THE Chemical Age

VOL. LXXIII 2 JULY 1955 No. 1877

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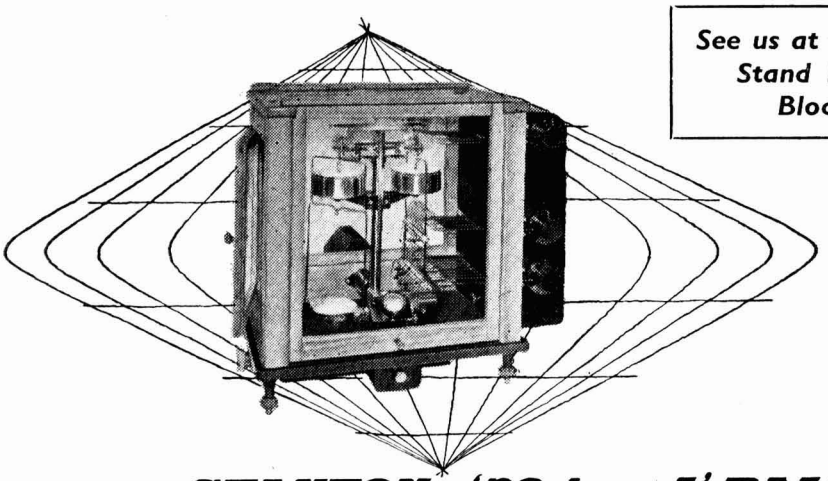

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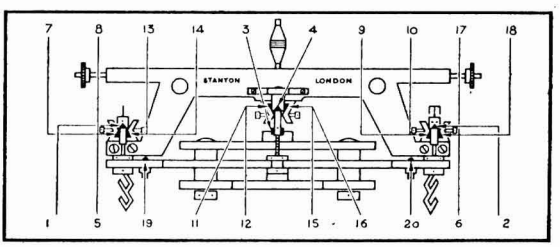

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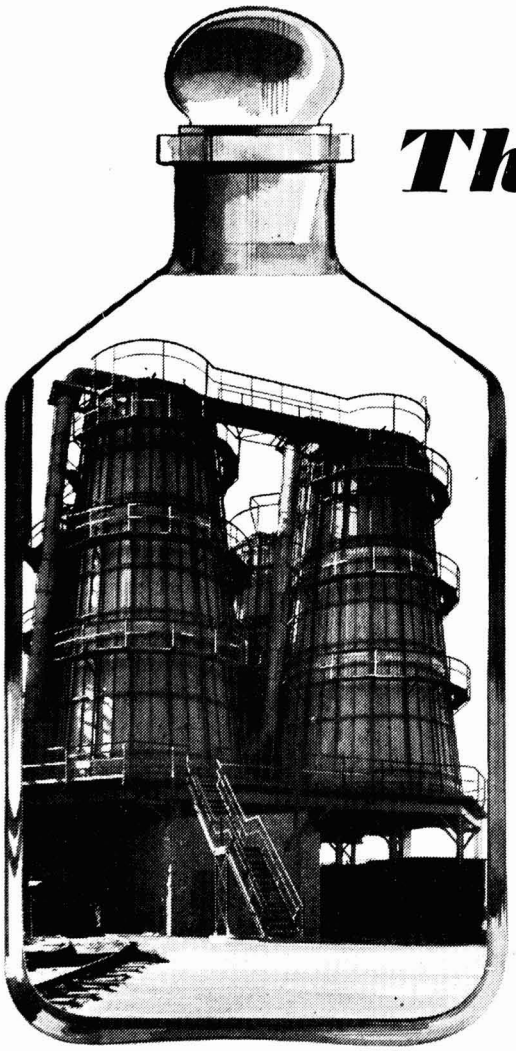

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The Chemical Age

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A Sign of Confidence

IT is doubtful whether the chemical industry in this country or in America has ever been regarded with more optimism and confidence. At the close of the last London Stock Exchange account the Ordinary shares of Imperial Chemical Industries Ltd. reached a price of 60s. Earlier in 1955 their lowest quoted price had been 38s. 3d. In 1954, shortly before the one-for-one scrip issue of shares, the price had been fluctuating in the 54s.-58s. range. In short, the effective rise in open market value of these units over rather less than 18 months has been from 27s. or 29s. to 60s. We can round this off and say that the investing-cum-speculating public has come to the conclusion that I.C.I. shares have more than doubled in value within about $1\frac{1}{2}$ years. Nor should emphasis be placed upon the element of speculation in these dramatic price movements. There is plenty of evidence that the pace of demand has mainly been created by genuine investment, that the supply of shares on the market is relatively small with holders retaining them rather than being tempted to sell at such attractive, profit-bringing prices. Nevertheless, the actual yield when 60s. is paid for one of these shares is only $3\frac{1}{3}$ per cent, and this at a period when Bank Rate is fairly high! Possibly by the time these comments appear in print the peak price of 60s. will have receded for that reason. Even so, a rise in market value in these shares of about 16 per cent occurred during a business period beset by a rail strike and docks strike.

