weeks, but in the majority of cases were quite well maintained on balance for the month. Imperial Chemical were 41s, compared with 41s 3d. Sentiment is being governed in the main by the belief in the City that the dividend will be restricted to 10 per cent, the same as for the previous year, although it is assumed that group profits will be at a new high level as the further expansion of turnover has probably offset the effect on profits of the price-freeze which has ruled on thousands of the group's products. ICI's loan stock, which is now £20 paid, was at a premium of over £8, and although not keeping best prices, has attracted steady demand for investment purposes: because of the future right of conversion, it combines the merits of a fixed-interest security and those of an equity or ordinary share. Fisons have attracted buyers, and were 1s higher at 55s 6d.

Greeff Chemicals Holdings 5s shares were firm at 17s 3d at which there is a yield of over five per cent on the basis of last year's 17½ per cent dividend. Boake Roberts 5s shares were 10s 6d and yield over eight per cent on last year's 17½ per cent dividend. Hardman and Holden 5s shares held steady at 9s and elsewhere Hickson and Welch 10s shares remained under the influence of the excellent financial results, and at 33s 9d were within a few pence of the level a month ago.

A steady feature has been provided by Albright and Wilson 5s shares, which continued to change hands around 18s. In other directions, William Blythe 3s shares have been dealt in actively around 10s. Monsanto 5s shares at 22s 4½d yield five per cent on last year's 22½ per cent dividend, while Laporte 5s shares strengthened from 18s 6d to 19s, but British Glues and Chemicals 4s shares reacted from 11s 9d to 10s 3d compared with a month ago. Willows Francis 2s 6d shares have strengthened to 4s 6d, Reichhold 5s shares remained firm and Anchor Chemical kept at 11s 6d at which these 10s shares show a yield of over eight per cent on last year's 17½ per cent dividend.

Borax Holdings 5s deferred shares at 23s 9d were well maintained under the influence of the excellent results and the 8⅓ per cent dividend on the capital increased by the two-for-one scrip issue. Group profits have advanced from £2,455,652 to £3,190,115. The shares yield only 1¾ per cent, and are one of the smallest yielding securities quoted on the Stock Exchange, which indicates the confidence that the group's spectacular rate of progress is likely to be continued in view of the $20,000,000 expansion programme in California.

The 6s 8d units of Distillers Co. strengthened to 22s 3d in response to the news that a plan is coming to exchange preference shares of subsidiary companies into a debenture or some other stock of the parent company.

Shares of plastics companies have been fairly steady with British Xylonite at 28s 6d, Bakelite 10s shares 21s 3d and BIP 2s shares 4s 9d.

Commercial News

Steep Rise in Borax (Holdings) Group Trading Profits

Borax (Holdings)

Group trading profits of Borax (Holdings) Ltd., formerly Borax Consolidated, in the year ended 30 September, 1956, were £3,190,115 (against £2,455,652). Net profit was £1,870,786 (against £1,113,100). A final dividend of 6¼ per cent is recommended on the £9 million deferred ordinary, making, with the 6 per cent interim on the £3 million stock, prior to the scrip issue, a total equivalent to 8¼ per cent (against an equivalent of 7¾ per cent). Group carry forward is £2,533,259 (against £1,313,914).

Bowmans Chemicals

Profit of Bowmans Chemicals Ltd., Widnes, for the year ended 31 October, before tax estimated at £17,385 (against £13,896) totalled £35,266 (against £28,631). Net profit amounted to £16,622 (against £11,611). Dividend of 10 per cent (same) is proposed on ordinary and carry forward is £22,780 (against £21,202). Annual meeting will be held at Widnes on 8 March at 2 p.m.

Mr. E. G. Turner, chairman, warns shareholders that, though the company's long-term development programme is promising, results for the current year may be disappointing. Lactic acid and lactate sales rose by quantity and value in 1955-56, but lack of demand from the leather industry led to a falling away in sales of oils and other products. Despite the short-term outlook, he hopes the present dividend rate will be maintained in the current year.

