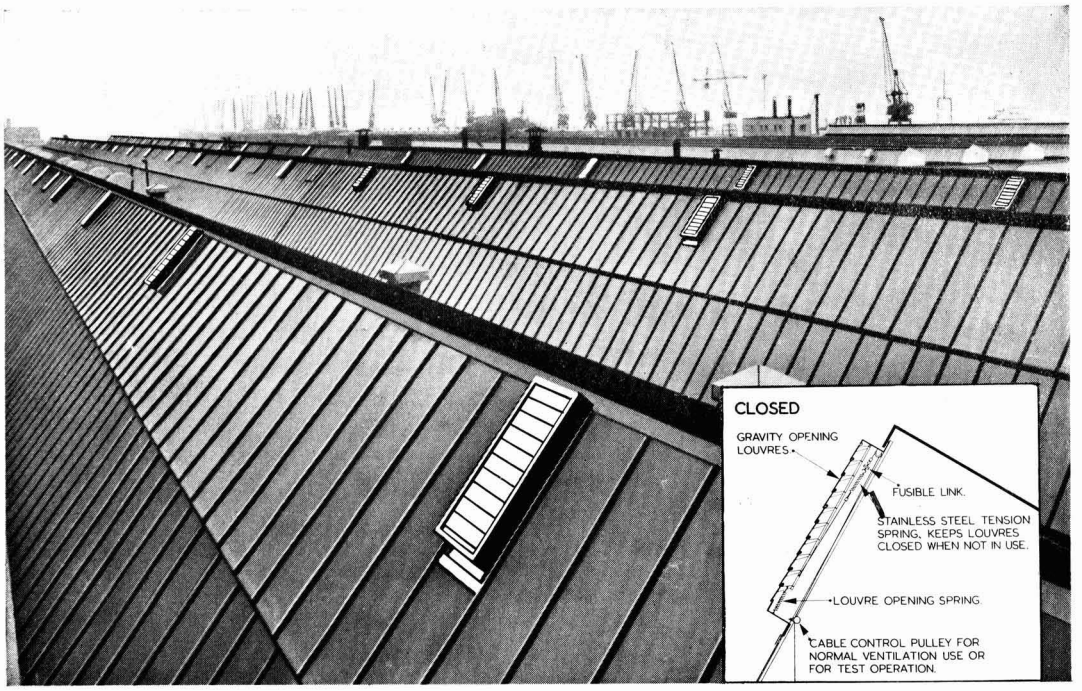
Chemical Age

Handling Alkylaluminium Compound (page 963)

VOL. 77 No. 1978

8 June 1957

VENTILATION *AND* FIRE PROTECTION!



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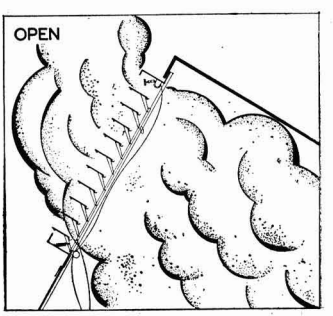

The insets illustrate the action of the ventilator as a Heat and Smoke Exhaust. In the event of fire, the fusible link fuses, providing Automatic Escape for Super-Heated Air and Smoke.

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INDEX TO ADVERTISERS

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

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INDEX TO ADVERTISERS

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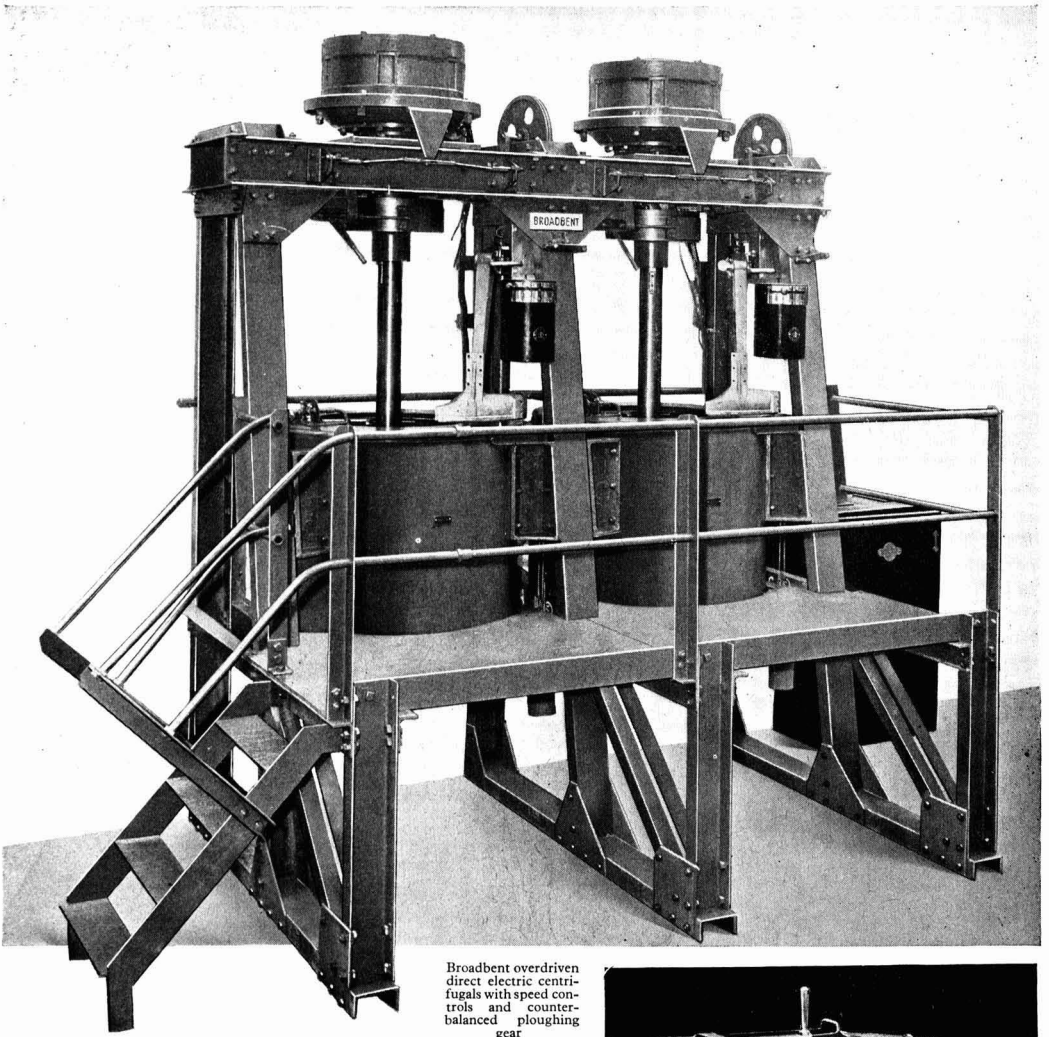

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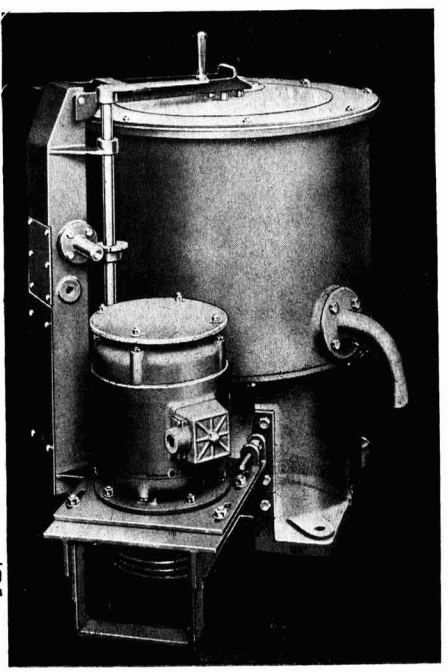

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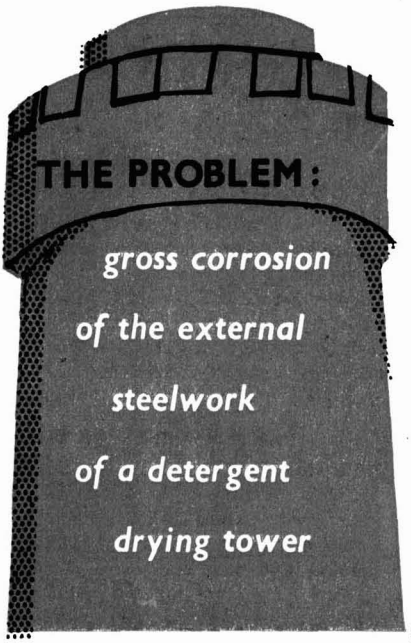

High humidity, high temperature and chemical vapours are part and parcel of the detergent drying process at the works of Joseph Crosfield Ltd., Warrington. The detergent slurry is dried in a tower at 100°C. and when the moisture has been freed from dust, it is exhausted at the top of the tower, via a wet scrubbing system. This process quickly eats into the external steelwork and conventional paints have given only short-lived protection.

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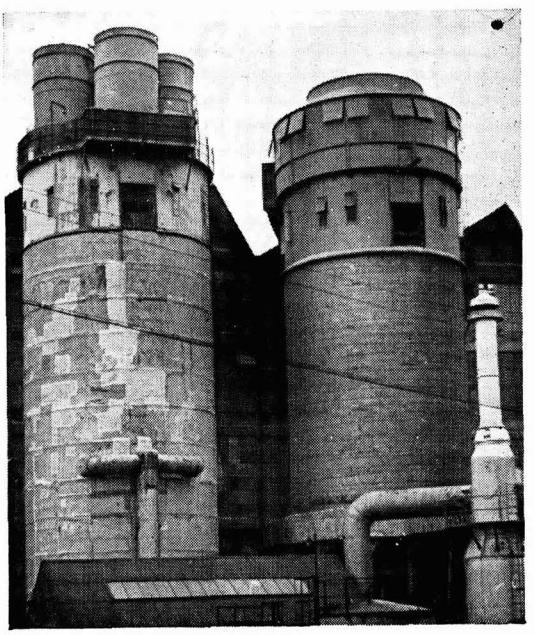

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IN THIS ISSUE

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MONEY FOR RESEARCH

INFORMATION concerning spending by industry is by no means precise and certainly little attention has been given to industrial research expenditure. This is easily seen when annual accounts are studied of the well-known chemical companies. Even personal communication with the large companies has elicited the fact that generally no figure is available for research expenditure.

There is, for various reasons, and some of them reasonable ones, a reluctance to disclose the cost of research.

It has been suggested that there is considerable difficulty in finding the cost of research by virtue of accountancy procedures, particularly in research departments. It may well be that there is no clear dividing line of what is and what is not a research cost. In some instances, the general technical staff or facilities are used on occasions for research and development work, and a careful note of time, materials used etc., may not be taken. There is, too, the vexed question of pilot plants which produce saleable outputs.

Recently, Lord Heyworth, chairman of Unilever Ltd., in his speech on research at the company's annual meeting, very adequately covered the subject. However, on the interesting point of what did research add up to in terms of the proportion of Unilever's resources, Lord Heyworth said that 'To measure the total effort in terms of monetary cost would be misleading, since research in the US is more than three times as expensive as in Europe.' (Unilever, of course, have considerable US interests and a research establishment at Edgewater, New Jersey). He therefore suggested that knowing the number of people engaged on research is a safer guide.

Now, in a recent report on behalf of the Science and Industry Committee, (see page 967) C. F. Carter and B. R. Williams (*Industry and Technical Progress*) estimate that the cost of conducting research is between £3,000 and £5,000 per qualified scientist (including his assistants and materials). In Unilever, of 2,250 persons engaged on research and development 'exactly 666 are qualified scientists and engineers.' If the cost of a qualified scientist engaged on research is £5,000 this would make Unilever's research expenditure £3,330,000 or one-fifth per cent of total turnover. (Turnover in 1956 was £1,671 m., of which £37 million was spent on new projects). The range of products manufactured by Unilever is, of course, not as diverse as that of ICI.

In 1954 the Association of British Chemical Manufacturers undertook, at the request of the President of the Board of Trade, a survey on the chemical industry's research expenditure. This census gave a gross turnover figure for the chemical industry of £1,400 million with a research expenditure of £14 million. It has to be remembered that the total turnover represents much duplication, particularly in the case of raw materials. These appear in the suppliers' sales figures and again in the sales returns of the chemical manufacturers who process them.

More will be known about the industry's research expenditure later this year when the ABCM publish results of the second supplement to the original survey, which is now in hand.

In the meantime, Imperial Chemical Industries, whose activities are considered by the chemical industry to reflect the general trends of the large and

progressive chemical concerns, have recently published the cost of their research. During 1956, ICI spent £12 million which is 3.1 per cent of its turnover. It is pointed out, however, that this figure of £12 million undoubtedly includes an unspecified amount that was spent on titanium research. This figure of 3.1 per cent brings to mind the opinion of the Monopoly Commission with regard to research expenditure by the British Oxygen Company which, it will be recalled, was 2.1 per cent of turnover. In view of ICI's 1956 research figures, it would seem that BOC's research costs are comparable with ICI. This expenditure of 2.1 per cent is even more interesting when one remembers that BOC's interests are much narrower than ICI's.

Of interest is the trend of ICI's research expenditure over the last few years. The company did not quote any figures for 1950, 1951 or 1952. In 1953, turnover was £281.9 million and of this £7.5 million was spent on research and development, approximately 2.66 per cent. In 1945, turnover was £352 million, of which £8 million was devoted to research etc., that is 2.2 per cent of turnover, and in 1955 when turnover was £411 million, research cost ICI £9.44 million or 2.29 per cent.

This year, too, ICI have further indicated that of the total sum set aside for research, 40 per cent was directed towards the improvement of existing products and processes; a further 40 per cent was spent on work aimed at the discovery and development of new products and processes; and the balance of 20 per cent was accounted for by the provision of basic scientific and technical information.

One other point of interest in this latest ICI annual report is the statement that the relation between the company's turnover and total expenditure on research is similar to that of more progressive US chemical companies.

In 1956, Fisons spent 2 per cent of turnover on research which represents expenditure by their four types of business—that is, Fisons Ltd., Whiffen and Son, Bengers Ltd. and Genatosan Ltd. In these last two, and certain sections of Whiffen and Son, research expenditure is believed to be considerably more, amounting to possibly 6 per cent of turnover. Total research expenditure was £800,000 last year.

In *Chemical and Engineering News*, 1957, **35**, No. 20, (May 20, 20) the latest C & EN survey indicates that pharmaceutical companies still do most research (as is the case in this country) and this year plan to spend 5.3 per cent of their sales turnover on research. This is the highest rate yet, for in 1956 they planned to spend 4.7 per cent and in 1955, 3.8 per cent. US chemical companies, however, plan to spend 4 per cent for research (last year it was 3.1 per cent, and in 1955, 2.9 per cent).

US chemical process industries will not be spending as much this year as last, only 1.9 per cent compared with 2.4 per cent last year.

Perhaps of greater significance is that this US survey indicates how money will be spent for research. Basic research is to get a smaller share as will new products. Emphasis this year appears to be on product improvement. Since last year the emphasis was on new products and also on basic research, this new allotment of research money is logical.

In Germany, there has been a marked extension of research installations and technical laboratories. It is interesting to record that each of the big three German chemical producers spends more on research in relation to turnover than do ICI or the US chemical industry. Figures for the past three years which have remained surprisingly constant are: Bayer, 4.5 per cent of total turnover in 1954, 4.3 per cent in 1955 and 4.8 per cent in 1956; Badische Anilin und Soda-Fabrik, 5 per cent in 1954, 4.8 per cent in 1955 and 5 per cent in 1956; Farbwerke Hoechst, 5.5 per cent in both 1954 and 1955 and 5.4 per cent in 1956. During those three years, the capital of the three companies has been increased substantially; Bayer by about 30 per cent; Badische Anilin by 40 per cent and Hoechst by between 35 to 40 per cent. The proportion of turnover spent on research has remained fairly static and in each of the three years turnover of the companies has increased and has remained closely related to the 'rule-of-thumb' of 'turn your share capital over three times each year.'