We have selected this particular chemical company's shares for discussion for no invidious reasons. An argument is more clearly sustained by taking an actual case than by expressing it in terms of averages and indexes; also, this company, as the largest British and Commonwealth chemical undertaking, probably represents the British industry more appropriately than any other. For smaller companies with interests in a narrower range of chemical products, spectacular rises in share values could be attributed to the success of a single new product or process or to some new demand for a main product. No qualifying explanations of this kind can be applied in the case of I.C.I. whose total activities are spread across the whole chemical field, from heavy semi-refined chemicals to fine and pharmaceutical chemicals, from metals to plastics.

Confidence in the further growth of the industry is the only logical explanation. That confidence may perhaps be augmented by fears of further inflation; but this factor, which constantly tends to create a market for the 'Blue Chip' industrial shares, is common to all major industries. In any case, it is reported that a considerable amount of the recent buying has been made on American account; fears of inflation affecting the value of sterling cannot make much of a part-explanation for these purchases. Investment with long-term confidence

must be the main impulse behind the new ascent in share value, a 90 per cent cause even if 10 per cent can be attributed to short-term speculation or inflation nervousness.

The truth is that the world's standard of living, its maintenance in some directions and its improvement in others, is increasingly dependent upon the products of chemical industry. In a broad sense this may have long been true, or at any rate during the past 200 years. But now the rate at which that dependence is increasing is unprecedentedly rapid. A recent US survey article has estimated that in six years, 1949-54, American chemical industry sales increased by 90 per cent and gross profits on operations were doubled. By no means the whole of this forward surge can be put to the credit of new chemicals; some part of it is due to expansion in use of long-known products. Outstanding fields of expansion cited are plastics and synthetic resins; plasticisers; synthetic rubbers; detergents; pesticides; synthetic fibres; petroleum additives; and fertiliser ammonia. The same list probably applies to the British industry except for synthetic rubber (now in contemplation) and fertiliser nitrogen (demand for which is steadily rather than rapidly advancing here). The US survey reaches the opinion that synthetic plastics and fibres alone can double the chemical industry within the next 10 years! This seems an over-bold prediction, and we prefer the more cautious forecast that the present rate of growth will continue to express itself.

Is there any danger of over-production, the old shadow that eternally hovers in the background of booming markets? It would be unrealistic not to admit this as a possible development for each major synthetic plastics material and each major synthetic fibre, but the flexibility of the industry itself is likely to counterbalance any serious consequences. Over-production would bring price falls, and this in turn would introduce synthetic materials into new-use markets. Temporary setbacks to profitability could lead to market expansions and an ultimately enlarged output could lead to lowered production costs. As demand and throughput rises, costs of synthetics tend to fall, but costs of primary materials are steadily tending to rise. A narrowing of the price-gap between synthetics and primaries is an almost certain expectation of the future. In terms of tonnage-use, synthetic constructional materials are used as yet to an extent that is dwarfed by the use of steel; It is possible for the tonnage-use of synthetics to double or treble at the expense of metals without seriously upsetting the primary materials market. In short, whatever has so far been accomplished by synthetics, their potential opportunities are far greater. The same argument can be applied with not much smaller faith to synthetic fibres—their current use is still small compared with the total use of cotton.

If the market prospect is good, so too is the production prospect. Few industries have a better record for freedom from problems of labour disputes. The output per man in terms of value is exceptionally high, and productivity advances have been made at an impressive rate in the past few years. Even so, the outlook for further productivity improvement is exceptionally good for chemical processes are well suited to the introduction of 'automation'; nor, when this is done, will it introduce new labour friction for the labour that is saved can be applied to other expanding operations. The single factor that might be regarded as serious is the shortage of fully-trained technical staff, a national problem that inevitably impinges with force upon an essentially scientific industry. To some extent the industry has avoided acute consequences by being able to offer high salaries, but this has increased the deficiency of science teachers in schools. Unless this exceedingly difficult economic dilemma is resolved—and the need is ever more urgent—the primary source of scientists and technologists, the schools, will produce smaller and smaller numbers of future scientists each year. It would help towards a solution if public opinion was made more aware of the size and potentialities of the industry's activities. The verdict of investors has been dramatic but the man-in-the-street has little knowledge of the industry, nor do more than a minority of companies seem interested in giving him better information.