Distillers Group

To improve the group's capital structure and to simplify accounting, directors of the Distillers Company are considering approaching certain preference and preferred stockholders with a view to acquiring their holdings in exchange for a suitable stock of the company. No holder will suffer a loss of future annual income. The subsidiaries in question include the Manchester Chemical Company and the United Yeast Company.

Goodlass Wall and Lead

Goodlass Wall and Lead Industries Ltd. have acquired the balance of the share capital of Gothoven Fry Ltd., which operates smelting and refining works at Germiston and Port Elizabeth, South Africa. Name of the company has been changed to Fry's Metals Ltd.

ICI of Australia and NZ

Consolidated net profits of Imperial Chemical Industries of Australia and New Zealand for the year ended 30 September, at £A2,324,560 were a record. Group sales, at £A36,723,000, were also a record and were £A4,280,000 higher than the previous year. Dividend of 9 per cent (same) is declared on ordinary. Owing to higher operating costs, profits did not rise in proportion to the increased sales.

Hickson and Welch (Holdings)

A £150,000 capitalisation scheme is announced by Hickson and Welch (Holdings) Ltd., Castleford, Yorks. It is intended to capitalise, from reserves, 300,000 ordinary shares of 10s. each to be distributed among shareholders registered on 15 March on a three-for-11 basis. These new shares will rank for dividends for the year ending 30 September 1957. This scheme will be put forward at the annual meeting at Basildon House, Moorgate, London EC2 on 29 March.

Referring to the group's chemical manufacturing activities in his annual statement, Mr. Bernard Hickson, chairman of Hickson and Welch (Holdings) Ltd., said that Hickson and Welch Ltd. had again expanded, completing on schedule its two year capital programme. Output sales turnover and profit were the highest ever. Space for future expansion was assured by the purchase of 17 acres next to the Castleford factory.

Plastic Engineers

Net profit of Plastic Engineers for 1956 was £333,018 (against £79,748). Dividend of 5 per cent (against 17½ per cent) is recommended. The directors report an appreciable decline of turnover with a lower profit margin, arising out of wage awards, higher overloads and higher overloads and higher material costs. A sales drive is being made to increase turnover and widen the range of industries served.

NEW COMPANIES

JENOLITE INDUSTRIES (NORTHERN) LTD. Capital £2,000. Manufacturers of and dealers in chemicals and chemical preparations, including rust removing and rust preventing processes, degreasers and metal surface treatment chemicals etc. Reg. office: Clare Hill, Huddersfield.

N. W. SPRATT AND SON LTD. Capital £100,000. Merchants, shippers, and factors and as manufacturers, importers and exporters of and dealers in chemicals, gases, drugs, disinfectants, fertilisers, salts etc. Directors: M. W. Spratt, W. A. M. Lloyd-Griffith, N. W. Spratt, M. T. Browne, C. C. Coker and R. M. Young. Reg. office: 30 Cornhill, London EC3.

TRU-PINE PRODUCTS LTD. Capital £100. Manufacturers of and dealers in chemicals, gases and disinfectants etc. Director: J. K. Lewis. Reg. office: Waterloo Terrace, Stapleton Road, Bristol 5.

SATISFACTIONS

ACTID LTD. London EC, chemical products etc. Satisfaction 21 January of debentures registered 19 July 1949, 1 February 1950, 6 June and 22 October 1951.

BRITISH CELANESE LTD. London W. Satisfaction 24 January of debenture stock registered 2 October 1943 and 8 November 1944 to the extent of £8,415.

LONDON GAZETTE

Release of Liquidator

LANDORE CHEMICAL CO. LTD., registered office Millbrook Works, Landore, Swansea, manufacturing chemists and fertiliser merchants. Liquidator W. W. Jordan, official receiver and liquidator, Government Buildings, 10 St. Mary's Square, Swansea. Released from 14 January 1957.