This emphasis on research in Germany has been particularly necessary as the chemical industry there is in a less favourable position than most of its competitors in regard to its raw material basis, since it has no overseas resources of its own.

In this country, if the trend indicated by ICI is reliable, more money is now being spent on research, and having regard to the increasing competition in chemicals, more money will be spent on research in the future. This is vital if the UK industry is to enter the projected European common market in as strong a position as possible.

MINERAL MONOPOLY

A reminder that a few mineral monopolies still exist in this widening technical world is given in an article in the excellent *Danish Foreign Office Journal* (1957, 23). Cryolite has been mined in Greenland for more than a century—in the past fifty years over 1,000,000 tons have been extracted from mountain-side granite. Natural cryolite occurs sufficiently abundantly to make its mining economic only in this arctic Danish territory. Originally cryolite was used for soda and alum production, but its main function today is as a flux material in the aluminium industry. It is also substantially used in making enamels and opalescent glass.

Cryolite users are not utterly dependent upon the Danish natural mineral—they have the choice between the mined material or the 'artificial' cryolite now made in a number of countries. Some 38,000 tons of cryolite were shipped from Greenland last year; of this amount, about a quarter went as raw product to the US, the rest being sent to Denmark for refining.

Refining gives Denmark worldwide markets for by-products—fluorite, hagmannite, and siderite are used by iron and steel industries, galena, zinc blende, and chalcopyrite are sold to metal-extracting works, and a cryolite dust insecticide is produced from the extractor fan 'waste' at the refining works.

There seems little likelihood that the Greenland deposits will become exhausted. The cryolite occurs as fairly pure nodules in the granite; at Ivigut in South-West Greenland open-cast blasting and drilling proceeds all the year round on day and night shifts. Geo-prospecting for fresh deposits in the Greenland mountains is steadily carried out.

Cryolite, however, may not remain Greenland's major mineral product. Large-scale lead and zinc mining has recently been started in the remote north-east. It is known that gold, silver, nickel, graphite, and coal exist there, but past efforts to mine these have mostly been beaten by the severe climate, navigation difficulties, and the stubbornness of the rock encasing the deposits.

SAFE HANDLING METHODS FOR ALKYLALUMINIUM COMPOUNDS

Results of US Investigations

KARL ZIEGLER'S announcement of the formation of olefin dimers in 1952 has brought into commercial realms the alkylaluminium compounds. These compounds are dangerous to handle but there has until now been no safe-handling techniques laid down.

Affinity for oxygen and hydrogen compounds is the reason for difficulty in handling. The hazard involved is violent fuming when the trialkylaluminiums are exposed to air. If impure, they are a source of ignition for other materials. Thermal decomposition of the substances promotes an explosion hazard.

Safe handling of alkylaluminium compounds has been investigated by James E. Knap and his co-workers in the development department, Carbide and Carbon Chemicals Co., US (*Industrial and Engineering Chemistry*, 1957, **49**, No. 5, May, 874). They report that while various techniques have been developed for handling small quantities of triisobutylaluminium and diisobutylaluminium chloride on a laboratory scale, there is no substitute for alert caution. Their watchwords for handling these aluminium alkyls are 'Keep them blanketed with inert gas.' Under an atmosphere of nitrogen or argon, and out of contact with reactive materials, they are quite safe.

Laboratory handling procedure described by Knap *et al.* makes use of filter flasks. The side arm is connected by rubber tubing to a glass tube through a stopper in the neck of the flask. This stopper is sealed to the flask (General Electric Glyptal alkyd resin No. 2592 was used). In addition, for greater safety, the stoppers can be wired on. A purge stream of gas is introduced at the neck and vented at the right side arm. Liquid can then be poured out of the side arm. It is recommended that the purge be re-established at short intervals by erecting the flask, to prevent pressure from building up in the reservoir vessel.

Handling Flasks

Some pressure builds up in the flask on standing (about 2 lb. per sq. in.). It is sufficient to cause a vapour effluence when the rubber tubing at the neck of the flask is removed. The tube through the stopper should, therefore, not be allowed to dip into the liquid. If liquid does enter the tube, the alkyl may be forced out through it by the pressure in the flask.

Where manipulations involve transfers to and from equipment a dry box is recommended. Infra-red cells, ampoules, viscometers, centrifuge bottles and oxidation cells can all be filled using this device. Even hypodermic amounts of alkyls can be transferred by wiping the needle before removal from the dry box, the tip being inserted in a cork or rubber stopper to prevent oxidation at the opening.

Equipment having spherical, ground-glass joints should be used whenever possible in laboratory reactions, Knap and his co-workers state. Stopcocks should be avoided, particularly in contact with the liquid, to prevent 'freezing' and leakage. If stopcocks cannot be avoided, a secure clamp should be used to prevent leakage. No cure for 'freezing' has been found, as all greases are attacked to some extent.

Destruction of small quantities of alkyls or removal from equipment can be carried out by means of a mixture of about 25 per cent isopropyl alcohol and butyl ether. More isopropyl alcohol can be added if the quantity of alkyl is large or if the reaction is violent. When a diluent such as a hydrocarbon solvent can be added in large quantities, water can be used. More than one gallon of alkyl compounds should be dumped where a fire is no hazard, or should be deliberately burned.

Production Considerations

For development or production scale work, mild steel is reported as a satisfactory material of construction for either triisobutyl aluminium or diisobutyl aluminium chloride. The best flexible tubing appears to be polythene, although even this is not satisfactory for isobutylaluminium dichloride. For service in contact with the vapour above the compounds and intermittent contact with the liquid Tygon and rubber have been satisfactory, although both harden on continued exposure. Steam hose has proved satisfactory in development-scale operations, but it should be examined frequently and replaced at intervals. Special cylinders are in use for inter-plant transfer. Standing four feet high, they hold approximately 12 gallons. At the top are: a relief valve, set to relieve at 25 lb. per sq. in., a gauge, a Hoke purge valve and a Hills-McCama diaphragm valve for filling. The bottom valve is a Durco plug cock with a Teflon liner.

For nearly all permanent or temporary lines in a unit, multiple valving arrangements and networks of inert gas purging lines with entries for deactivating solutions and washing liquids are required.

For filtration, of diisobutylaluminium, porous stainless steel filters and ceramic filters have been found suitable.

It is stressed by Knap *et al.* that when equipment has been deactivated with isopropyl alcohol and butyl ether and washed and steamed, it is important to remove all traces of these compounds and leave the equipment clean and dry. An instance is reported of a severe reaction when a filter with residual solvents came in contact with diisobutyl aluminium chloride.

Tests with triisobutylaluminium and diisobutylaluminium chloride showed that the undiluted material burned holes in adhesive tape, cloth, and polythene sheeting in the presence of air. Similarly 'holes are burned in the skin wherever the undiluted compound makes contact.'

Experience of the authors is that all personnel burns were superficial, very slow healing, and extremely painful. Affected areas should be flooded immediately, preferably with water, to remove material and lessen reaction with the skin. Because of the intense pain, the Carbide and Chemicals Co. medical department at Charleston, has authorised the immediate intramuscular administration of $\frac{1}{4}$ grain of morphine to personnel burned by triisobutylaluminium or diisobutylaluminium chloride. Until the drug acts, some relief can be obtained by immersing the burned part in ice-water. Even the issuance of Demerol as a sedative for home use in cases of these burns has been authorised.

Strict inspection is required to prevent leakage in the plant, and these workers recommend that caps should be worn by operators. When transfers are being made full-face masks should be worn, and operators should wear gloves. Rubber and leather aprons, to protect clothes, have proved to be fairly resistant.

Toxicity of fumes of diisobutylaluminium chloride at strength of one gall. per 2,000 cu. ft. of volume has been tested using rats. Exposure for one hour killed one rat out of six. The toxicity of fumes from triisobutylaluminium is stated to be somewhat less.

Fumes are white and have an unusual musty odour so being detectable even in small concentration. Personnel exposed to fumes should be examined for possible lung or bronchial injury. An attack of 'fume fever' is a result of inhaling the vapours. Reasonable ventilation of enclosed areas is stated to be sufficient protection for daily operation against vapours. In an emergency, a gas mask would provide adequate protection. In the case of the chlorides, acid canisters are suggested.

Fire Studies

Fires involving samples of aluminium alkyls from 0.5 pint to five gallons in various confined areas are being studied at Carbide's fire research laboratory. It is stated that burning triisobutyl aluminium liberates about 3,000 BThU per minute and presents a considerable extinguishment problem.

Small fires due to spillage or confined to open-topped vessels, can be extinguished with high rates of application of carbon dioxide. Generally, however, 'dry chemical' extinguishers appear to be more effective since carbon dioxide offers less protection than the radiant heat-absorbing cloud produced by the 'dry chemical' extinguisher.

Water and aqueous, mechanical foam have been applied to fires and spillages of five gallons of triisobutylaluminium. Investigations show that although water extinguished fires when applied at the rate of one gallon per minute per sq. ft. of surface, the reaction was very violent. With foam applications even more intense explosions resulted: Carbide and Carbon Co. are continuing with tests to find a satisfactory fire-extinguishing medium.

DISTILLATES

★ Two chemical industry experts who have done much work on the development of flame retardant processes for clothing textiles are Mr. J. Kerr of Peter Spence and Sons Ltd., who are marketing a product known as Lifeguard, and Mr. W. E. K. Piercy of Albright and Wilson Ltd., who through a company jointly owned with Bradford Dyers' Association Ltd., have developed Proban.

Mr. Kerr and Mr. Piercy represented the Association of British Chemical Manufacturers on the British Standards Institution committee which has just recently reported on the flammability of apparel fabrics (see page 972). They have recently been appointed to the BS technical committee that is at present revising BS 2081 dealing with the same subject.

Other representatives on the committee which has just reported include Mr. J. Tankard (British Rayon Research Association), Mr. F. W. Thomas (British Cotton Industry Research Association), Mrs. J. O. Paton and Mr. L. Joluffe (DSIR), Mr. D. I. Lawson (DSIR and Fire Offices Committee joint research organisation), and Dr. J. P. Bull (Medical Research Council).

★ ALEMBIC has just received details of the junior chemical laboratory kit of miniature Quickfit components. This is no toy, for the components enable a dozen or more different sets of all-glass apparatus to be assembled to carry out the common reaction, distillation and other techniques in chemical preparations.

Each piece is made as its macro equivalent and is said to be useful for the research worker doing gramme scale preparations. It is suitable for students as no additional supports or clamps are needed—the box opening out to form a stand on which sets of apparatus are clipped.

The new Quickfit kit in its case

★ ONE OF THE week-end talking points among Labour politicians seems to be the desirability or otherwise of nationalising Imperial Chemical Industries. Now is, of course, the between-general-election policy-making period and there is no doubt that many more senior Labour members will come out on one side of the fence or other.

Sir Alexander Fleck can, if he wishes, weigh against left-wing nationalisers, the warnings of two once powerful party spokesmen. First, Sir Hartley Shawcross, former Attorney-General and President of the Board of Trade and secondly Mr. R. R. Stokes, who held the seals of office at the Works and Materials Ministries.

How much weight these views would carry if nationalisation should become an election issue is a doubtful factor. Sir Hartley would seem to have lost much of his popularity in the party, while it must not be forgotten that Mr. Stokes is an industrialist himself, being chairman of Ransomes and Rapier.

But Mr. Stokes speaks with experience, for he said that earlier investigation had shown that ICI's arrangements with US chemical interests were so complicated with regard to the use of 'US patents on which they very greatly depend.' that it would not be practical successfully to nationalise them. He thought a Labour Government could get all it wanted by control.

At any rate, Alembic hears that undaunted spirits at ICI are already laying the odds as to who will be the next spokesman against nationalisation.

★ MANY scientists will be disappointed that the Government still refuses to bring all aspects of scientific research under the wing of a new Ministry. At present, the machinery for co-operation between the dozens of organisations, official, semi-official or completely unofficial, is highly complex.

The creation of a new Ministry of Science would not solve all the vast problems facing the scientist, particularly in the field of recruitment, but it would greatly help the promotion of science in all its many aspects.

At present it seems that most Government departments have a finger in the scientific pie; one overall Ministry would surely help in the determination of priorities and make for an all-round improvement in the direction of the country's organisation for scientific research and development.

★ WHEN he recently visited the new Roderic Hill building of Imperial College, Alembic began to think that educational establishments had changed since his day. It was not until he wandered by accident into the old City and Guilds College that he realised just how great the change was. He thought of other colleges he had visited, in particular, one technical college, which shall be nameless, where the metallurgy laboratory was situated in what had been the borough mortuary until the corpses were removed to more palatial surroundings. Many other colleges were in situations which were just as unsuitable if less macabre.

The new building, which is to be shared by the chemical engineering and aeronautical departments, is, Alembic hopes, a foretaste of the technical university of the future. The emphasis throughout is on lightness, brightness and spaciousness and the laboratories, admittedly polished and painted for the occasion, are places where a man can work without being distracted by all the little irritations which occur in less well designed buildings.

Present teaching staff of the chemical engineering department is about 25 and there are about 100 postgraduate students together with some 150 undergraduates.

★ CONCERN among the world's scientists is mounting at the continuance of atomic and hydrogen bomb tests, the subject of last week's leading article in CHEMICAL AGE. Dr. Linus Pauling, head of the chemistry and chemical engineering department of the California Institute of Technology, has secured the signatures of 2,000 fellow scientists to a statement he has prepared urging that further tests be stopped by international agreement.

In an address which he gave in May at Washington University, St. Louis, Dr. Pauling said that scientists experienced in the biological effects of radiation were in general agreement about the effects of hydrogen bomb tests.

At the annual conference of the UK Chemical Workers Union, held last weekend a resolution was adopted urging the Trades Union Congress to press for an immediate inquiry into the health hazards arising from the extended use of radioactive materials for medical, industrial, power and military purposes. After the meeting. Mr. R. Edwards, MP, general secretary, stated that the union was satisfield with present safety precautions, adding that everything was being done that could be done in the light of present knowledge, but that not enough was known.

Last week's CA leader called for British initiative in the setting up of an international radiation hazards committee.

Alembic

AN ECONOMIST'S VIEW OF ICI

Liverpool University Lecturer at Widnes One-Day Conference

TRENDS in automation in the chemical industry and an analysis of the position occupied by Imperial Chemical Industries Ltd. in relation to monopoly considerations were the main topics discussed by Mr. N. J. Cunningham in a one-day conference at Widnes. Subject of the conference was 'Capital and labour in the chemical industry'. Mr. Cunningham is a lecturer in the Department of Economics, Liverpool University.

'The chemical industry,' he said, 'is a very loosely connected industry using a vast number of raw materials and producing an even greater variety of finalised products, and tied together mainly by the similarity of the processes employed.

'There is little doubt at all that automation, as we know it, eliminates many jobs, particularly unskilled jobs, and it is for this reason above all that many people fear it.'

Automation in the chemical industry was a tricky subject to deal with, said Mr. Cunningham, owing to the variety of definitions applied to it. Two main principles were involved—(1) the continuous flow of materials from process to process and (2) the automatic control of production, both as to quantity and to quality. In this respect, automation in the chemical industry was going ahead faster than in any other industry. Two examples which illustrated that were a US gas producing plant which was fully automatic, employing only two production workers, and a new magnesium plant which, costing $40 m. (about £15 m.), would employ 400 people.