Notes & Comments

Matter of Opinion

NOT long ago we went to some trouble to obtain up-to-date information about a certain industry. We do not grumble about the trouble we took, beset though we were by the effects of a strike at the time—it is a first editorial duty to take trouble to get information, and, of course, to make sure that it is also correct information. This particular sector of Britain's technical industry has several trade associations. We tackled each of them. Was there anything they would like to have said about recent progress, export trades results or outlook, new trends, etc., etc.? We sought nothing specific, asked no question that probed into some possibly delicate subject. In fact, we offered a *carte blanche* opportunity for points to be made about the industry, the only proviso being that we would weld all the information or data we obtained into one general picture of the industry. We could not offer long notice of our requirements—we needed any information we could use within a few days. In that single respect we were perhaps a little difficult, but the Press is often conducted with a certain touch of urgency. After all, ours is a weekly publication and type-setting and proof-reading and subbing all have their set times of finality if regular publication is to be achieved.

Broken Promises

WHAT was the sum result of our efforts to get this industry's own collective organisations to tell us and our readers about current events in the industry? Almost but not quite nil! There were persons apparently in charge of public relations. They all seemed to be excessively busy and even more excessively non-commital. If only we could have given them more time! Promises were made that we should receive 'something' within two or three days. Only in one case was there any further reaction from our first approach—we were telephoned for further discussion and we did by the last possible date receive a short letter and a table of useful statistics. It was a small enough portion of help but at least it showed willing. As for the rest, we might just as well have saved our own time and costs and gone ahead (as we had to in the end) with our own outside view of the industry.

Second Class Citizens

WE can only conclude that this industry prefers to hide its considerable light under some fear-ridden bushel. Its organisations seem to have put people in charge of Press or public relations not to supply information with any freedom but to act as censors; alternatively, these people have no power to act speedily but must refer everything backwards to more remote officers or committee-members of the associations. We quote from a commentary in the June issue of *F.B.I. Review* on this same subject, the industrial PRO: 'If he is employed as a second-class industrial citizen to act as a buffer state between a company and the outside world he has little chance to act as the channel for which he should surely have been originally intended.' There could hardly be a more appropriate comment upon our own experiences in one small section of British industry.

No Mere Bell

ON the other hand, when a company or trade organisation decides that it wants the Press to devote space to some new development, it is common custom to hold a lavish party—a Press conference at some well-appointed hotel

FLEet Street 3212

The telephone number of THE CHEMICAL AGE has been changed to to FLEet Street 3212. There has been no interruption in the service during the transfer and calls dialled to the present number (CENtral 3212) after the change have been automatically connected to the new number.

with hospitality even more generously provided than words and statistics. When the Press seeks, it gets a dusty answer; yet when the Press is sought, no overseas client could be more flatteringly entertained. And on many such occasions the information handed out is already fairly well known to the Press and of much less news-interest than the company or organisation supposes! We cannot do more than drop hints. The Press, especially the technical Press, is anxious to give all possible help to British industry, to put into print all that is worth saying. But no section of the Press is a mere bell to be rung and echoed when industry sees fit, to be ignored at other times. We do not blame PROs. Theirs is a newish occupation and many of them have adequate qualifications. But they are word-bound by restricted terms of reference, by having to refer anything they might issue to trade association officers or company executives who are often busily inaccessible and who in any case know little about the Press. And in some cases they seem to have been appointed not to inform the Press but to control the Press! Where this latter attitude operates, we can but observe that money is being totally wasted.

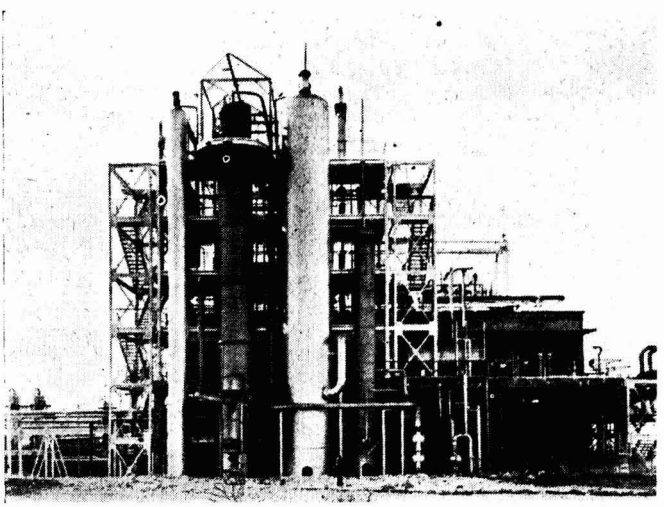
US Firm Designs Antwerp Plant

A NEW petrochemicals plant to be built near Antwerp, Belgium, will include major ethylene oxide and ethylene glycol production units, according to a statement by Mr. Harry A. Rehnberg, president of the Scientific Design Co. Inc. which has been awarded contracts for the design and engineering of these components. The plant, to be completed by next year, will be operated by the Societe Chimique des Derives du Petrole ('Petrochim').

Ethylene oxide production will be prominent among the variety of compounds to be manufactured by the plant from the gases of refineries in the Antwerp district. It will be the third plant designed and engineered by Scientific Design Co. Inc. for the manufacture of ethylene oxide by direct oxidation.