Market Reports

More Active Demand for Fertiliser Materials

LONDON Steady trading conditions characterise most sections of the industrial chemicals market with new business continuing on a satisfactory scale, and the main home consuming industries taking good quantities against contracts.

A more active demand has been reported for fertiliser materials and interest in the potash chemicals is sustained with prices on a firm basis. The general price position shows little change on the week.

Pitch and crude tar are moving well in the coal-tar products section, and a good business is being done in creosote oil and cresylic acid on home and export account.

MANCHESTER Reasonably steady trading conditions have been reported on the Manchester chemical market. The alkalis and other leading heavy products are mostly being taken up in satisfactory quantities against contracts, and a fair number of enquiries from home consumers as well as from shippers are coming forward. Most lines are in good supply, with a continued steady-to-firm price position reported. Pressure for deliveries of fertilisers is improving in several directions, including superphosphates and the nitrogenous materials. With one or two exceptions the tar products are meeting with a good demand.

GLASGOW During most of last week steady conditions prevailed on the Scottish market although towards the latter end a little more activity was experienced. Demands have been for normal requirements and covered a varied range of chemicals. The export market was again brisk, with a reasonable demand for fertilisers, the emphasis being on forward bookings. Prices, with some slight alterations taking place, have on the whole been steady.

Change of Name

JOHN SMYTHE (LONDON) LTD. Manufacturers of pharmaceutical preparations etc. Stafford House, Norfolk Street, WC2, have changed their name to Rona Laboratories Ltd.

NEW PATENTS

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

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

AMENDED SPECIFICATIONS

Fluoroalkyl vinyl ethers and compounds therefrom. Air Reduction Co. Inc.
Covering of tablets and other articles. Holroyd, J., & Co. Ltd.