Employment Rise

Despite this trend to automation, employment in the industry had not fallen but had risen slightly on the operation side and had risen sharply in respect of clerks, supervisors and technicians. This meant that although low-grade jobs were eliminated, higher-grade jobs were created. The problem arising was that people displaced from the low-grade jobs were not automatically, nor even usually, the ones to go into the high-grade posts. The problem had never become acute, however, because new products and cheaper processes permitted by automation had helped the whole industry to expand and so displaced people had generally been able, with a certain amount of training sometimes, to find broadly similar jobs elsewhere in the industry. If automation continued at its present rate and the expansion of the industry slowed down, then the problem might emerge in a more acute form.

So far as this country was concerned, he could not see automation taking place fast enough in the chemical or in any other industry, in the near future, to cause large displacement of labour. Automation involved heavy investment and the amount of investment possible at the moment was severely limited by the pressure of consumption and the great expenditure. Also the bottleneck in the supply of expert programmers and technicians was making itself felt and would take many years to overcome. However, if other countries were going ahead with automation faster, the economic problems created might be far greater than looking after workers who were displaced in the race for technical progress.

The future of the chemical industry could not be considered without taking account of the future of the whole industry because the industry lived by selling its products mainly to other firms, not directly to the public. From this standpoint, there was no danger of a return to the conditions of the 1930's, although minor recessions might occur from time to time. The chemical industry had been expanding faster than the rest of industry and as far as one could see this should continue as the synthetic products of the chemical industry, often lighter, more durable and cheaper, were substituted for the natural products. That obviously could not continue indefinitely but he dared not predict when the rate of expansion of the chemical industry would slow down in relation to the rest.

ICI's Position

Dealing with the more controversial aspects of the industry, Mr. Cunningham said:

'I do not imagine that ICI will reappear in the Labour Party's next election programme for nationalisation. The punitive arguments in favour are not impressively strong and the practical difficulties of disentangling this highly complicated industry are far too serious.'

Mr. Cunningham said that in the new monopoly laws, control of 30 per cent of output was considered to be a *prima facie* evidence of monopoly and firms in such a position would be subjected to investigation by the reconstituted Monopolies Commission.

At various times the chemical industry had been involved in all the different forms of monopoly, he said. After explaining the mergers which led to the formation of ICI in 1926, Mr. Cunningham continued: 'It is impossible to say with accuracy what degree of monopoly exists in the chemical industry; everything depends on how you define the industry. The official definition includes many activities in which ICI do not take a part and ICI have many activities which are not covered in statistics for the chemical industry. ICI's own view of the matter is that they control about one-third of the entire industry and if one takes the industry to cover soap, fats and petrochemicals, then this is the case since ICI's turnover of £411 m. in 1955 was almost exactly one third of the total industrial turnover of £1,240 m. and ICI's labour force of 115,000 almost one third of the total labour force of 357,000. These figures are misleading and if the soap and fats section were deducted from the account, ICI controlled more like two-thirds than one third of what was left.

Even this did not show a great deal because one could only argue about monopoly in terms of one product at a time, not in relation to an extremely diverse collection of products.

100 Per Cent Monopoly

If individual products were taken, then ICI had a 100 per cent monopoly in some lines, such as Terylene, yet produced a relatively small proportion of other products such as paints and petrochemicals and pharmaceutical products. 'If you try to be exact and specific on this question you are likely to end in pretty deep waters and I think we should content ourselves by the generalisation that the industry is heavily monopolised without stating exactly how highly monopolised it is.'

According to the National Institute for Economic and Social Research, ICI was the largest company in Britain, except for the Shell Transport and Oil Co. which was partly British, partly Dutch and which had most of its assets outside this country.

No other firm handled anything approaching the range of products of ICI as indicated by the titles of the main divisions—alkali, general chemicals, lime, salt, dyestuffs, pharmaceuticals, metals, Nobel, leathercloth, paints, plastics with the special organisations of the Billingham division and Wilton Council, etc. In addition there were 97 subsidiary undertakings, many of them specialising in particular processes and products, and mostly operating under different names to ICI. Products ranged from penicillin to zip fasteners, from sulphuric acid to motor car draught excluders.

Sooner or later the Monopolies Commission would be faced with the question of whether the public interest was best served by having all these diverse activities under single financial control. There were strong arguments for and against this kind of organisation. In other countries with large chemical industries similar large monopoly organisations had grown.

'The principal argument, I would say,

is largely a technical one. Although the various products may be so startlingly different, they are all related in one way or another. The products of one process may be the raw materials of another. Similarly plants have been set up to process formerly useless by-products. Some processes have to be carried out on a large scale to be economical, for example Terylene and titanium, the cost and price of which tend to fall as output increases.'

A further telling point on the technical side was connected with research. The chemical industry was a rapidly developing industry and probably there was no other industry where scientific research was more closely linked with industrial production. There was a great deal to be said for centralising research; since it avoided wasteful overlapping, it could concentrate the resources of much larger and better equipped laboratories on a particular line and it could make use of many of the incidental results.

The chemical industry could present a strong, but by no means overwhelming case for super-monopoly. The financial strength of these large organisations could be an advantage, especially if the industry was subject to severe fluctuations. The larger organisations were generally better able to weather a slump. Further, if there was a wide range of activities in one firm, when one was down, it was highly probable another was up so that a certain amount of stability was achieved.

Financial Advantage

Further possible financial advantage was that the profits from existing activities might be available to finance the development and extension of others. One of the main problems facing small and medium sized firms was that it was exceedingly difficult and expensive to raise capital in the markets to finance new developments and nobody knew how many promising industrial developments had been stillborn because of that. The chemical industry was fortunate in that it contained such a big, profitable organisation with the resources to finance any promising new developments which might arise. Finally, ICI itself put forward the argument that this merger was forced upon the industry as a defence against the number of large undertakings in other countries.

Chemicals had generally been in short supply in industry in the immediate post-war years and in various times since, such as the Korean war, yet there was little evidence that prices in the chemical industry were disproportionate to other prices. The rate of return on all the capital invested in ICI was above average, although dividend payments were relatively modest. 'I think there is possible evidence of exploitation in the figures given in ICI's 1955 annual report. This shows that since 1948 the wage cost per unit of output remained almost constant despite wage increases.

'It seems, therefore, that productivity was improving at a faster rate and prices running at a slightly faster rate than for the rest of industry. Unless the difference was absorbed by higher material prices, which does not appear to have been the case after 1952, it seems as though there may be some grounds for saying that ICI has been using its monopoly position in order to retain most of the advantages of increased productivity in the form of increased profits, rather than passing them out in higher wages and lower prices.

'Against this, nearly all of the increased profits were retained and ploughed back into the business. This may not be altogether desirable, but taking the imperfections as they stand today, this is a desirable policy from the national point of view. Further, a share of the increased profits were passed on to employees via a profit sharing scheme.

'Nationalisation may be a useful weapon for a Government to keep in reserve in case the controllers of ICI ever started to abuse their great powers, but there is no reason to suppose that it will ever be required for that purpose.'

Distillers—Hercules Cumene Phenol Process Now Used Extensively

THE current issue of Angewandte Chemie (21 May, 313) contains a further article by Professor H. Hock and Dr. H. Kropf on 'Autoxidation of hydrocarbons and the cumene phenol synthesis.' Hock, with co-worker Lang, was the originator of this process (*Ber. dtsch. Chem. Ges.* 1944, 27, 257) which employs as raw materials benzene and propylene from petroleum cracking. From these isopropyl benzene is synthesised and is then air-oxidised to cumene hydroperoxide which is finally split to produce phenol and acetone. According to Professor Hock some 100,000 tons yearly or about 25 per cent of global synthetic phenol is produced via this process. (It is assumed that the phenol figure mentioned is entirely from synthetic processes—world production of synthetic phenol is estimated at 400,000 tons a year).

In this country, the Distillers Co. Ltd., and Hercules Powder Co. in the US, both working independently developed Hock's process technologically. Professor Hock, in this latest paper, does not include Distillers as manufacturing phenol by this route.

Distillers, in the early 1930's became interested in petroleum as a raw material for the chemical industry. The company's research workers were therefore interested in Professor Hock's first paper published in 1944 and proceeded to investigate the commercial possibilities of the process. Similarly in the US, Hercules Powder Co. also became interested in it since they saw it as a possible method of using by-products of their turpentine output.

Both companies patented their findings and filed applications in a large number of countries.

Distillers have, from small pilot plant at Tunbridge Wells, gained the know-how and have designed suitable plants which have been built by the companies listed below. A substantial degree of scaling-up was necessary, but problems in plant construction, it is understood, did not, however, arise in scaling-up. Distillers and Hercules Powder, in fact, license the process to the companies named.

What then has been the reason for no plant being set up in this country to manufacture phenol by this route? At the time Distillers had obtained all technical know-how and had designed suitable plant (about five years ago), phenol was in adequate supply, obtained by classical routes. Two large phenol plants had, in fact, just been completed by Imperial Chemical Industries Ltd., and Bakelite associate. Now, however, demands for phenol are increasing. Should new phenol capacity be required it seems obvious that the cumene phenol synthesis route will be seriously considered in this country.

'PLAIN COMMON SENSE'

From Mr. W. Yates, M.P.

Dear Sir,

Thank you for the leading article ('Radiation Hazards') in your issue of 1 June. Plain sound common sense.

Yours truly,
Bill Yates.

House of Commons.

Company	Location	In production since	Approximate annual capacity (tons)	Comments
B.A. Shawinigan	Montreal, Canada	Early year 1953	8,000	Extension being built
Standard Oil of California	Richmond, California	Winter 1953/54	16,000	—
Allied Chemicals and Dye	Philadelphia, Pa, U.S.A.	Winter 1953/54	13,000	—
Progil-Electro-Chemie ...	Pont-de-Claix, France	Early year 1954	10,000	—
Rhone-Poulenc	Roussillon, France	Early year 1954	10,000	Capacity increase announced
Phenolchemie	Zweckel, Ruhrgebeit	Summer 1954	10,000	Capacity being increased to 15,000 tons
Hercules Powder	Gibbstown, N.J., U.S.A.	Winter 1954/55	12,000	—
Société Chimique des Derivés du Petrole	Antwerp, Belgium	In build	—	—
Mitsui Petro-chemical Industries	Japan	Planned for 1956	7,500 or higher	Being built

APPLICATION OF RESEARCH BY BRITISH INDUSTRY

Charge that UK is Backward Refuted

COMPLAINTS about the backwardness of British industry in applying the results of research have been widespread in the post-war years both at home and abroad. Comparisons with Western Germany and the US are always being made to the detriment of Britain.

Although these complaints are, in many cases, justified, one has often felt in the past that they have been made without a full appreciation of the facts. Criticisms are made without allowing for different conditions at home and abroad.

In these circumstances the publication of 'Industry and Technical Progress: Factors Governing the Speed of Application of Science' (Oxford University Press, 25s) is particularly welcome. The authors, Professor C. F. Carter, Queen's University, Belfast, and Professor B. R. Williams, University College of North Staffordshire (Keele Hall), are both economists with a special knowledge of industry.

Variety of Opinions

The book is the result of a committee 'to study the problems of speeding up in industry the application of the results of scientific research' set up by the British Association in 1952. Later, in conjunction with the Royal Society of Arts and the Nuffield Foundation, and with financial support under the US conditional aid programme, research units were set up at Keele Hall and Belfast.

That there was a need for this book is shown in the first chapter which examines the various conflicting views about British 'unprogressiveness.' A variety of opinions were discovered, ascribing the situation to political, economic, social and organisational reasons. These opinions were in many cases contradictory and were based on a limited view of the problem. To quote from the authors: '. . . we are impressed . . . by the immense complexity of the forces impelling or hindering the application in the ordinary business of life of the products of man's scientific ingenuity.'

After stating the problem the book goes on to examine the factors influencing the application of science. All sides of industry, research, development, management and sales come in for criticism and encouragement. Case histories are traced for several developments including transistors, silicones, penicillin and transformer steels, all of which sprang from British research work but were developed largely abroad. On the whole the authors are able to refute the charge that these discoveries were 'lost' to the UK because of delays in applying them.

Ion exchange resins are quoted to show that the UK does not lag behind other countries in all fields. Most important developments in this field took place in 1934 at the Chemical Research Laboratory. Substantial work on this topic has been done in the US, but, say the authors, 'our inquiries indicate that the technology is as advanced in this country as in America.'

Chapter 5 (The extent of research activity) contains figures for research expenditure in this country. For example a Department of Scientific and Industrial Research sample inquiry gave the following results for 1955:

Government direct work	£120	*million*
Government contracts	£115	,,
Universities, research associations etc.	£16	,,
Industry	£74	,,
Total expenditure in 1955	£325	,, (±80)

This gives total research and development expenditure as 2 per cent of gross domestic product. This, say the authors, is a high figure as the US proportion for 1953 was 1.5 per cent.

Perhaps the most important sections of the book are those devoted to the organisation of companies to give the best possible use of research work. In many cases, particularly the craft industries, there is a resistance to the adoption of new ideas which can only be overcome by good overall management. Faults in industrial relations occur just as much on the research side as on the production side and the authors point out that the role of the businessman, so often misunderstood by the scientist, is primarily not to encourage science but to use science for a variety of purposes. He employs scientists to find applications of science. Realisation of this point would save many of the apparent heartaches and frustrations that appear to be the lot of industrial scientists.

In the final chapter, 'A progressive economy' the authors conclude that 'British industry is not universally backward in scientific matters, but is uneven in its development, with a great range from the best to the worst.'

'We have found many firms which need fear no comparison with similar firms anywhere in the world; but we have also found firms which have shocked us by their ignorant complacency. Although all countries must expect to have some unprogressive firms, we do not think this justifies the parochialism of large tracts of British industry.

'But the situation we have observed is in process of change. Industrial research and development are growing rapidly, but their growth is mainly recent, and they will yield greater rewards in the future.'

The authors do not believe that Government control or 'red tape' has any great effect and on p. 174 they suggest that the net effect of Government action must be favourable.

Two findings, one encouraging, one showing the difficulties to be faced, conclude the book. Technical progressiveness is related to financial success and it may pay to be first in the field rather than allow others to do the pioneering. As the authors put it: 'The forces of natural selection, stimulating the growth of profitable firms, are allied to those of technical progress.

Less encouraging is the suggestion that backwardness is self-perpetuating, both in firms and industries. 'The backward firm, even if it can be made to desire technical progress, is ill placed to command the resources (and in particular the human ability) necessary to begin that progress. It will take much ingenuity by industry and Government to break up the crust of habit and to divert lively and able minds from the places where change is most likely to where it is most needed.'

J.P.S.J.

Price's Second Fatty Acids Plant

A SECOND Emersol unit for the production of stearines and oleines has been completed by Price's (Bromborough) Ltd. Announcing this on Monday 3 June Mr. J. Arnold Fox, chairman, said that in 1936 Price's was acquired by Unilever and after the war it was decided to carry out a major programme of reconstruction and modernisation.

Immediately after the war Price's acquired the rights to a process for the solvent separation of solid and liquid fats developed by Emery Industries of Cincinatti, US. The first plant was built by Price's own engineers in 1950 from parts fabricated in the US by Blaw-Knox of Pittsburgh.

The Emersol process is carried out in a plant, most of which is constructed from stainless steel. The process is continuous, automatic and is worked by two skilled operators a shift. Since 1950 oleines and stearines have been produced by the first unit and at the same time the old-fashioned pressing process was also operated. The original pressing plant has now been closed down and is being dismantled.

By using the Emersol process exclusively, claimed Mr. Fox, it was possible to maintain a higher degree of quality control and to obtain an increased output of more standardised product and a higher degree of separation. 'As a result,' he said, 'we are now able to offer all our products to improved specifications.'

Manesty Extension

A new bay to the Milnrow works of Manesty Machines Ltd. has been completed. Extensions now well under way at Speke will comprise new experimental laboratories and showrooms, additional offices and the doubling of the present works area.

Need for More Capital Stressed by German Big Three

Free Trade Favoured by Hoechst Chairman

FINANCIAL problems connected with the continuous high capital expenditure on new plant were stressed by the leaders of the German chemical industry at the shareholders' meetings of the three IG Farbenindustrie successors, held in the third week of May.