A useful chemical used in the manufacture of permanent anti-freeze and many detergents, ethylene oxide is also used to produce acrylonitrile, the base material for a number of leading synthetic fibres, including Orlon, Acrilan and Dynel.

The project is financed by eleven Belgian corporations who have $8,000,000 capital available, including a loan of $2,000,000 from the Belgian Government. Leading shareholders include the Societe Belge d'Azote, Carbochimique, Petrofina and Sofina.



The first plant designed and engineered by Scientific Design of New York for the manufacture of ethylene oxide by direct oxidation for Naphtachimie at Lavera, France

New Home for Water Pollution Research

Lord Salisbury Opens Stevenage Laboratories

THE new Water Pollution Research Laboratory at Stevenage, Herts, was officially opened on 20 June by the Lord President of the Council, Lord Salisbury.

In referring to problems with which the laboratory was concerned, Lord Salisbury described pollution as a by-product of civilisation. In the days of Queen Elizabeth I, the population was so small and scattered that, except in a very few of the larger towns, there was very little pollution in the wider sense of the word.

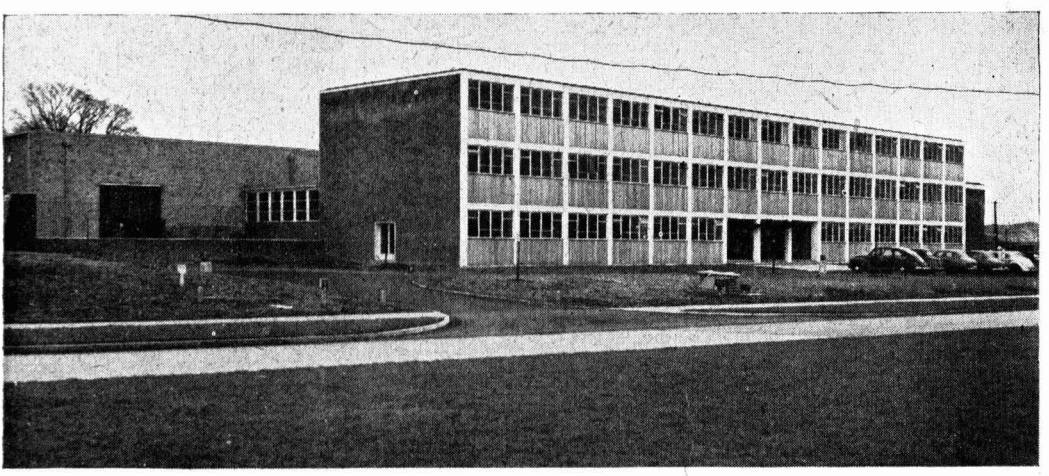
First there was the ordinary domestic pollution which came from bad drains or possibly from no drains at all. With the advent of the industrial revolution there came also industrial pollution. Latterly the increasing cleanliness of the population had presented the new problem of pollution by synthetic detergents. Finally, a completely new form of pollution was presented by radioactive waste.

As an example of the Laboratory's important and far-reaching work, Lord Salisbury instanced the inquiry into the pollution of the Thames Estuary, where the situation was steadily deteriorating. Ships and structures were being corroded, paint was being blackened, and unpleasant smells were pervading the whole neighbourhood. He recalled the time when so many Thames salmon were delivered at Billingsgate market in a single day that there was a complete slump in prices.

As the member of the Government predominantly responsible to Parliament both for the DSIR and for the Atomic Energy Authority, Lord Salisbury looked forward with particular interest to the results of the Laboratory's researches into methods of dealing with radioactive wastes. Its help was going to be of vital importance in dealing with problems arising from the immense programme for the production of power by nuclear energy. The Laboratory was already in consultation on the siting of generating stations so as to ensure that the radioactive waste would be disposed of without danger or even embarrassment to the public.

The new headquarters of the Water Pollution Research Organisation includes offices and a library, small-scale and pilot-scale laboratories, constant-temperature rooms, well equipped workshops and a canteen.

The laboratory services include hot and cold water, compressed air, electricity, gas, drainage in polythene pipes, and fume extraction. The services are concealed in ducts in false ceilings of corridors, below the ground floor corridor, in ducts between floors, and in the upstand behind panels. The rooms are warmed by thermostatically controlled heaters behind the benches or hot



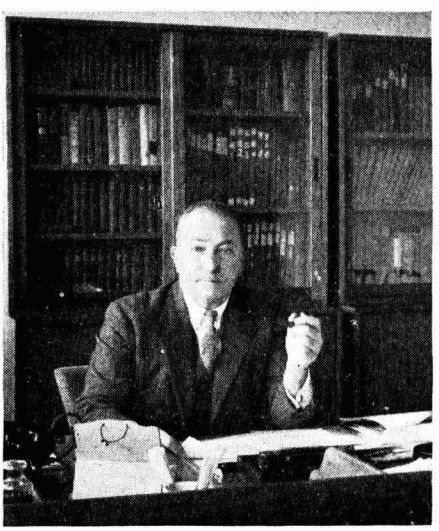
Main block and pilot-scale laboratories

water radiators under the windows. Rooms facing south are provided with venetian blinds. The doors of laboratories are louvred to admit air.