ACCEPTANCES

771 172 Heat exchangers. Koppers, H., Ges.
771 205 N-1-naphthylphthalamic acid herbicidal compositions. United States Rubber Co.
771 216 Incomplete combustion of methane and other hydrocarbon fuels with oxygen, with direct production of mechanical energy. [Addition to 727 865.] Deutsche Gold- und Silberscheideanstalt Vorm Roessler.
771 179 Removing mercaptans from hydrocarbon oils. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.
771 180 1,4-Naphthoquinone addition product. Abbott Laboratories.
771 221 Treatment of water. Permutit Co. Ltd.
770 990 Liquid straining device. [Addition to 713 894.] Batchelor, S. A. S.
771 230 Cyclone apparatuses for separating solids from flowing air or other gases. Aktiebolaget Asbrink & Co.
771 557 Reduction of iron catalysts for hydrogenation of carbon monoxide. Rheinpreussen AG Fuer Bergbau und Chemie.
771 531 Detection and estimation of sulphur dioxide in a gaseous mixture. Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny, & Cirey.
771 442 Means for automatically controlling temperature of drying cylinders. Holt, T., Ltd., Holt, F., and Lee, G.
771 827 Preparing rapid-hardening artificial resin compositions containing hardening agents. Ciba Ltd.
771 559 Electrically conductive reinforced polyester resin compositions. Semtex Ltd.
771 807 Oxidising agent. California Research Corp.
771 478 Water-insoluble nitrogen-containing polymerisation products. Wacker-Chemie Ges.
771 806 Materials for enhancing the growth and improving the quality of plants. Heyl, S.
771 678 Flushing pigments. Farbenfabriken Bayer AG.
771 679 Electrolytic production of titanium and zirconium. Horizons Titanium Corp.
771 563 Dyeing textile fibres with vat dyestuffs. Cassella Farbwerke Mainkur AG.
771 446 Alloy steels. United Steel Cos. Ltd.
771 808 Dyeing aromatic linear polyester fibres and a dyeing assistant therefor. Ciba Ltd.
771 566 Water-insoluble mono-azo dyestuffs. Farbenfabriken Bayer AG.
771 683 Bath for the electrolytic bright deposition of metals. Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler.
771 567 Substituted O-nitro amino compounds. United Kingdom Atomic Energy Authority.
771 809 Para-amino salicylic acid derivatives of 2-pyridyl-(4)-1:3:4-oxadiazolone-(5). Geistlich Sohne AG für Chemische Industrie, E.
771 538 Ferromagnetic non-ferrous alloys. National Research Council.
771 810 Solutions of acrylonitrile polymers. British Celanese Ltd.
771 484 β-Aminomethyl tropolone. Monsanto Chemicals Ltd.
771 568 Process for anodic esterification. Oehman, P. V.
771 569 Polymeric products. Distillers Co. Ltd.
771 453 Carbonated potash. Allied Chemical & Dye Corp.
771 833 Fabric-reinforced polyester resin sheets or articles. Semtex Ltd.
771 695 Electrodeposition of iron-chromium alloy. Yoshida, T.
771 572 Fire-extinguishing compositions. Pyrene Co. Ltd.
771 493 Instruments for measuring pressures in fluids. Wilson, A. C.
771 573 Polymerisation of acrylic acid in aqueous solution. Union Carbide & Carbon Corp.
771 698 N-Carboxyalkyl hexitylamines. Atlas Powder Co.
771 811 Treating wool to improve its resistance to shrinkage. Wolsey Ltd.
771 797 Anhydrous grain-free grease. Texaco Development Corp.
771 798 Stable substantially anhydrous grease. Texaco Development Corp.
771 501 Hot-dip coating with aluminium or aluminium alloys. Kaiser Aluminum & Chemical Corp.
771 626 Aqueous surface active agent compositions. Air Reduction Co. Inc.
771 628 Ozone resistant rubber composition and adhesive. Goodyear Tire & Rubber Co.
771 390 Titanium alloys. [Addition to 757 383.] Rem-Cru Titanium Inc.
771 813 Esters of epoxy-substituted polycarboxylic acids and epoxy-substituted alcohols and their polymers. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.
771 631 Increasing the effectiveness of catalysts for the production of polymerisation products. [Addition to 734 948.] Heraeus, W. C., Ges., and Deutsche Gold- und Silber-Scheideanstalt Vorm. Roessler.
771 578 Aromatic sulphamic acids. Compagnie Francaise des Matieres Colorantes.
771 549 Synthetic resin coating compositions. Du Pont de Nemours, E. I., & Co.
771 843 Organosilicon coating compositions. [Addition to 746 306.] Midland Silicones Ltd.
771 905 Manufacture of artificial yarns. Nai, A.
771 844 Silicone water-repellent compositions. General Electric Co.
771 633 Titanium boride. [Divided out of 748 808.] National Lead Co.
771 581 Oil-soluble petroleum sulphonic acids. Lobitos Oilfields Ltd., Brown, T. F., and Wilson, B. S.
771 515 Steroids. Upjohn Co.
771 634 O, O-dimethyl-O-(β, β-dichlorovinyl)-phosphate. Farbenfabriken Bayer AG.
771 583 Oxidation of propanol and butanol. Celanese Corp. of America.
771 635 Amphoteric surface-active organic compounds. Goldschmidt, T., AG.
771 708 Monoalkali metal acetylides. Badische Anilin- & Soda-Fabrik AG.