Professor Haberland, board chairman of Farbenfabriken Bayer AG, said that products which were not made at all in 1948 accounted for no less than 40 per cent of total sales in 1956. This figure indicated the need for constant heavy investment expenditure on new plant. To increase total sales by DM 158 million, an additional output of about DM 380 million of some products had been required last year because sales of other products had declined by about DM 220 million.

Capital Expenditure

Capital expenditure on investment work now under way amounts to DM 450 million for Farbenfabriken Bayer AG. In 1957-1959 a total capital expenditure of at least DM 750-800 million is anticipated. Despite 'the remarkable earning capacity' of the enterprise as reflected by last year's depreciation allowances of DM 177 million, Professor Haberland thinks that the investment expenditure cannot be met without recourse to outside finance. Additional capital will be needed already within the next twelve months.

Professor Winnacker, board chairman of Farbwerke Hoechst AG, said that the German chemical industry required a volume of investment expenditure equal to 10 per cent of total sales in order to assure a healthy development in the future. As, however, it was incapable of accumulating reserves to the extent foreign competitors did, it stood in need of a period of financial consolidation. Hence the dividend policy must not be judged from the point of view of the capital market alone.

Commenting on the Common Market, Professor Winnacker said that he favoured free trade as a matter of principle. The chemical industry, however, was operating in some fields in which it could not do without duty protection. This held good in particular in fields in which it was unable to keep in step with foreign producers because of natural raw material conditions. It would, for instance, be hardly possible to defend the production of phosphorus compounds without tariff protection against the US. Production of petroleum chemicals would also require some protection for quite some time to come.

Professor Winnacker said one had to remember that in some countries with which German producers of bulk chemicals were engaged in the most severe competition there was no mutual liberalisation. Several of these countries had maintained high tariff walls. If the German Federal Government pursued its liberalisation measures step by step after careful preparation, they would be 'a good prerequisite' for the Common Market and Free Trade Area.

Professor Wurster, of Badische Anilin- und Soda-Fabrik AG, who also devoted a large part of his speech to financial questions, rejected shareholders' criticism of the company's method of financing new investment largely out of its own resources as 'out of place'. Capital expenditure in the chemical industry was inevitably high, partly because of rising demand, partly because of the exceedingly rapid technical progress throughout the world.

The existing disproportion between the supply of and demand for capital could not, as far as BASF was concerned, be eliminated by curbing capital requirements. The continued expansion of production largely depended on an increase in the supply of capital. The company was therefore watching with the greatest anxiety the fact that various sources of capital were now supplying much reduced amounts of finance for industry.

The chemical industry, Professor Wurster said, could not do without special depreciation allowance in the first few years after new plant had been built. Present methods of self-financing would not do in the long run. More use than in the past would have to be made of share issues as a means of attracting capital into the chemical industry.

Professor Wurster also criticised the abolition of export promotion measures. Last year they had reduced BASF earnings by an amount equivalent to a 20 per cent increase in the proposed dividend (of 10 per cent). Contrary to OEEC recommendations, other countries had not followed the example of the Federal Republic and voluntarily lowered their tariff protection.

Professor Wurster stated that BASF was disposing of 72 per cent of its output in the area of the Coal and Steel Union and of as much as 80 per cent in the projected Free Trade Area. It was possible to increase sales in this region even further but considerations concerning the location of production connected with the availability of raw materials in a Common Market could possibly affect competitive conditions. Professor Wurster drew attention in this connection to the big natural gas finds in Upper Italy after the second world war and the opportunities which had recently become apparent in the French Pyrenees.

All three companies are well satisfied with sales in the current year. BASF reports that past investment expenditure was beginning to be felt while Bayer and Hoechst say that the rate of sales in the first five months of 1957 has been above expectations. This has been partly due to some plants having been extended or newly erected. Bayer expects to bring extensions to the Dralon fibre plant and a new big titanium dioxide plant into operation this year. The full effect of Bayer's capacity extensions, however, will not be felt until next year.

Hoechst now expects to start production of heavy water towards the end of this year. It is co-operating with Siemens-Plania in the production of atomic graphite. As regards the development of nuclear processes for the generation of electricity, Hoechst is confining itself to work on physical and chemical problems and the production of ancillary materials. The special laboratory under construction at Griesheim will concern itself with the processing and utilisation of spent nuclear fuels.

Berk's Schori Division Promotes Plating by Electroless Method

PEEN plating, a process in which articles can be plated without the use of electricity, is being promoted by the Schori division of F. W. Berk and Co. who hold the rights from the US for the UK, Europe and most British Commonwealth countries.

The articles are given a suitable pretreatment; degreasing, acid pickling or grit blasting to etch the surface, and sometimes a very thin coating of copper. They are then put into a hexagonal tumbling barrel with an impacting material, a promoter solution, the coating metal in the form of a fine dust, and water. Particles of metal dust are welded on to the surface of the objects by the hammering action of the impacting material.

Full details of the process were given in a paper presented at the spring conference of the Institute of Metal Finishing, 10 April, by Mr. G. H. Jenner, manager, peen plate department, and Dr. T. P. Hoar, department of metallurgy, Cambridge University.

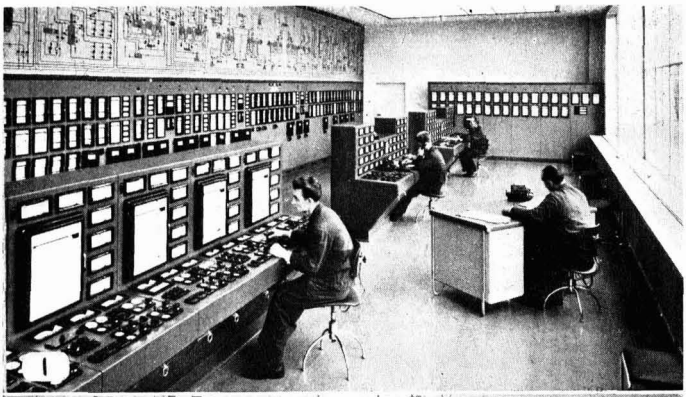
ICI Plastics Extensions in Lancashire

A site of about 90 acres on the northern outskirts of Darwen, Lancs, is to be purchased by the plastics division of ICI Ltd., subject to planning approval being obtained.

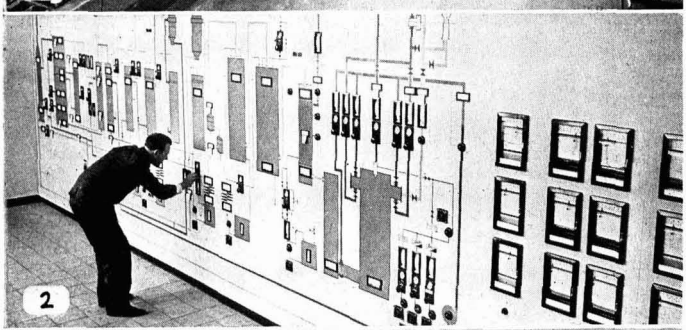
ICI's manufacture in Darwen has so far been confined to Perspex acrylic sheet and allied products at the Orchard and Britannia Mill sites. The company plan to develop the new site for a wider range of products, and the first plant to be erected will probably be for the manufacture of Melinex polyester film. Later the land may be used for a further extension of Perspex production.

CHEMISCHE WERKE HÜLS ADOPT AUTOMATION ON LARGE SCALE

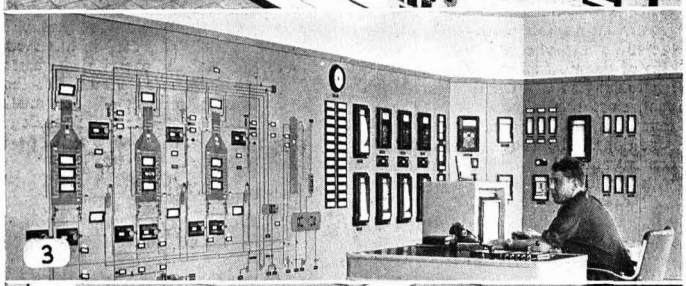
One of Europe's most modern chemical concerns, Chemische Werke Hüls AG, has been quick to adopt automation techniques. Established in 1938, the company now employs 13,000 workers, and has an annual turnover of about DM 450 million. The works were erected in two years for the production of BUNA synthetic rubber, but the modernisations carried out since 1945 have enabled the production range to be extended to synthetic plastics and plasticisers, raw materials for detergents, chlorinated hydrocarbons, organic acids and their salts, ethylene hydrocarbons, ethylene glycol and derivatives, and carbon black.



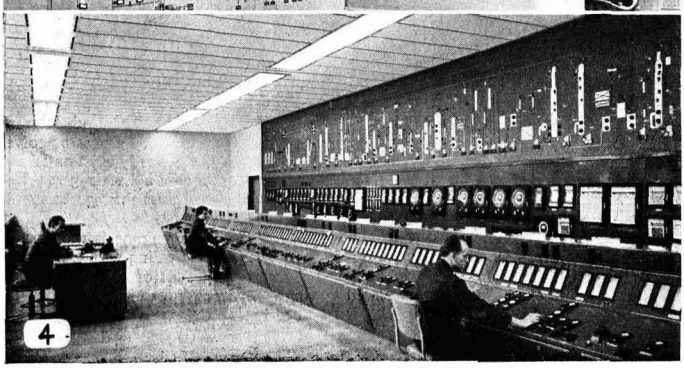
1 This shows the largest automatic production department at Chemische Werke Huls AG—the ethylene oxide department. Ethylene oxide, produced by the contact process, is used as an intermediate in the textiles, dyestuffs and pharmaceutical industries. From the three desks, 35 different processes are automatically regulated and 200 operations are worked by remote control.



2 The control department for the regeneration of waste sulphuric acid. On the control panel is a diagram of the production flow installation for measurement and control. Recording instruments are beside the production charts. Advantage of this arrengement is that general production procedure can be controlled from one part of the works.



3 The automatic control room for ethylene production. Production is controlled on the long wall which has the flow sheet on it. By means of electro-pneumatically controlled regulators the required temperature, pressure and rate of flow are checked.



4 This depicts the control layout for the production of acrylonitrile, starting material for many fibres and fabrics. The panel contains an outline of the flow process and a range of regulating and recording instruments. Control of the production process is managed from a desk on which are remote control panels, a selection mechanism for ascertaining temperatures and automatic regulators. In the event of a breakdown lamps light up on the flow sheet and their flashes are accompanied by sound signals.

Chemist's Bookshelf

PROPERTIES OF SOLVENTS

SOLVENTS. By *Thomas H. Durrans*. Seventh edition. Chapman and Hall Ltd., London. 1957. Pp. 244. 30s.
HANDBOOK OF SOLVENTS. Volume 1. Pure Hydrocarbons. By *Ibert Mellan*. Reinhold Publishing Corporation, New York; Chapman and Hall Ltd., London. 1957. Pp. 249. 52s.

A solvent may be broadly defined as some substance or mixture of substances by means of which a solid may be brought into a fluid state. This definition, though somewhat crude and inadequate, may be regarded as expressing the general idea of a solvent. With cellulose lacquers the object of the solvent is to provide a means of transferring a solid, such as a cellulose ester, from one place to another in a convenient and desirable manner. When the transference has been accomplished the solvent is of no further use and has to be removed as rapidly and completely as possible. For the production of a satisfactory film various other factors make it desirable that certain characteristics of the solvent should be known and that a solvent should be chosen which is suitable for a particular application. The most important characteristics of a solvent are solvent power, volatility, stability, toxicity, inflammability and colour.

Importance of Viscosity

Viscosity is also of considerable importance in relation to the use of lacquers. Vapour pressure and viscosity are somewhat related properties since the greater the vapour pressure of a solvent the lower the viscosity of its solutions. One of the most important factors affecting toxicity is the volatility of the solvent, since this largely governs the concentration which can arise under given conditions. The probability of a lethal concentration being reached is greater with the low boiling point solvents than with those of high boiling point. The inflammability of a lacquer is governed initially by the flash point of its volatile ingredients. Practically all lacquers contain either solvents or diluents of the low boiling class which flash at ordinary temperatures. However, the flash point of a mixture of inflammable liquids is not necessarily identical with that of its lowest flashing constituents—it may be higher or lower.

In 1930 the practical use of plastics was mainly confined to a few such as cellulose acetate and nitrate, phenolic and urea materials and alkyd resins for surface coatings. The immense possibilities of synthesising many new plastics were foreseen only by those in the industry. Solvents have been closely connected with plastics, to an extent not contemplated in those early days, both as regards their mutual use and as products from identical raw materials. The manner in which a solvent acts and the reason for its solvent action have been extensively investigated, but the problem is undoubtedly very complicated. Thus while some varieties of cellulose nitrate are soluble in a mixture of alcohol and ether they are not soluble in either liquid separately. Plasticising solvents, or plasticisers, are substances of very low volatility which possess the power of increasing the flexibility of polymers. Plasticisers act as lubricants and by increasing the distances between adjacent chains of polymer weaken the forces holding them together and permit greater relative movement.

In his contribution to the literature on solvents Dr. Durrans has endeavoured to bring his information into a concise form wherein the scientific and fundamental aspects of the subject are expressed in a readily comprehensible manner, and to show the relations of these aspects to technical usage. The first part of the book takes the form of a more or less connected series of chapters dealing with the scientific fundamentals in a broad and simple manner. The second part is of a more utilitarian nature and deals comprehensively with individual solvents, mainly with the view of facilitating the intelligent use of these solvents in the cellulose lacquer industry. The book is not, however, designed to deal with the actual manufacture of lacquers or varnishes.

Solvents dealt with in the second half of the book include hydrocarbons, alcohols and ethers, ketones, esters, glycols, cyclohexane derivatives, chloro compounds, furanes, and various plasticising solvents. The data quoted in this section for the physical and chemical characteristics of a solvent refer primarily to those for a technical product of good quality, although some data are given relating to pure substances.

Solvent Impurities

In many cases, however, it is not desirable or expedient that chemically pure substance should be used for lacquers. In some instances the presence of impurities considerably enhances the desirable properties of a solvent. On the other hand the cost of removing certain impurities may be out of all proportion to the advantages to be gained.

In view of the large and increasing number of proprietary names of solvents these have been mostly eliminated from the text, although a list is given in an appendix which gives their probable composition.

Ibert Mellan's volume is the first of a projected series dealing with a wide range of chemical groups of solvents. The term pure hydrocarbons is not apparently used in its strict chemical sense, but as an indication that the solvents discussed contain only hydrocarbons; most of those dealt with are in fact mixtures. The book is more particularly directed at the technical personnel engaged in the manufacture and application of solvents. The use of commercial and proprietary names in place of chemical designations and the fact that these products are almost entirely American in origin means that a lot of the information is likely to be of limited use outside the American continent.

The introductory section is of general appeal ranging over the use of coal and petroleum as the source of modern solvents, and the various properties of a solvent, such as aniline point, dilution ratio etc., which are of significance in specifying a sovent. The major section of the book lists various properties of commercial solvents, which are divided into aliphatic and aromatic hydrocarbons and terpenes. The solvents are classified according to their distillation range starting with those of lowest boiling point, and in the main designated solely by the proprietary name of a particular manufacturer. The information thus provided, while important technically to American commercial users of solvents, is likely to be limited in its appeal to British readers.

G. S. EGERTON.

Heating Without High Temperature Heat Source

INDUCTION AND DIELECTRIC HEATING. Electricity and Productivity Series No. 6 British Electrical Development Association, London. 1957. Pp. xv+191. 8s 6d.

Use of induction heating is at present largely confined to metal refining and processing and the first two parts of this book are almost entirely devoted to the theory and practice of this method.