There are facilities in the grounds of the station for carrying out large-scale experimental work on the treatment of sewage, up to 70,000 gallons of which can be pumped daily from a domestic sewer which crosses the site and serves the residential part of the new township of Stevenage. A supply of this settled sewage can be pumped to the pilot laboratories.

The toxicity of a range of substances commonly discharged in effluents is being determined in the Laboratory. Apparatus has been developed for controlling the concentrations of oxygen and carbon dioxide simultaneously and adding any dissolved toxic substances required. *p*H value and temperature are closely controlled.

For its work on the toxicity of effluents to fish, the Laboratory has been authorised to take water straight from a borehole and hence unchlorinated. This water supply has been divided into two circuits. One stream goes to a cold storage tank, while the other goes to a storage tank from which it is fed to a calorifier which heats it to a temperature higher than that required. The two streams are brought to mixing valves in the laboratory and mixed under thermostatically controlled conditions for use in the fish tanks.



Dr. B. A. Southgate, C.B.E., Director of Water Pollution Research

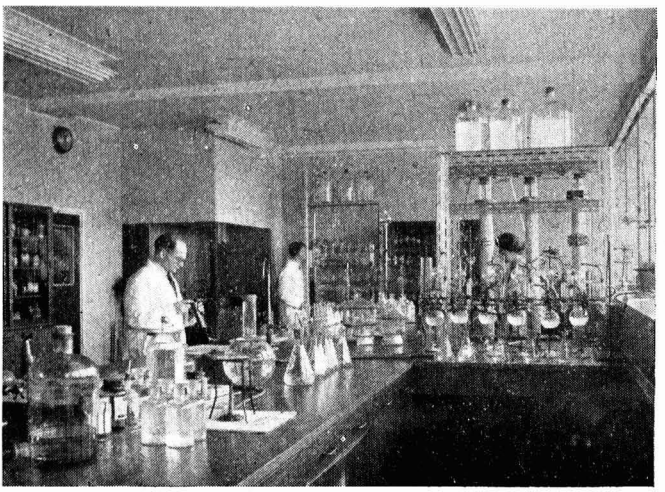
In laboratory experiments determinations were made of the toxicity to trout of water containing measured quantities of mixtures of seven proprietary synthetic detergents. Of trout exposed for a week some were killed when the concentration of surface active agents exceeded about 6 ppm. This concentration is of the same order as that now sometimes found in sewage effluents, but is considerably higher than would normally be found in a polluted river.

Toxicity Determined

The concentration of synthetic detergent in sewage is reduced during treatment at a sewage works and there may be chemical changes in those constituents discharged with the effluent. Experiments are therefore being made to determine the toxicity of effluents produced in a miniature sewage works which is in duplicate. Sewage is made up, settled and pumped to one of two overhead tanks, from which it is fed through a mechanical dosing valve into a percolating filter. The effluent is allowed to settle for a short time and is then collected for use in toxicity tests. Two effluents are produced, one being from synthetic sewage alone and the other from synthetic sewage to which known quantities of detergents have been added. Fish tanks are treated with the effluents under precisely controlled conditions and the survival times of the occupants are analysed. The miniature plant exhibits all the characteristics of a normal sewage works, even to the fly population.

Under the Rivers (Prevention of Pollution) Act, 1951, River Boards were given powers to fix standards for effluents discharged to streams in their areas. One of these standards may be the toxicity of an effluent to fish. At present there is no standard method of making this test and the Ministry of Agriculture, Fisheries and Food is working at the Water Pollution Research Laboratory on the development of a standard technique.

Oxidation is the fundamental process involved in most forms of sewage treatment and in the design of treatment plants the supply of oxygen to the sewage undergoing treatment is considered of prime importance. Experiments are being made to determine whether the supply of oxygen is a factor limiting the performance of treatment processes and also to determine to what extent oxidation is responsible for the purification effected, compared with coagulation of



One of the chemical laboratories where experiments are in progress on removal of fluoride from water and on the effect of oxygen concentration on the efficiency of percolating filters

colloidal matter and formation of humus. Three experimental percolating filters are being maintained in atmospheres containing various proportions of oxygen, and the effect of this variable on their performance is being studied. The following results have been recorded:

Concentration of oxygen in atmosphere, %	21	6	2
Proportion of carbon removed, %	95	93	88
Proportion of nitrogen oxidised, %	76	31	1
Period before nitrofication started, days	7	16	25

To understand the mode of action of percolating filters, information is required on the factors affecting absorption of oxygen from the air by the sewage. Research is in progress to determine the rate at which absorption takes place and the effect of variable factors such as the design of the filters, its physical environment, the rate of application, and the chemical nature of the sewage. Preliminary experiments are being made in which clean water is applied to inert, laboratory-scale 'model' filters containing a regular assemblage of glass spheres. The rate at which oxygen is absorbed by the thin films of water on the surfaces of the spheres is measured by adding to the water a large excess of sodium sulphite and measuring the uptake of oxygen in terms of the amount of sulphite oxidised.