771 584 Synthetic drying oils. Esso Research & Engineering Co.
771 814 Butyryl amides. Aktiebolaget Pharmacia.
771 411 Purifying raw materials containing alumina. Grothe, H.
771 815 Solutions of polyacrylonitrile and of acrylonitrile copolymers. Vereinigte Glanzstoff-Fabriken AG.
771 520 Polymeric 1-chloro-1, 2,-difluoroethylene. Dow Chemical Co.
771 640 Isopropyl nitrate. Aktiebolag Nynaes-Petroleum.
771 641 Separators for separating liquid from gas. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.
771 710 Separation of mixtures by means of adsorptive distillation. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.
771 414 Thermosetting compositions and cross-linked plastics produced therefrom. Farbenfabriken Bayer AG.
771 847 Blowing agent for production of cellular plastics. Olin Mathieson Chemical Corp.
771 848 Bis(halopentenoxy) alkanes. Rohm & Haas Co.
771 416 Trichloromethyl halogen benzenes. Ciba Ltd.
771 417 Recovery of glutamic acid. Corn Products Refining Co.
771 849 Pyridyl-alkyl aryl sulphones and salts thereof. Hoffmann-La Roche, F., & Co. AG.
771 850 Sulphones. Hoffmann-La Roche, F., & Co. AG.
771 418 Polyalkylphenylpentenyl halides. Rohm & Haas Co.
771 716 Foamed polyester-polyisocyanate reaction products. General Motors Corp.
771 718 Apparatus and method for cooling thermoplastic materials. Midland Silicones Ltd.
771 719 Regenerating quaternary ammonium anion exchange resins. Dow Chemical Co.
771 420 Urea granules. Stamicarbon NV.
771 855 Derivatives of 4-hydroxycoumarin. Geigy, J. R., AG.
771 856 Hexachlorocyclopentadiene. Pechiney Compagnie de Produits Chimiques et Electrometallurgiques.
771 723 Thermo-setting resin. Esso Research & Engineering Co.
771 859 Heat - hardenable aminoplast resin moulding compositions. Ciba Ltd.
771 861 Butyl rubber compositions. United States Rubber Co.
771 423 N-alkyl-N-sorbitylalkanamides. Rohm & Haas Co.
771 587 Acetoxysilcarbanes. Midland Silicones Ltd.
771 736 Stabilised waxes resistant to discoloration by light. D-X Sunray Oil Co.
771 863 Stabilisers for vinyl chloride polymers and copolymers. Chemische Werke Hüls AG.
771 425 Substituted 2-imino thiazolidines. Knoll AG Chemische Fabriken.
771 741 Stable solutions of salts of diethylstilbesterol diphosphate. Miles Laboratories Inc.
771 743 Desulphurisation of fluid coke. Esso Research & Engineering Co.
771 865 Sulphite diesters and insecticides and herbicides containing them. United States Rubber Co.
771 866 Poly (chlorophenoxyethyl) phosphites and plant growth regulants and herbicides containing them. United States Rubber Co.
771 746 Polymerisation catalyst. Rohm & Haas Co.
771 647 Aluminium alkyls as initiators in polymerising olefins. Rohm & Haas Co.
771 748 Vat dyestuffs. Ciba Ltd.
771 650 Monocyclopentadiene by thermal depolymerisation of dicyclopentadiene. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij.
771 869 Salt of vitamin B_1. Soc. des Usines Chimiques Rhone-Poulenc.
771 752 Converting methyl trichlorosilane to dimethyl dichlorosilane. Union Carbide & Carbon Corp.
771 875 Monoquaternary ammonium compounds. Henkel & Cie. Ges.
771 754 Antibiotic compositions. Pfizer, C., & Co. Inc.
771 431 Dinitrobenzoxazoles. Dow Chemical Co.
771 435 A quinuclidine derivative. Ciba Ltd.

Key Industry Duty

THE FOLLOWING additions and deletions to the articles exempted from key industry duty till 18 August 1957 have been made by the Treasury:

Additions *n*-butyl alcohol, di-*n*-butyltin maleate.

Deletions Tubing of neutral glass, of a kind hitherto exempt, *p*-acetamidophenyl salicylate, cobalt arsenate. 4:4-diaminodiphenylmethane (an aminodiphenylmethane) of a purity not less than 97 per cent, *N-mono*ethylaniline, ethylene glycol monobutyl ether (an ethylene glycol ether), maleic anhydride, *DL*-malic acid, phenoxymethylpenicillin, piperazine.

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