However, at the end of chapter 10 there is a section entitled 'Induction heating for chemical and process plant' and this provides a clue to what might well become an important chemical engineering procedure. To quote from the book: 'A convenient way, however, of raising the temperature of the vessel (a steel autoclave) and its contents as rapidly as possible, without a high temperature heating source, is to use normal frequency induction heating.'

Part three of the book is devoted to dielectric heating. When a non-conducting material is placed between two electrodes and an alternating voltage placed across them the material undergoes molecular disturbance and is heated.

In the chemical field the plastics industry has been the largest user of dielectric heating. It is claimed that the introduction of this type of heating into the manufacture of moulded components can increase the productive capacity of a press by 200 to 300 per cent.

Another important application is the welding of thin sheets of thermoplastics materials.

It would seem from a study of this book that the potentialities of induction and dielectric heating have not yet been fully realised in the chemical industry and we can expect wider future applications of these versatile methods. J.P.S.J.

Source Book of Greatest Value

'CHEMICAL ENGINEERING PRACTICE'. Edited by *Herbert W. Cremer* and *Trefor Davies*. Vol. III—Solid Systems. Butterworth's Scientific Publications, London. 1957. Pp. vi + 534. 95s.

Publication of the third volume in this series will be welcomed by all concerned with chemical engineering. Both the teacher and research worker will find inspiration in this book, and the practising engineer will discover it to be a source book of the greatest value. A pleasing feature is the up-to-date reference section given at the conclusion of each chapter and, in several cases, an extensive bibliography.

The first major section contains five chapters, concerned with size reduction, in the course of which fundamental principles are thoroughly surveyed along with interesting discussions on the equipment used. It is probable that here is presented the largest collection of practical data on the subject yet brought together in one volume, and making available those details sought after by design and process engineers. A chapter is included on fine grinding.

There follows an excellent account of screening and associated processes, which serves as a precursor to sections concerned with minerals beneficiation processes. The classic processes of tabling and jigging are treated very thoroughly and, in the chapter on wet classification, hydrocyclone operation is discussed. Flotation and sedimentation are each treated in an authoritative manner. The use of dense media for coal cleaning is discussed in a series of descriptions of modern processing plant while, in direct contrast, there is a section on the separation of fractions by air flow.

Materials storage and handling is a perpetual problem for the process engineer and especially is this the case when solids are being considered. This volume, however, contains a lucid account of these matters which should prove to be especially valuable. An equally welcome contribution is that dealing with the measuring and gauging of solids in bulk.

Mixing of solids is a very difficult subject to discuss in the space available in a text of this nature. The section dealing with this matter is mainly descriptive, although an attempt is made to explain, in an outline manner, the mechanics of the process.

The final section is entitled 'Cleaning gaseous media,' and consists of two chapters concerned with cyclones and electro - precipitators respectively. The authors are recognised experts in these fields and the presentation, in each case, is clear and precise.

The slight misprints observed are immediately obvious and easily corrected.

An excellent index is provided and this makes the volume particularly satisfactory to use. The student will find this a fascinating volume, where philosophy and knowledge are blended to discover the basic processes through which our everyday needs are satisfied. H. K. SUTTLE.

Chemist's Bookshelf

Book for Tracking Down Reactions

ENCYCLOPEDIA OF CHEMICAL REACTIONS: Vol: VI. Compiled by the late *C. A. Jacobson:* Edited by *Clifford A. Hampel.* Reinhold Publishing Corp. New York: Chapman and Hall Ltd., London. 1956. Pp. vii + 438. 100s.

There is a suggestion in the preface to this volume that the remaining volumes in the series will confine themselves essentially to the material which Professor Jacobson had collected before his death, with only minor additions. There does not, however, appear to be any restriction in scope because of this. Each of the elements with which this volume deals, samarium (77), scandium (128), selenium (387), silicon (638), silver (1101) and sodium (1714) has a representative allocation of entries, as indicated by the numbers in brackets. The smaller sections on samarium and scandium are only to be expected since the chemistry of these elements has not been extensively investigated.

The form of the entries follows that in previous volumes: that is, the compound studied, the reagent, a statement in words of the reaction, an equation for the reaction, and the literature reference. This rigid specification undoubtedly leads, as in previous volumes, to occasional dubious, anomalous, even (chemically) absurd results. Examples are: the formulation and naming of a compound as selenium sulphur oxytetrachloride, $SeSO_3Cl_4$; the nicely balanced production of oxygen in the decomposition of scandium nitrate; the representation of 'hydrous scandium oxide monohydrate, $Sc_2O_3.H_2O.aq.$' as the product of the action of sodium hydroxide on scandium chloride, although ammonia and potassium hydroxide are stated simply to produce $Sc(OH)_3$.

However, the terms of reference of the series make it clear that the purpose of these volumes is not to correct published work, but merely to record it in a form that can readily be consulted. Anyone wishing to track down known or reported reactions will find these volumes of undoubted help if this limitation is borne in mind.

It is probable that the reader will be forcibly struck by the amount of existing inorganic 'facts' deriving from 19th century investigations which have not been subjected to a critical examination in the light of modern knowledge.

The reviewer has already had occasion to comment on the lack of uniformity, in earlier volumes, of binding style. The binding of this volume follows that of Vol. V; but for some unexplained reason the type face has now been completely altered. CECIL L. WILSON.

Valuable Analytical Reagent

OXINE AND ITS DERIVATIVES. Vols. III and IV. *R. G. W. Hollingshead.* Butterworths Scientific Publications, London. 1956. Pp. 278 and 324 + indexes. 42s per volume.

In these two volumes the author completes the monumental task of surveying the entire literature of oxine, and the very high standard which was achieved in the earlier volumes is consistently maintained. In this series the derivatives of oxine are examined with the careful attention to detail which characterised his study of the parent compound.

Volume III is divided into five chapters dealing in order with the salts of oxine itself, the mono-halogen and the poly-halogen derivatives, the methylated oxines and the oxine sulphonic acids. The first chapter contains an analysis of the confused nomenclature of the oxine sulphates and an account of their use in medicine and agriculture as bactericides and fungicides.

The following two chapters contain very complete accounts of the preparation and properties of the halogenated oxines including the fluoro derivatives, and describe a number of methods for the determination of the rarer metals. Data of a physico-chemical nature such as the chelate stability of various metal oxinates may be found in the chapter dealing with methylated oxines, together with a review of the attempts to relate the structure of substituted oxines to both their chemical stability and their absorption spectra.

Volume IV has seven chapters dealing with the carboxylic acids, the phenyl, nitro, nitroso, azo, and amino derivatives: the dihydroxy quinolines, miscellaneous derivatives such as the alkyl, alkenyl and acyl derivatives and then N-oxide.

The final chapter will be of little interest to the analytical chemist as it is devoted to effects of oxines upon bacteria and fungi.

Also in Volume IV are the complete author index and an addendum of papers too recent for inclusion in the appropriate earlier chapters. It is a striking indication of the continued attention which is being paid to the subject that this section alone covers 150 pages.

To sum up the complete series it may fairly be said that they constitute an excellent abstract service and one which will save the analytical chemist countless hours in the library. Nevertheless it should be stressed that the treatment is entirely uncritical, the personality of the author never intrudes except in minor details as for example on page 798 where he suggests a possible reducing agent for 5-methyl-γ-phenylazo-oxine. It is necessary therefore that the work should be used critically and not considered as a manual of standard recipes. On the other hand it is certain that the collection of so much information in one place will stimulate the reader to make comparisons of the many methods and it is to be hoped devise new methods. J. R. MAJER.

FLAMEPROOFING OF APPAREL FABRICS

BSI Report Describes Processes

WORK on the development of flameproofing and flame-resistant processes for apparel fabrics is still in its early stages. So far three processes have been developed; these are discussed in 'The Flammability of Apparel Fabrics,' a report of a committee of the British Standards Institution (PD 2777/1957), price 4s net from the Institution, 2 Park Street, London W1. Each is suitable for cellulosic fibres, the group which presents the greatest risk of accidents.

1—*THPC.* The principle underlying this treatment is the formation of insoluble resins inside the fibres. THPC is the basis of the Proban finish of which the patent rights are controlled by Proban Ltd., a joint subsidiary of the Bradford Dyers' Association Ltd. and Albright and Wilson Ltd. The finish is unaffected by laundering or dry cleaning.

No information has been published regarding possible toxic effects arising from the presence of THPC in a fabric. But Dr. J. M. Barnes, Medical Research Council Unit for Research in Toxicology, after a number of experiments made at the request of Albright and Wilson Ltd. concluded that no material of a significantly toxic nature could be extracted from the treated cloth nor on burning the cloth were the fumes produced of any greater toxicity than those produced from untreated cloth.

2—*Antimony Oxide.* The flame retardant properties of chloride are used in a new flame-proofing process developed by Antiflamm Ltd., 138 Royal Exchange, Manchester, a new company formed by Associated Lead Manufacturers Ltd. and Horrockses, Crewdson and Co. Ltd.

Tendency to Rot

Antimony chloride cannot be used directly as it tends to rot the fabric. To overcome this difficulty antimony oxide is dispersed in p.v.c. and the fabric (cotton or other cellulosic material) is treated with this dispersion.

No antimony chloride is present in the fabric but at the ignition temperature of cotton hydrochloric acid is liberated from the p.v.c. and immediately reacts with the antimony oxide to form antimony chloride vapour which extinguishes the flames.

Fabrics treated with this process are claimed to pass both BS and ASTM inflammability tests and will not support combustion when a large naked flame is applied and then withdrawn. Laundering and dyeing properties are said to be good and tests have revealed no skin irritation hazard.

3—*Antimony and Titanium.* Compounds of these substances are applied to the fabric so as to precipitate insoluble oxides inside and around the fibres. An antimony/titanium flame-retardant solution is marketed by Peter Spence and Sons Ltd. under the name Lifeguard, a trademark that applies only to the chemical solution and not to the flame retardant process. The company, which supplies the solution and provides technical service, claims that apart from some possible release of small quantities of these oxides at the first wash, the treatment is unaffected by launderings or dry cleaning.

The MRC burns unit has reported that Lifeguard treated fabric is unlikely to entail toxic hazard; the report added that 'as a flameproofing process it appears extremely eligible.'

A fourth process, which like those mentioned above, is applied to the fabric in the piece, has been developed by the Lace Research Association and John Heathcoat and Co. Ltd. for nylon nets and laces. It is said to be effective in reducing the burning rate as against other stiffening materials which can cause these fabrics to burn more rapidly. The LRA process is based on thiourea and methylated urea formaldehyde resins.

So far as the effect of the various treatments on other properties of textiles are concerned, there is evidence that when correctly applied no adverse results occur. On the contrary, the resin-forming compounds are said to give treated fabrics better dimensional stability and there is also a higher resistance to tension and creasing. The effect on such properties as handle and drape cannot be objectively assessed, but the producers of the proofing agents are satisfied that there will be no deleterious effects.

ABCM Members Attend Harrogate Work Study Conference

TREMENDOUS interest in more efficiency was shown by chemical firms in the North of England said Mr. George Brearley, director-to-be, Association of British Chemical Manufacturers, at a work study conference held by the ABCM in Harrogate on 23 to 25 May.

'They are putting their backs into taking advantage of the latest manufacturing techniques and are doing very well,' he said.

Good progress had been made in this direction by small chemical firms, Mr. Brearley continued. At the last conference most lectures were given by experts from large companies, but today many small manufacturers were obtaining the same degree of specialised knowledge.

Mr. D. V. E. Howard told the conference that application of work study in smaller factories might present problems.

'If the labour turnover is small there will be process operators who have been working on the same job for years and supervisors who have supervised the same processes since their appointment. Thus there will be a very great resistance to change, partly because they are sure there is no better way of doing the job and partly because they fear that if a better way is found it reflects on their ability.

'On the other hand, in the smaller firm there should be a very good team spirit. There should be a minimum of suspicion between management and employee. Top management should be able to take a personal interest in the activities of work study officers and, if need be, play an active part in implementing changes. I cannot emphasise too much the need for a good relationship between management and workers.'

BSI Set Up New Committee to Study Colouring Matter in Foodstuffs

STANDARDS for the purity of colouring matter—both natural and artificial—used in the manufacture of food are to be prepared by a new committee set up by the British Standards Institution. The committee hopes to hold its first meeting in July.

It has been established following an approach to the BSI from the Ministry of Agriculture, whose own food standards committee has for some time been working on the subject of colouring in foods and has issued recommendations on the colours which should be permitted.

Although BSI has not previously been particularly concerned with food standards it has completed, or is engaged on, several projects in this field. For example, British Standards have been published on methods of chemical and physical analysis of dairy products. BS 911 deals with the biological assay of vitamin D3 in food oils. Another BS has been published for annatto used in colouring butter.

It is thought that there is considerable scope for additional, national standards and codes of practice.

The new BSI committee which is charged with preparing standards of quality for colouring matter, includes representatives of the Association of British Chemical Manufacturers, essence manufacturers, food manufacturing concerns, research associations, Government departments, and organisations such as the Association of Public Analysts, the British Pharmacopoeia Commission, the Pharmaceutical Society, the Royal Institute of Chemistry, the Society for Analytical Chemistry and the Society of Chemical Industry.

Overseas News

CIBA MAY CONCENTRATE SOME PRODUCTS IN PLANTS IN COMMON MARKET COUNTRIES

BOTH J. R. Geigy AG and Ciba AG of Switzerland reported increased turnovers in 1956. Geigy's net profit of SF 8.5 million, compared with SF 8.1 million in 1955. Dyestuff exports were up on 1955 and the share of the European market increased at the expense of North America. Chemicals, textile finishing products and pharmaceuticals all showed increased turnovers. Government restrictions in a number of countries adversely affected the sales of insecticides.

Ciba's annual report shows that the company's share of world trade in chemical products increased in 1956. Turnover rose by 5.7 per cent to reach SF 827 million, with all sectors of the business sharing in the increased results, including dyestuffs, sales of which had fallen in 1955. As in previous years, 50 per cent of sales went to the European and 40 per cent to the US markets. Net profit totalled SF 22 million.

Ciba exports 25 per cent of its products to the six common market countries and at the annual meeting, the vice-chairman said the firm would probably be forced to accelerate plans to concentrate production of certain items in its factories in those countries.

Belgium Chemical Industry in March

As in preceding months, the situation in the Belgium chemical and allied industries was dominated by the closure of the Suez Canal and the transport difficulties which have resulted.

The surtax of 15 per cent applied by France on freed products affected trade with that country. There was no change in the fertiliser situation. Sales of mineral chemical products were favourable. There was noticeable interest in most sections of organic chemicals.

Good activity was reported in paints, photosensitive products, pigments, plastics materials and explosives.

Pharmaceutical trade remained quiet. Soaps reflected the rebound of heavy sales last winter. The rubber industry is being tried severely by the measures taken by France.

Caffeine from Tea Waste

A scheme for the manufacture of caffeine from tea waste has been prepared by the Small Industries Organisation of the Indian Ministry of Commerce and Consumer Industries.

India's annual production of tea is over 600 million lb. of which nearly three-quarters is exported and the remainder utilised for meeting India's home needs. A large quantity of tea leaves is left unused as tea waste and is an economic but important source of caffeine.

Attempts have been made to extract this alkaloid from tea waste on economic lines in competition to the imported product. In the scheme prepared by the Small Industries Organisation the process of extraction and manufacture of caffeine is detailed. Basic data regarding requirements of plant and equipment, capital investment, manufacturing costs etc., are also given. Fabrication of the equipment needed for the industry is envisaged in the scheme.

Since the demand for caffeine in the country is about 30,000 lb. per year the future of the industry is considered to be bright.

Copies of the scheme can be obtained free from the Development Commissioner, Small Scale Industries, 114 Sundar Negar, New Delhi.