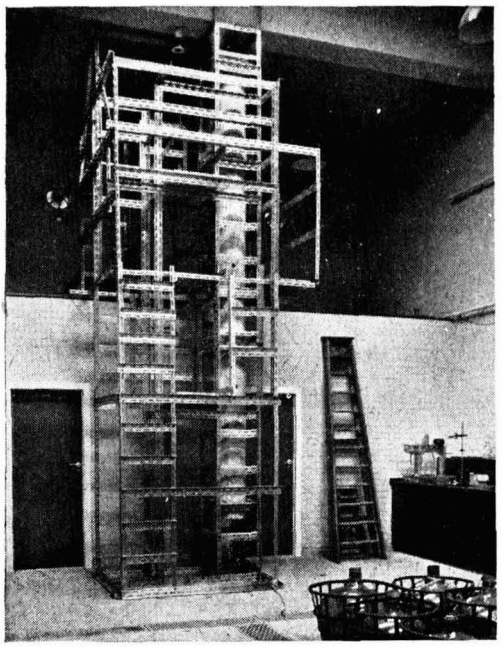
Since aeration in filters is probably governed largely by the rate of transfer of oxygen into thin films of water, this aspect of the subject is being studied in detail, using an apparatus in which films of measured thickness and velocity are allowed to flow over a glass plate under carefully controlled conditions.

Although most of the analytical work required in research on the treatment of sewage and waste waters is done by the section of the Laboratory concerned, a room has been equipped for carrying out centrally the tests most commonly used for assessing the characteristics of a sewage. These are the b.o.d., the permanganate value, and the contents of ammonia, oxidised nitrogen and suspended solids.

In fundamental research on the biological decomposition of sewage and wastes containing organic matter, an absolute measure of the content of organic matter in the liquid undergoing treatment is required. This is given by determination of the content of organic carbon and of organic nitrogen present.

Some substances in polluted waters—e.g., sulphite—may interfere with the chemical determination of dissolved oxygen. To overcome this difficulty experiments are being made with a modification of the Van Slyke apparatus, originally designed for analysis of blood. All dissolved gases are extracted from the water and the oxygen is then determined in the gas phase.

Among the problems under investigation at Stevenage is the removal of fluoride from water. The presence of excessive fluoride in a water supply causes mottling of teeth. In experiments now in progress the water is passed slowly through a bed of granular activated alumina which absorbs most of the fluoride. When the bed is exhausted the



Treatment of cyanide by biological filtration

alumina is regenerated by washing successively with dilute caustic soda, water, dilute sulphuric acid, and then water again. The bed material can then remove fluoride from a further quantity of water. The bed can be regenerated repeatedly.

Progress in the treatment of waste waters containing cyanide (see THE CHEMICAL AGE, 1955, **72**, 984) was illustrated by a series of exhibits. Hitherto chemical methods have been used for treatment of metal-finishing wastes containing cyanide. By addition of ferrous sulphate and adjustment of *p*H values, most of the cyanide is precipitated as insoluble complex cyanides of iron. The reagents are cheap and non-poisonous and the process is widely used where complete removal of cyanide is not required.

For complete removal of cyanide, a chlorination process must be used. In a detailed investigation of this process, the Laboratory found that the cyanides of sodium, potassium, zinc, cadmium and copper in strongly alkaline solution are converted first to cyanogen chloride, which is then rapidly hydrolysed in the alkaline medium to relatively harmless sodium cyanate. Several plants using this process have recently been built in Britain.

As an alternative to chemical treatment, the Laboratory has found that cyanide in concentrations up to about 150 ppm. can be destroyed biologically, using a percolating filter of the same type as is used for purifying sewage. Pilot plants are being tried by two commercial firms and there is a good prospect that the process may find general application in the metal-finishing industry. From filters matured for treating cyanide, the Laboratory has isolated a bacterium that can live on the cyanide. The organism has been provisionally classed among the *Actinomycetaceae* and investigation of its biochemical activity is proceeding.

The Ministry of Housing and Local Government has asked the Water Pollution Research Laboratory to investigate the fate of radioactive substances discharged to streams. This will be done in a section of the new establishment which has been specially designed for radiochemical work.