Ammonium Sulphate Plant for Rumanian Coke Works

New plant for the production of ammonium sulphate has been commissioned for the coke works at Hunedoera, Rumania. The precision equipment required was partly imported and partly home produced. This new ammonium plant will also produce pyridine bases and phenols for the pharmaceutical industry. Pure benzene, xylene and toluol are also being produced as solvents for the pharmaceutical and chemical industries.

US Pilot Plant for Decaborane

First commercial plant for producing decaborane is that of American Potash and Chemical Inc. Decaborane is a high energy compound which on burning gives off 28,000 BThU per lb. The company is concentrating on the jet and rockets fuel aspects, but small quantities are stated to be available for industrial investigation studies.

US/Italian Sulphur Marketing Agreement May be Revived

Hopes that the US may revive the marketing agreement which existed before the war between US and Italian producers of sulphur have been raised by the visit at the end of May of an American commercial mission to the various sulphur-producing centres of Sicily.

Under this agreement Italy produced about 300,000 tons of sulphur yearly and exported some 200,000 tons. Sicilian mines contributed to this output to the extent of 65 per cent. After the war, the agreement was not renewed and the Italian output of sulphur dropped to about 100,000 tons while a startling shrinkage in exports led to a swelling of surplus stocks. The few mines that still operate in Sicily are reported to be undergoing difficulties and causing concern to banks that finance them.

Sicilian producers cannot compete with American competition because the particular structure of US sulphur mines allows economic and efficient methods which are impossible with the geological structures existing in Sicily. Even if the US agree, in the general interests of Europe, to make room for Sicilian producers, there will remain Mexico which has recently appeared in the market and which has mines that permit American methods. It is believed, however, that much could be done by modernising Sicilian methods as far as possible and investing adequate money in prospecting.

Vanadium Mill Planned for Transvaal

In association with High Speed Steel Alloys of the UK and Rockefeller Centre Inc., US, Minerals Engineering Co., US, is to construct a vanadium mill in the Transvaal. The mill will have a capacity of 3.6 million lb. of vanadium concentrate annually. The plant is being built by Minerals Engineering Co., South Africa, in which the three companies will hold stock.

ITL Celebrates Silver Jubilee

The first 25 years of the Mysore Industrial and Testing Laboratory Ltd. (ITL) is recorded in a special silver jubilee souvenir, recently published.

Founded in 1931 by the Mysore Government the ITL has two main objects: (1) manufacturing the pharmaceutical requirements of the several Government departments and (2) having a testing and research laboratory where industrial problems of the state can be investigated and Government purchases properly tested.

Development of ITL between 1931 and 1944 is summarised as follows:

1931 Spirituous section started. Manufactures standard spirituous pharmaceutical preparations.
1933 Analytical and testing laboratory.
1938 Medicinal specialities.
1939 Biological preparations.
1941 Fine chemicals.
1942 Injectables.
1944 Malt extract.

Eight production charts indicate how production has, in general, increased, particularly in the last two years.

Sulphate Wood Turpentine Symposium

Forty representatives from industry and Government met on 7 May in New York for a symposium on sulphate wood turpentine. This symposium was organised by the sulphate turpentine division of the Pulp Chemicals' Association and was introduced by Albert Scharwachter, president of the Association and executive vice-president of Arizona Chemical Co., and by L. A. Radeker of Champion Paper and Fibre Company who is chairman of the division.

The subjects discussed at the symposium were: history of the industry, statistics and estimates of future sulphate turpentine capacity, end uses for the product and potentials for increasing its recovery.

Mr. J. M. Wafer, vice-president of West

Virginia Pulp and Paper Co., gave a review of the early history of the industry. He, in conjunction with Mr. T. K. Heston, assistant secretary and statistician for the Association, and Mr. Herbert B. Wagner of the US Department of Agriculture, provided statistics on production and uses of the various kinds of turpentine since 1934, the first year for which figures were available.

Mr. G. Fred Hogg, of Hercules Powder Co. and Dr. W. David Stallcup, of the Glidden Co., explained their companies' treatment of crude sulphate turpentine by refining or converting it into α- or β-pinenes. They each touched upon the five major end uses for sulphate turpentine products; oil additives, synthetic pine oil, camphor, insecticides and synthetic resins.

Mr. Robert Wier, Hercules Powder Co., explained some of the ways by which the recovery processes at pulp mills were being improved to increase the yields of sulphate turpentine in the pulping process. The Association's figures showed an industry yield of approximately 2.2 gallons of sulphate turpentine per ton of sulphate pulp made from pine wood. Dr. Raymond S. Hatch, vice-president of Hudson Pulp and Paper Corp., described a pilot operation in which up to four gallons of sulphate turpentine had been recovered per ton of pulp.

Photometric Determination of Nickel with Diacetyldioxime

Photometric determination of nickel in different materials can be performed by means of an improved method with less labour and greater accuracy and speed than is possible with methods at present in use states L. Donbek in *Hutnické Listy* (1957. *xii* No. **5**, 430, paper in Polish). The determinataion is based upon coloration measurements of red nickel-complexone with diacetyldioxime in a mixture of sodium hydroxide and solium tartrate; iodine solution is used as an oxidising agent. The coloration obtained is said to be unusually stable.

India Continues Protection of Calcium Lactate Industry

The Indian Government has accepted, *inter alia*, the tariff commission's recommendation that protection to the calcium lactate industry should be continued at the existing rates of duty until 31 December, 1960. Existing *ad valorem* rates are 37.8 per cent standard, and 27.3 per cent preferential.

Sulphur Bill for Sicily will Give Price Guarantee

The Sicilian Regional Assembly are reported to have drawn up a Bill which provides for the establishment of a three-year period for a minimum guaranteed price for sulphur which is delivered to the Italian Sulphur Board.

Object of the Bill is to assist Sicilian sulphur companies in obtaining a reduction in the present costs of producing crude sulphur while they are transforming and modernising their plants.

The Bill is shortly to be introduced to the Italian Parliament.

Rumanian Bauxite Exports Increase

Exports of bauxite from Rumania have steadily increased since 1951. Main importers are Czechoslovakia and Germany.

Rumanian bauxite contains a minimum of 52 per cent Al_2O_3, 18 to 25 per cent Fe_2O_3, and a maximum of 9 per cent of SO_2. It is most suitable for use in the manufacture of abrasives (artificial corundum) as flux in the steel industry and as a raw material for manufacture of bauxite cement.

Silicon Carbon Rectifiers in Operation

A silicon carbide rectifier up to 1,200°F has now been operated by General Electric of the US. Previously similar devices of other semiconductor materials, principally silicon, have been operated up to 400° to 500°F only. Silicon carbide rectifiers have also been operated down to −100°F. This GE rectifier is still at the laboratory development stage.

Solid state rectification at high temperatures may well have an important role in aircraft and military electronic applications.

Building Research Station for E. Pakistan

A research station is being built in Dacca to carry out research in building materials, including bricks, stones, cement etc., available in East Pakistan. Capital expenditure is estimated to be Rs 1,500,000, while the annual recurring expenditure will be about Rs 50,000. The research station is expected to start functioning by January 1958.

Decision on Australian Uranium Treatment Plant

Uranium Mines NL, and Northern Uranium Development NI, have decided not to establish a treatment plant south of the Alligator River field. Subject to satisfactory negotiations, these companies will sell ore to the Government-owned Rum Jungle plant instead. Reason for the change in plans is that the companies have not been able to develop a minimum tonnage to justify the erection of a treatment plant.

Commodities for Korean Nitrogen Fertiliser Plant

McGraw-Hydrocarbon, 51 East 42nd Street, New York 17, US, are seeking tenders for chemicals and equipment for a nitrogen fertiliser plant project in Korea. Purchases, to be made under International Co-operation Administration procurement, include: chemicals and chemical preparations to the value of $110,000; non-metallic mineral products, $540,000; construction, mining and conveying equipment $1,102,000; industrial machinery $4,498,000; and miscellaneous project items, $260,000.

Shawinigan Halts Pilot Work on Electrolytic Titanium Sponge

Shawinigan Chemicals Ltd. of Canada have closed their pilot plant work on the electrolytic production of titanium sponge. According to Mr. J. A. Fuller, president, further research is necessary to determine the possibilities of producing by this process material of sufficient purity to meet to-day's standards. In the meantime, production of titanium sponge by other processes has brought about some excess of supply and consequent price reductions, which have decreased the profit potential of commercial production.

US Chemical Industry Gets $50 Million a Year for Know-How

FOREIGN licensing of chemical processes contributes $50 m. a year to the American chemical industry in the form of royalties for patents and 'know-how', according to Dr. Robert S. Aries, New York consultant, who recently returned from a world study trip.

The growth of the chemical industries in Western Europe and in Japan during the last four years has outstripped the proportional growth of their counterparts in the US and has been aided by private US industry, he said.

Average European and Japanese chemical growth from 1953 until the Middle East crisis was 12 per cent a year compared to somewhat less than 10 per cent for the US.

The average net profits after taxes of the publicly owned European and Japanese chemical process companies is about six per cent of their sales, compared to about nine per cent for US counterparts, according to Dr. Aries.

Dr. Aries stressed that petrochemical growth is the most impressive and that American processes have been very prominent in the post-war industry development. Hundreds of agreements are in existence involving joint ventures, engineering and licensing with US firms.

Western Europe manufactured products based on US licenses are conservatively estimated to sell for $1,000 million annually and provide about $30 million of annual income to US chemical process companies. Processes have also been purchased from Western Europe by North American companies at an increasing rate since 1951, most of which have been based on inventions rather than complete 'know-how'. It is expected that in a decade the technical flow will be about equal in both directions.

US chemical process companies now receive $20 million annually from Japan for stock participation, the sale of 'know-how' and patent licensing. The term 'technical currency' has been adopted to describe the policy of international exchange of processes.

In Parliament

CHEMICAL INDUSTRY DEMAND FOR WATER MAY RISE 50 PER CENT

BRITAIN'S water resources, the subject of a CHEMICAL AGE leader on 20 April, were discussed in the House of Lords last week, when the Earl of Albermarle said that within the next 10 years the chemical industry was likely to raise its demands for water by 50 per cent. Most industries using chemicals, particularly textiles, leather and paper, were likely to increase their demands, probably by 25 per cent over the same period.

Between the years 1931 and 1955 metered supplies of water rose from 156 million to 286 million galls. a day, an increase of 82 per cent. The increase in the 30 years to 1956 in the area of the Metropolitan Water Board was 39 million galls. a day to a total of 109 million galls.; for Leeds, demand rose from 5 to 8 million galls, a day; for Liverpool, from 10 million to 22 million galls, a day; and for Manchester from 16 million to 41 million galls. a day.

The Earl of Listowel referred to the disproportionate capital expenditure in the major services; in 1955, £247 million was invested in electricity; £57 million in gas and £56 million in water. Lord Radnor made the point that the Thames Valley basin had dropped by from 20 to 40 feet, while Lord MacPherson of Drumochter estimated that by 1970 the demand for water for all purposes would be double the rate of 1938. In London alone meter supplies to industry had been increasing on an average each year by about 2 million galls. a day.

Lord Macpherson was concerned at the de-oxygenated condition in which water used for power plants and others, was now returned to the Thames. It was only by retention of a sufficient flow of fresh natural water that sewage and trade effluents could be absorbed without causing conditions harmful and dangerous to river water.

Viscount Waverley, chairman of the Port of London Authority, wanted further detailed scientific investigation of the hydro-dynamic forces by which underground waters are supplemented from the surface.

Replying to the debate, Lord Mancroft, parliamentary secretary, Ministry of Defence, stated that the Government did not yet know whether increasing demands for water were likely to strain our water resources. The Central Water Advisory Committee, set up in 1955, would press on as a matter of urgency with its inquiries into the problems involved in meeting increasing demands for water.

He rejected any idea that water undertakings should be nationalised but said that positive steps were being taken to overhaul the water industry. Some of the thousand undertakings were too small for modern needs. Regrouping into larger units was now in train. It was hoped this would be done on a voluntary basis, but Lord Mancroft said that the Government would not hesitate to use its powers of compulsion if it was felt necessary.

Referring to the figures of capital investment quoted by Lord Listowel, Lord Mancroft said that nearly £24 million was invested in 1956, while the figure for 1955 was £27½ million.

Monopolies Report on Chemical Fertilisers

Asked whether the President of the Board of Trade would make a statement on the reference of chemical fertilisers to the Monopolies Commission, Mr. Derek Walker-Smith said that the Commission was proceeding with its work. A report was not expected for some time.

European Nuclear Research Programme

The full research resources of the European Organisation for Nuclear Research will only become available when the two accelerators are completed, said Mr. H. Nicholls, parliamentary secretary to the Ministry of Works last week. The smaller accelerator is expected to be in operation by late summer; full scale research on it should start by the end of the year and a research programme is now being worked out. The UK Government have suggested some problems for study.

No Science Ministry

There is no need to establish a new executive body to study and direct the nation's organisation for scientific research and development in all fields. That was the answer given in the House of Commons last week by Mr. H. Nicholls, parliamentary secretary to the Ministry of Works. He added that complex machinery already existed for co-ordinating the national scientific research effort.

Safety Code for Radiation Hazards

A code of practice for the protection of all hospital workers exposed to ionising radiations has been prepared by the radioactive substances advisory committee and will be published shortly. This was announced by Mr. D. F. Vosper, Minister of Health on Monday.

Marchon Launch Own Ship

A SHIP designed for Marchoff Products Ltd., a member of the Albright and Wilson group of companies, was launched last week by Mrs. Frank Schon, wife of the chairman of Marchon Products. Built by Austin and Pickersgill at their Sunderland yard, the ship, *Marchon Trader,* will be employed by Marchon Products to carry phosphate rock from North Africa to Whitehaven Harbour, Cumberland, which is only a mile from the Marchon works.

Special equipment has been installed at Whitehaven to facilitate unloading and the ship can return via Europe to deliver detergent chemicals.

The *Marchon Trader* has a shallow draught (under 17 ft.) to enable her to enter Whitehaven Harbour, and although continuously employed, will be unable to carry the company's total requirements of phosphate rock, the balance being made up by chartered shipping.

Cruising speed of the ship will be 11½ to 12 knots. She will have a complement of 21, a cargo capacity of 2,500 tons at 50 cu. ft. per ton, and will be 265 ft. in length and 40½ ft. in breadth.

Mr. Frank Schon, chairman, with Mrs. Schon who launched the ship.

De La Rue and American Cyanamid Agreement

A NEW COMPANY, Formica Ltd., will be formed by Thomas De La Rue and Co. and the American Cyanamid Co., subject to approval from the Treasury, the Capital Issues Committee, the Bank of England and the US Treasury.

In a letter to De La Rue shareholders, Mr. B. C. Westall, chairman, said that during the last few years the manufacture of laminated plastics had become one of the company's most important interests.

'By virtue of licensing agreements with the Formica Corp. of Cincinatti, US, an American Cyanamid subsidiary, De La Rue have built up a considerable trade in the Empire, Europe and elsewhere for the sale of Formica.'

This licence expires in eight years and the new agreement will be made with the object of obtaining a more permanent arrangement.

Formica Ltd. will be a De La Rue subsidiary in which American Cyanamid will have a 40 per cent interest.

Formica Corp. trademarks and goodwill are to be assigned to the new company in all countries outside the Americas and certain Far East territories while De La Rue will transfer certain assets, including the Tynemouth factory.

Chemical Exports to China Aligned with Trade to Soviet

FOLLOWING the Foreign Secretary's announcement in the House of Commons on 30 May that the strategic controls on exports to China are to be aligned with the existing controls on exports to the Soviet bloc, the Board of Trade have made the necessary order giving statutory effect to the changes to operate from Wednesday, 5 June.

From that date licences will no longer be required for the export of goods other than those specified in the First Schedule of the Export of Goods (Control) (Consolidation) Order 1956, to any port or destination in (a) China, North Korea, North Viet Nam, Tibet, or (b) Macao. A consequential amendment will also be made to the Open General licences for aluminium goods, copper goods, iron and steel goods, lead and zinc, dated 18 February 1957, so as to permit exports under the terms of the licences to those destinations previously mentioned.

The order and amendment making these changes are: The Export of Goods (Control) (Amendment No. 4) Order 1957 (S.I. 1957/950), and Amendment to Open General Licences—aluminium goods, copper goods, iron and steel goods, lead and zinc dated 3 June 1957.

Goods requiring licences for exports to the Soviet bloc will continue to require licences for exports to the above destinations.

Copies of the order and amendment, price 2d (by post 4d) respectively are obtainable from HM Stationery Office, Kingsway, London WC2, and branches.

Inquiries concerning the order and applications for licences should be addressed to the Export Licensing Branch, Board of Trade, PO Box 122, Atlantic House, Holborn Viaduct, London EC1.

TRADE NOTES

Manesty US Agents

Manesty Machines Ltd., Speke, Liverpool 19, have appointed the Fitzpatco Corporation, 1001 Washington Boulevard, Chicago 7, Illinois, as their agents for the US.

Steel Valves From Stock

Immediate delivery of stainless steel valves from stock is being offered by Langley Alloys Ltd., Langley, Slough, Bucks. The company are now manufacturing for stock valves of various sizes and types in the Langley range of stainless steels.

Change of Name and Address

Gemec Chemicals Co. of 120 Moorgate, London EC2, moved on 30 May to 103 Mount Street, London W1, telephone Legation 5361. As from 1 June, they are known as Union Carbide Ltd., chemicals division.

Dispersitron Agreement

George Scott and Son (London) Ltd., of Leven and London, have reached an agreement with Professor P. Willems, of Lucerne, Switzerland, to manufacture and supply to the British Commonwealth, Dispersitron, a mechanical dispersing unit. This will shortly be placed on the market in a range of sizes for the chemical, paper, food, paint, pharmaceutical, cosmetic and other industries, where dispersion, homogenising, emulsifying, contacting and similar systems call for the use of kinematic high frequency operations.

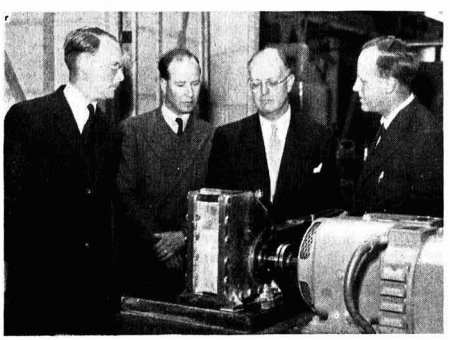
Packings in PTFE

A new technique for manufacturing 'U' and 'V' ring packings in the chemically inert polymerised plastics, polytetrafluoroethylene (p.t.f.e.), has been introduced by Crane Packing Ltd., Slough.

Treasury Increase Drawback

The Treasury have made the Import Duties (Drawback) (No. 9) Order, 1957, which increases, from 4s to 5s per cwt., the rate of drawback allowable in respect of Customs duty paid on certain solid potassium hydroxide used in the manufacture of exported potassium ethyl xanthate and potassium amyl xanthate. The Order comes into operation as from 1 June 1957, and has been published as Statutory Instruments 1957, No. 896.

Engineers Visit Paper Laboratories



Delegates at the two-day symposium on scaling-up of chemical plant (last week's CA, p. 925) at the central laboratory, Reed Paper Group, Aylesford, on 30 May. L. to r.: R. L. Nicholson, Whiffen and Sons; K. W. Gladman, W. J. Fraser and Co.; Mr. P. H. Prior, Reed Group's paper and paper making technical division; and D. C. F. Pratt, Courtaulds Ltd.

FOR YOUR DIARY

TUESDAY 11 JUNE

SCI (Chemical Engineering Group)—London: 14 Belgrave Square SW1, 5.30 p.m. 'Granulation' by W. C. Peck.

THURSDAY 13 JUNE

Royal Society—London: Burlington House, Piccadilly W1, 4.30 p.m. 'Mechanical behaviour of single crystals of metals, in particular, copper' by E. N. da C. Andrade and D. A. Aboav; 'Dislocations and stacking faults in stainless steel' by M. J. Whelan, P. B. Hirsch, R. W. Horne and W. Bollmann.

UKAEA forms Safety Branch

A SAFETY BRANCH has been formed by the UK Atomic Energy Commission. This will serve two committees, the safety executive committee and the health advisory committee which will carry out the safety responsibilities placed on the UKAEA by the Atomic Energy Authority Act 1954.

Under this act the Authority must secure that no ionising radiation from any of its premises or from any waste discharged from its premises shall cause any hurt to any person or damage to any property.

Previously these responsibilities have been carried out by a number of committees dealing with the various aspects of safety policy.

The new branch will operate from the headquarters of the industrial group at Risley, near Warrington, Lancs.

Mr. F. R. Farmer has been appointed to the post of chief safety officer and will take charge of the safety branch.

Boron Phosphide A New High Abrasive

Mention was made in CHEMICAL AGE recently (9 March, 436) of the synthesis of borazon crystals (boron nitride with the zinc-blende structure) by General Electric Co. of the US. Two chemists attached to the British Ceramic Research Station now report (*Nature*, 1957, **179**, 1075) that they have prepared boron phosphide (BP) of zinc-blende structure by the reaction of boron and red phosphorus in an evacuated, sealed silica tube at 1,100°C. Analysis of the reaction produced by X-ray diffraction showed a zinc-blende structure. Traces of tungsten carbide, originating from the mortar were present in the X-ray diffraction photographs, indicating the high abrasiveness of boron phosphide.

The authors state that by analogy with borazon and diamond, BP would be expected to be harder than silicon carbide and also to have a larger energy gap. These and other physical and chemical properties are now being investigated.

People in the NEWS

● THE MARQUESS OF SALISBURY, K.G., P.C., and SIR WILLIAM SLATER, K.B.E., have been elected Fellows of the Royal Society under the statute of the society which provides for the election of persons who either have rendered conspicious service to the cause of science or are such that their election would be of signal benefit to the society.

● MR. ROBERT KRIS, B.SC., has been appointed general manager of Aeroplastics Ltd., Hillington, Glasgow. He will be responsible for increasing the company's plastics service to the aircraft, shipbuilding, motor car, electronics and allied industries. Mr. Kris was formerly managing director of Welwyn Plastics Ltd., and general manager of East Anglia Plastics Ltd.

● MR. J. PICKTHALL, F.R.I.C., chief chemist, Polak and Schwarz (England) Ltd., has been elected president of the Society of Cosmetic Chemists of Great Britain for 1957/58. DR. A. W. MIDDLETON, B.SC., F.R.I.C., has been elected vice-president, MR. F. RILEY, hon. secretary, MR. R. E. SPATE, hon. treasurer, and MR. G. A. PITT, M.SC., A.R.I.C., MR. P. G. GUGENHEIM, M.A., A.R.I.C., and MR. E. POLAN, members of council. DR. H. W. HIBBOT, DR. W. MITCHELL and DR. W. W. MYDDLETON have been elected to serve for a further year as members of council.

J. Pickthall

M. N. Gladstone

● MR. M. N. GLADSTONE, of Fisons Pest Control Ltd., has been elected chairman of the Association of British Insecticide Manufacturers for 1957/58. MR. GEORGE HUCKLE (Shell Chemical Co. Ltd.) has been elected vice-chairman, MR. H. J. JONES, O.B.E. (Hemingway and Co. Ltd.) hon. treasurer, MR. N. B. TAYLOR (Hickson and Welch Ltd.) hon. auditor. Executive committee has been elected as follows: MR. R. E. BERK, (F. W. Berk and Co. Ltd.), MR. A. W. BILLITT (Boots Pure Drug Co. Ltd.), MR. E. T. BUGGE (Bugges Insecticides Ltd.), MR. D. J. S. HARTT (May and Baker Ltd.), MR. H. C. MELLOR (Bayer Agriculture Ltd.), MR. A. J. MOYES (Mirvale Chemical Co. Ltd.), MR. D. NAHUM (Pan Britannica Industries Ltd.), MR. R. C. STOTTER (Plant Protection Ltd.), MR. N. K. SMITH (Murphy Chemical Co. Ltd.).

● The Corday-Morgan Commonwealth Fellowship for the academic year 1957/58 has been awarded to DR. E. A. MAGNUSSON, teaching fellow in the School of Applied Chemistry at the New South Wales University of Technology, Australia. During his fellowship Dr. Magnusson is to carry out an investigation of the theoretical basis of chemical bonds, with special reference to inorganic complexes, under the supervision of Professor D. P. Craig, in Professor C. K. Ingold's department at University College, London. Awarded for post-doctorate or equivalent study in any branch of chemistry, the fellowship is tenable for one year.

● MR. A. J. OXLEY, M.SC., has been appointed production manager at the Chester-le-Street works of British Oxygen Chemicals Ltd.

● As a personal tribute to the late MR. J. E. KINGSBURY, former vice-chairman and director of Bakelite Ltd., his portrait in oils was presented to his daughters recently by MR. H. V. POTTER, chairman. Mr. Kingsbury was one of the founders of the Damard Lacquer Co. which became associated with Bakelite Corp., Delaware, US, thus leading to the formation of Bakelite Ltd. He was also a pioneer in the development of the telephone.

● MR. D. SELWOOD, chairman of the South Wales and West of England chemical productivity committee has been appointed Bristol and District secretary for the general workers' group, Transport and General Workers' Union.

● MR. F. R. FARMER, who has been appointed to take charge of the UK Atomic Energy Authority safety branch with the rank of chief safety officer, studied mathematics and physics at Cambridge. Before joining the UKAEA in 1947 he was with a firm of chemical engineers in London.

● MR. C. E. RAMSDEN, managing director of C. E. Ramsden and Co. Ltd., has been elected president of the Society of Glass Technology. SIR CHARLES PONSONBY, chairman of Forsters' Glass Co. Ltd., past president of the Glass Manufacturers' Federation, and MR. E. A. S. ALEXANDER, deputy chairman of the United Glass Bottle Manufacturers Ltd., and past president of the federation, have accepted invitations to become Fellows of the Society.

● LORD HALSBURY, F.R.I.C., F.Inst.P., M.I.Prod.E., managing director of the National Research Development Corporation since 1949, has been elected president of the Institution of Production Engineers for 1957/58. MR. H. G. GREGORY, M.I.Prod.E., chairman of council, and MR. H. W. BOWAN, O.B.E., M.I.Mech.E., M.I.Prod.E., vice-chairman of council, have been re-elected for a further year of office.

● MR. E. G. WILLIAMS, production director of the plastics division of Imperial Chemical Industries Ltd., has been appointed joint managing director of the division. Mr. Williams has been with the plastics division since 1942. He became research director in 1951 and in December 1956 was appointed production director.

● At the annual general meeting of the Association of Public Analysts on 23 May the following officers were elected for the coming year:

President, F. C. BULLOCK; *vice-president,* H. E. MONK; *past presidents,* G. TAYLOR; T. MCLACHLAN; E. VOELCKER; *hon. treasurer,* H. E. MONK; *hon. secretary,* D. D. MOIR; *assist. hon. secretary,* F. A. LYNE; *hon. editor,* E. C. WOOD.

Obituary

MR. WILLIAM ALASDAIR CHRYSTAL, joint managing director of British Chrome and Chemicals Ltd. since 1953, died last Saturday in a fire at his home in London, at the age of 45. Joining John and James White Ltd., Glasgow, in 1932. Mr. Chrystal was a director of that company for many years, becoming chairman in 1952. When the company merged with British Chrome and Chemicals in 1953, he became joint managing director of the latter company. Mr. Chrystal was closely connected with the company's Canadian organisation, British Chrome and Chemicals (Canada) Ltd., of which he was a director.

MR. VICTOR G. BARTRAM, chairman of Shawinigan Chemicals Ltd., until his retirement on 1 March, died on 31 May at the age of 66.

Wills

DR. ARTHUR ERIC JARVIS VICKERS, PH.D., M.SC., F.R.I.C., F.R.M.S., of Wynnstay, Millfield Road, Whickham, Co. Durham, a director of Thermal Syndicate Ltd., and head of the company's research department, who died on 8 September last, intestate, left £2,441 net.

MR. EDWARD FITZWALTER WRIGHT, of The Castle House, Deddington, Oxon., chairman of British Chrome and Chemicals (Holdings) Ltd., who died on 27 March last, left £11,468 net.

First Atoms for Peace Film

'British Atomic News,' Britain's first coloured documentary film on the peaceful uses of the atom will have its premiere after Whitsun. So many British and foreign industrialists have asked to see the film, that the original premiere of one showing has been extended over five days. The film is the first of a series to be sent abroad.

Commercial News

Laporte Industries Pay Same on Lower Group Net Income

FINAL dividend of Laporte Industries for the year ended 31 March is 11 per cent, making a total for the year of 16 per cent, same as for last year.

Consolidated income rose from £1,687,655 to £1,774,443, but net income decreased from £935,511 to £909,177 owing to a heavier tax charge.

Courtaulds

More than 90 per cent of the stockholders of British Celanese have accepted, or intimated their intention to accept, the offer made by Courtaulds through Baring Brothers and Co. The offer is now unconditional and Courtaulds are willing to receive acceptances from stockholders who have not yet replied.

Edwards High Vacuum

A record turnover in 1956 is reported by Edwards High Vacuum Ltd., Manor Royal, Crawley. Group trading profit was £179,119 (£163,819), and net profit, after tax of £94,244, was £84,875 (£77,998). Final dividend of 11 per cent, making 15 per cent, is announced on ordinary.

During the year, the company developed its complete range of high vacuum equipment to standards of leak tightness comparable with those required for atomic energy. To-day atomic energy in many forms is said to be possible only because of high vacuum equipment. In particular atomic fuels are produced by high vacuum metallurgy.

Cancellations for installations in connection with the television industry, were more than off-set by other developments, including the growth in associated activities with Efco Ltd., for vacuum metallurgical plant. The company's leak testing equipment, built primarily for use in the nuclear field, is being increasingly used in industry for testing cans, drums, and large tanks to ensure freedom from imperfections.

Morgan Crucible

Group profit of Morgan Crucible for 1956 totalled £2,038,271 (£2,219,091). Net profit amounted to £1,006,093 (£1,088,643). Final dividend of 6½ per cent is declared making 10 per cent (10 per cent, plus centenary bonus of 1 per cent).

Lacrinoid Products

At the annual meeting of Lacrinoid Products Ltd., chairman, Mr. S. 3. Gibbins, announced that production in 1956 was a record.

Reasons for the lower net profit was the increase in wage rates during the year and the reduced margin of profit that has had to be accepted in a highly competitive market. The third reason was construction difficulties with a separate building to house the company's manufacture of basic raw materials. The cost of developing the raw material, £7,717, was written off during 1956.

Twenty per cent of the company's turnover was exported direct and about another 20 per cent was believed to be exported indirectly.

Yorkshire Dyeware

Final dividend announced by the Yorkshire Dyeware and Chemical Co. was 10 per cent and bonus 5 per cent (same), making a total of 20 per cent for the year ended 31 March (same). Group profit was £123,558 (£124,049) after tax of £147,592 (£140,725).

Hugo Stinnes Corporation

The US office of Alien Property is inviting tenders from citizens of America and OEEC members nations for 530,712 shares in the Hugo Stinnes Corporation, which has interests in chemicals, oil products etc. The company is registered in Maryland but most of its activities are centred in West Germany. Shares are currently quoted at about $40 each.

NEW COMPANY

LIQUID CARBONIC CO. LTD., Capital £100. Manufacturers of and dealers in carbon dioxide and other gases, and equipment for the storage, compression and sale of such gas; bottling and brewing machinery, soda fountains, bottling and brewers' engineers etc. Directors: Malcolm J. Briggs, George P. R. Baldwin, Harry L. Cook, Pierre F. Lavedan and Rex Nicholson. Registered office: Fairfax House, Fulwood Place, London WC1.