Tracer techniques are being used by the Laboratory for determining periods of retention in tanks, filters, and other systems. Investigations should be of value in elucidating the reactions which occur during biological filtration.

Sulphur Mercurial!

WHEN it became apparent that sulphur supplies were adequate to meet the requirements of all countries outside the Communist bloc in 1953, pressure for the development of new sources of supply relaxed, and several development projects were abandoned.

The Bureau of Mines, a Department of the US Interior, in its report 'Sulphur in 1953' which has just been released, reveals that production in the US declined slightly, although home consumption was four per cent higher. The demand was strictly local, for exports decreased by five per cent.

During the year despite production-trimming output capacity was added, particularly at the American mines using the Frasch process, and in plants where sulphur is recovered from natural and refinery gases. Major progress was made in the construction of Frasch sulphur production facilities in Mexico.

Domestic consumption in 1953 was 5,049,400 tons, and exports 1,271,011 tons. The import total of 92,229 long tons was 37 per cent below that imported the previous year.

The Dust-Proofing of Concrete with Sodium Silicate

WHEN the porous surface of untreated concrete is subjected to an abrading action, small particles break off and crumble away to a gritty dust. This quality is particularly objectionable if the concrete forms a floor, roadway or yard in a factory, etc., where the dust formed in this way may injure delicate machinery, cause contamination of products and have a harmful effect on the health and comfort of employees.

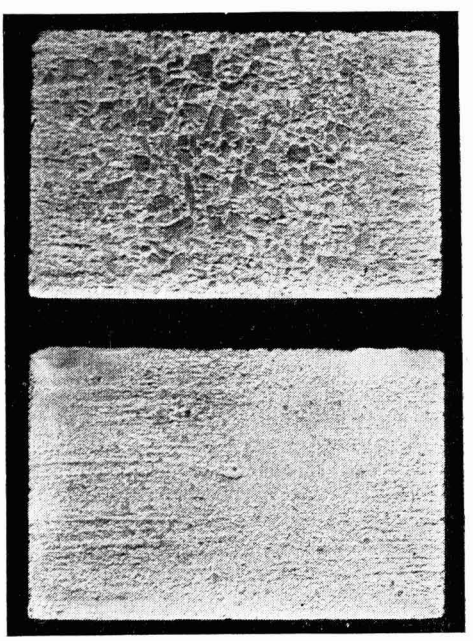
To produce a concrete with a non-dusting surface, by far the best means to adopt is to lay high grade concrete, taking every precaution in relation to the grading of the aggregate, the cement-water ratio, the careful laying and avoidance of over-trowelling, curing, etc. In practice this standard is not usually reached, and it is necessary to resort to treatment with a dust-proofing agent.

Cheapest & Most Effective

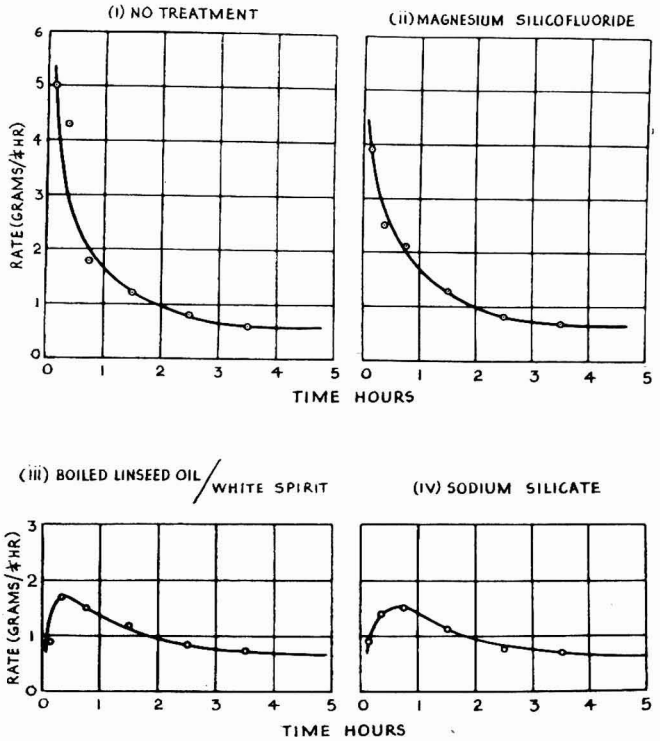
Treatment of the concrete with sodium silicate is the cheapest, simplest and most effective way of overcoming this dust problem. Sodium silicate solutions are clear, colourless and odourless. They are non-inflammable and non-poisonous, and if kept in a closed container will not deteriorate on storage. Many grades of sodium silicate are marketed which differ in the proportion of silica to sodium oxide which they contain. Those with a silica to sodium oxide ratio of 3.3 or 3.4 to 1 and specific gravity of 79 to 84° Tw are especially suitable for treating concrete. Inferior results are likely to be obtained if common water-glass, which has a lower ratio and higher density, is used. Proper treatment with sodium silicate results in the pores of the concrete being filled up with a very hard, siliceous material which is not easily abraded, and which will not give rise to harmful dust.