INCREASES OF CAPITAL

ALCOCK (PEROXIDE) LTD., chemical manufacturers, etc., Chaul End, Luton. Increased by £62,800 beyond the reg's tered capital of £34,000.

EFCO LTD., 17 Victoria Street, London SW1, increased by £100,000, in 10s ordinary shares, beyond the registered capital of £500,000.

YARDLEY AND COMPANY LTD., 33 Old Bond Street W1. Increased by £1,075,000 beyond the registered capital of £2,425,000.

MORTGAGES & CHARGES

F. COLLINS LTD., Lytham, chemical and general merchants. 6 May, mortgage, to Martins Bank Ltd. securing all moneys due or to become due to the bank; charged on properties.

LONDON GAZETTE

Voluntary Winding-up

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

FLETCHER MILLER LTD., manufacturers of oils, including cutting and leather oils, registered office, Alma Mills, Hyde, Ches. By special resolution, 30 May 'to reconstruct the company.' Mr. W. Moss, Booth Street Chambers, Ashton-under-Lyne, Lancs, appointed liquidator.

UNITED KINGDOM NAVAL STORES ASSOCIATION LTD., agents to the Board of Trade for the sale, purchase and distribution of resin, turpentine, pine oil and other products, registered office, 46 St. Mary Axe, London EC3. By special resolution, 21 May, Mr. E. R. Nicholson, 11 Ironmonger Lane, London EC2 appointed liquidator.

Market Reports

PRICES REMAIN ON FIRM BASIS

LONDON There has been little change on the industrial chemicals market and the overall demand both for new business and against contracts continues steady. There is a ready outlet for hydrogen peroxide, borax and boric acid and also for the general run of the potash and soda products. Overseas demand remains satisfactory and a good export trade is being transacted in cresylic acid. The other coal-tar products are in good demand on home account.

As from 5 June basis prices for dry white lead and red lead are lower at £134 5s and £126 15s per ton respectively, and litharge is quoted at £128 15s per ton.

MANCHESTER Traders on the Manchester market for heavy chemical products during the past week have reported a steady movement of the alkalis and other leading lines to home industrial consumers and also for export, with fresh inquiries circulating in fair numbers. However, they are anticipating the usual seasonal dullness during the coming week. Price conditions generally are on a firm basis. The demand for fertilisers, with one or two exceptions, is now at a seasonally low level, but most light and heavy tar products continue in steady request.

GLASGOW Business in most sections of the Scottish heavy chemical market has been very brisk during the past week, both in regard to spot and contract deliveries. On the agricultural side also demands have been well maintained and a fair volume of business has been transacted. On the whole, prices have been steady.

NEW PATENTS

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

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

ACCEPTANCES

Open to public inspection 10 July

Methylene compounds of lithium and magnesium. Ziegler, K. **778 619**

Production and regeneration of photographic silver-bleach solutions. Kodak Ltd. **778 559**

Production of metal oxides. Cabot, G. L., Inc. (Divided out of 778 705.) **778 706**

Spiro [cycloalkane-1, 6'-(m-thiazane-2'-, 4'-diones)]. Merrell, W. S., Co. (Divided out of 778 693.) **778 694**

Producing silica sol. Wallace and Tiernan Inc. (Divided out of 778 675.) **778 696**

Open to public inspection 17 July

Acids of the trisnorlanostane series and their derivatives. Ciba Ltd. **779 188**

Dry lubrication methods. National Research Development Corp. **779 243**

Recovery of butadiene-1:3 from hydrocarbon mixtures thereof. Polymer Corp. Ltd. **779 402**

Cosmetic agents for the treatment of the skin, deodorising agents and insect-repelling agents. Boehme Fettchemie Ges. **779 083**

Uranium recovery process. Grace and Co., W. R. **779 008**

Refractory materials. Plessey Co. Ltd. [Cognate applications 25 973 and 30 213.] **779 128**

Production of a methylol derivative of dicyclopentadiene. Ruhrchemie AG. **779 241**

Producing water-insoluble azo-dyestuffs on the fibre. Farbwerke Hoechst AG. **779 009**

Emulsions. Newton, Chambers and Co. Ltd. **778 902**

Streptomycin or isonicotinyl hydrazine preparations. Pfizer and Co. **779 142**

Esters and a process for their production. Ruhrchemie AG. **779 052**

Manufacture of highly refined mineral oils and petroleum sulphonates. Lobitas Oilfields Ltd., and Brown, T. F. **779 084**

Tanning process. Boehme Fettchemie Ges. **779 244**

Manufacture and use of amide-like polymerisable or copolymerisable compounds. Ciba Ltd. **779 231**

Manufacture and use of polymerisable or copolymerisable amide-like compounds. Ciba Ltd. **779 232**

Coating compositions containing polyamides. Imperial Chemical Industries Ltd., and Scott, I. C. **779 247**

Production of aldehydes and ketones. Rheinpreussen AG für Bergbau und Chemie. **779 350**

Polymeric esters and methods of preparing them. Du Pont de Nemours, E. I., and Co. **779 054**

Protection of aluminium and its alloys against corrosion. Schulman, J. H., Waterhouse, R. B., and Liddiard E. A. G. **778 943**

Apparatus for filling containers with liquids. Clayton, G. S., Ltd., and Farrar, L. R. **779 196**

Continuous dyeing of vegetable fibres with vat dyes. Standfast Dyers and Printers Ltd. **778 945**

Steroid 3-enamines. Upjohn Co. **779 001**

Antibiotics and preparation thereof. Pfizer, C., and Co. Inc. **779 257**

Heat and chemical resistant synthetic resins and varnishes. General Electric Co. **779 355**

Isophthalic acid. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 946**

Process for fractionating starch. Cooperatieve Verkoop- en Productievereniging van Aardappelmeel en Derivaten Avebe, GA. [Addition to 722 586.] **779 261, 779 262**

Manufacture of stable solid diazonium compounds. Farbwerke Hoechst AG. **778 917**

Dehydration of dimethylphenylcarbinol. Soc. des Usines Chimiques Rhone-Poulenc. **778 947**

Stabilisers for organic compositions. Esso Research and Engineering Co. **779 360**

Isothiouronium salts and pesticidal compositions containing them. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 949**

Fluid-flow measuring devices. Electroflo Meters Co. Ltd. **779 363**

Substituted α-aminophenyl ethers. May and Baker Ltd. **778 919**

Production of p-xylene. Newby, H (Chemische Werke Huls AG). **779 163**

Purification of glycol. Imperial Chemical Industries Ltd. **779 063**

Producing cellular natural or synthetic rubber material. Guggenheim, C. **779 365**

Ethyl esters of thiolcarboxylic acids. Imperial Chemical Industries Ltd. **778 951**

Acrylic acid esters. Badische Anilin- und Soda-Fabrik AG. **779 277**

Photographic emulsions. Imperial Chemical Industries Ltd. **779 065**

Oximes. Synthese-Chemie Ges. **779 238**

Organic hydroxylamine compounds. Synthese-Chemie Ges. **779 239**

Epoxy resins from aldehyde-ketone condensation products. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **779 092**

Impregnation of fibrous materials with unsaturated polyester resins. Herberts, K. [trading as Herberts and Co. Vorm O. L. Herberts, Dr. K.]. **779 069**

Oleaginous compositions. Esso Research and Engineering Co. [Addition to 769 427.] **778 920**

Production of cross-linked elastomers of high molecular weight, and intermediates in the production thereof by reacting linear or substantially linear polyesters with diisocyanates and diamines. Farbenfabriken Bayer AG. **779 070**

Preparation of cellulose esters. Hercules Powder Co. **779 281**

Gasification of small particles of solid fuel. Steinmüller, L. and C., Ges. **779 202**

Synthetic glycols and their preparation. National Distillers Products Corp. **778 924**

Separation of mixtures of fluids by distillation and/or absorption. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **779 073**

Flameproofing compositions. Diamond Alkali Co. **779 288**

Recovery of tetracycline. Bristol Laboratories Ltd. **779 290**

Recovery of hydrogen peroxide by fractional distillation of the products of the oxidation of alcohols. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 966**

Production of polyesters of high molecular weight. Kleine, J. **779 291**

Deodorisation of benzene hexachloride. Ethyl Corp. **779 075**

Fuel combustion apparatus and production of controlled gaseous effluents therefrom. Urquhart's (1926) Ltd. **779 076**

Preparing a siliceous material. Columbia-Southern Chemical Corp. **778 926**

Making binding agents having good water resistance and mechanical strength and binders obtainable thereby. Bureau d'Etudes et Laboratoires Annexes a l'Institut Meurice-Chimie Soc. P. R. L., and Maes, G. P. J. **778 968**

Dibasic carbocylic acids and derivatives thereof. Esso Research and Engineering Co. **779 025**

Pesticidal compounds and compositions containing same. Rohm and Haas Co. **779 209**

Resinous reaction products of phenyl glycidal ethers and resols. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **778 927**

Hetrocyclic magnesium chloride complexes. Metal and Thermit Corp. **779 100**

Dehydrogenation process. Esso Research and Engineering Co. **779 380**

Expanded materials from linear polyesters and diisocyantes. Hudson Foam Plastics Corp. **779 077**

Separation of impurities from cobalt-containing materials. Duisburger Kupferhütte. **779 031**

Manufacture of carbinols. Distillers Co. Ltd. **778 974**

Diagnostic reagent. Miles Laboratories Inc. **779 303**

Rendering synthetic linear thermoplastic polymer products infusible. Naamlooze Vennootschap Onderzoekingsinstituut Research. **779 304**

Flame-photometric testing of flammable gases and apparatus therefor. Stamicarbon NV. **779 212**

Preparation of amides. Esso Research and Engineering Co. **779 213**

Production of polymerisation products. Farbenfabriken Bayer AG. **779 216**

Hygrometers. Commonwealth Scientific and Industrial Research Organisation. **779 307**

Purification of concentrates containing vitamins of the B_{12} group. Aschaffenburger Zellstaffwerke AG. **779 982**

Ion exchange resins. Chemical Process Co. **779 178**

Bis (cyanopentoxy) alkanes. Rohm and Haas Co. **778 934**

Drying moist solid materials and a processing plant for carrying said process into effect. Aktieselskabet Stord. **779 310**

Coloration of articles of polymeric esters or ethers. Celanese Corp. of America. **779 219**

Solutions of organic acid esters of cellulose. Celanese Corp. of America. **779 220**

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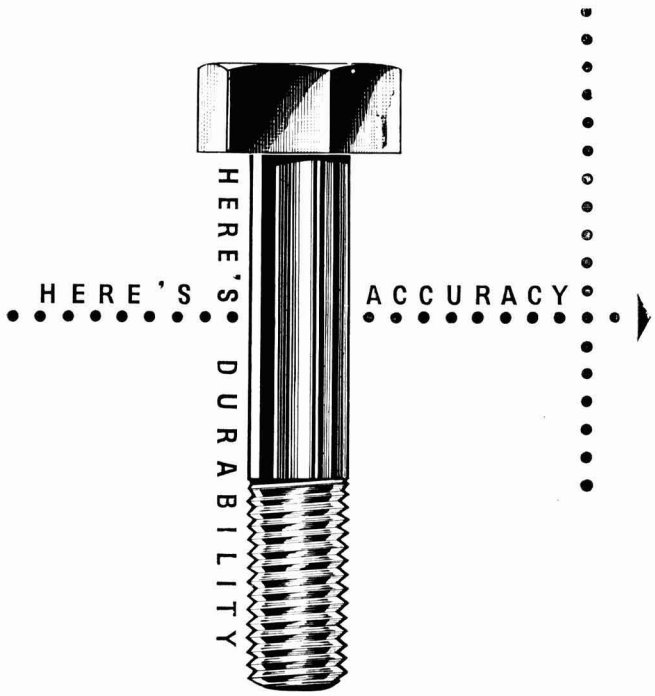

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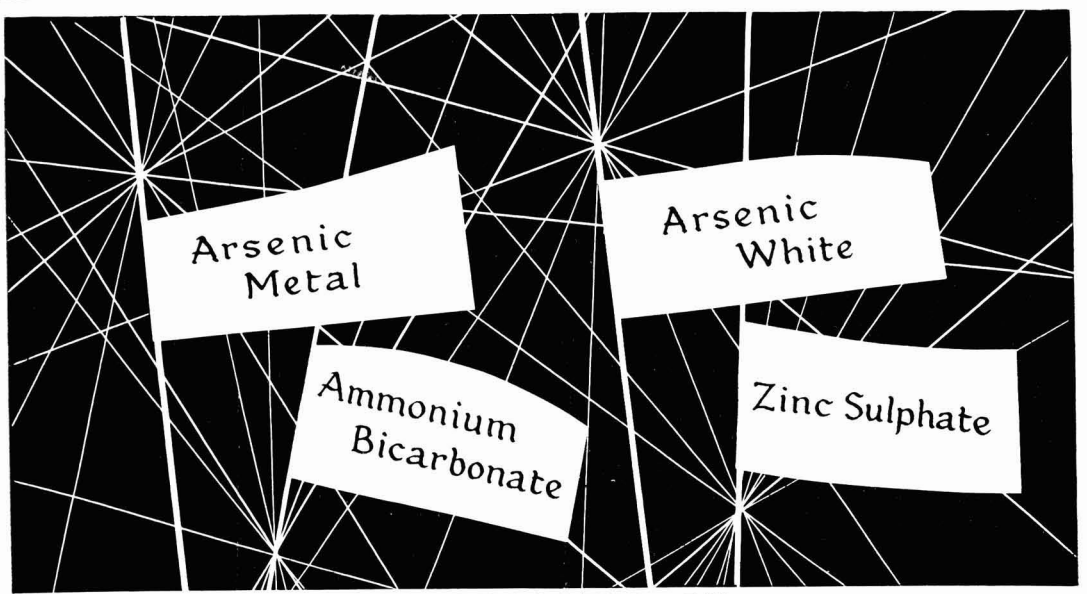

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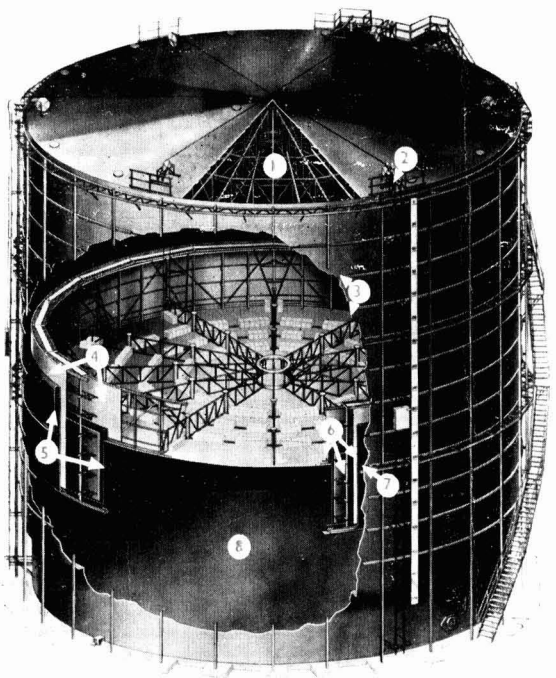

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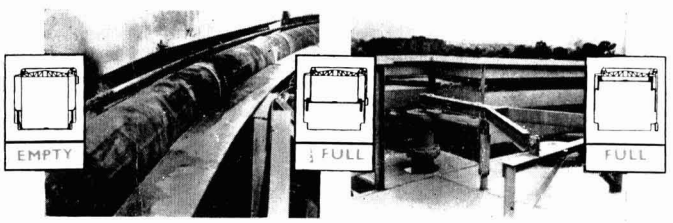

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