The sodium silicate treatment is very easy to apply. To effect proper penetration of the silica into the concrete, and thereby obtain a more enduring hardening effect the application should be in three stages, at intervals of about 24 hours. The first employs silicate diluted in the ratio of 1 of silicate to 4 of water (by volume); the second is at a dilution of 1 to 3; and the third at a dilution of 1 to 2. The covering power of the sodium silicate varies with the porosity of the concrete, but on an average one gallon of silicate, mixed with water as described above, is sufficient for the complete treatment of 200-350 sq. ft. of concrete. The treatment may be applied to new or old concrete, provided it has a clean surface, at any time after the concrete has set. As a result of a thorough investigation into this point it has been shown that if the silicate treatment is applied between seven and fourteen days after the concrete has been laid an additional hardening effect is obtained.

From time to time other materials, such as the silicofluorides and linseed oil-white spirit mixtures, sold under various proprietary trade names, are suggested as alternatives to sodium silicate for dust-proofing concrete. A thorough investigation of these materials has shown that sodium silicate possesses many advantages over them. This point is illustrated in the graphs shown over the page.



Test specimens of concrete after 2 hours abrasion. Top, untreated; bottom, treated



Graphs showing the effect of abrading under identical conditions, four specimens of concrete treated in different ways

These graphs were constructed from abrasion tests carried out under identical conditions with a standard abrading machine. They show the effect of abrading four test specimens of concrete, one of which was untreated (i), the other three having been treated according to the manufacturers' instructions (ii) with magnesium silicofluoride (iii) with a linseed oil-white spirit mixture and (iv) with sodium silicate. The rates of abrasion in cases (i) and (ii) are similar, both being much greater than in cases (iii) and (iv), which are also similar.

The photographs show the surface of two test specimens of concrete after they have been abraded for two hours, photograph I corresponding to graphs (i) and (ii), and photograph II corresponding to graphs (iii) and (iv). Since both silicate and the silicofluorides depend for their effectiveness upon the deposition of hard insoluble, siliceous compounds, it is to be expected that there should be some resemblance in their performance. In an effort to account for the surprising failure of the magnesium silicofluoride, the sample used was examined and was found to have deteriorated on storage, leaving a deposit of silica at the foot of the container. This explained the poor result.

A repeat of the test with a freshly prepared sample of magnesium silicofluoride gave results similar to that of cases (iii) and (iv). This shows clearly the marked deleterious effect on the dust-proofing properties of magnesium silicofluoride resulting from decomposition in storage.

The chief advantages of silicate over alternative dust-proofing agents may be summarised as follows:

1. Silicate is much cheaper than the alternative materials.
2. Silicate can be stored indefinitely in a closed container without deterioration, a property not possessed, for instance, by the silicofluorides.
3. Silicate is non-toxic. On the other hand the silicofluorides are toxic, their toxic effects being identical with those of the fluorides.
4. Silicate is non-inflammable, whereas dust-proofers of the linseed oil-white spirit type are highly inflammable.

These advantages, combined with the fact that silicate is so effective and easy to apply, substantiate its superiority over other materials for dust-proofing concrete.

Food Investigation 1954

Developments in Biochemistry of Foodstuffs

CO-OPERATION between industry and research organisations is of the greatest importance. This point is emphasised in 'Food Investigation 1954' which has just been published by the Stationery Office for DSIR, price 3s. 'Secondment of industrial staff to research and of research staff to industry in order to help the implementing of research results should be encouraged', says the report.

The report goes on to stress the need for more engineers in the organisation to work in close collaboration with the chemists, physicists and biologists in development work. The engineers should study problems of technical organisation and costs, as well as the design and development of plant and equipment.

The aims of the research programme of the Food Investigation Board are the advancing of scientific knowledge and the achieving of technical improvements in the methods of handling certain classes of foods, mainly,

(a) Meat, eggs and other animal products;

(b) Fish and fish products;

(c) Fruits, vegetables and other plant products.

The distribution of effort in the research programme is: basic research 40 per cent, applied research and development work 45 per cent, advisory work 15 per cent. The figures for DSIR as a whole are 30 per cent, 45 per cent and 25 per cent.

The recovery by ion exchange columns of ascorbic acid concentrate as a by-product from lucerne drying has been attempted on the semi-technical scale by the Low Temperature Research Station in collaboration with the National Research Development Corporation. It was found that although the process could be operated smoothly the production costs were disappointingly high. It became clear that the process could be of economic value only if considerable reductions in processing costs could be made or if a crop richer in ascorbic acid were used. Both these alternatives have been investigated in the last year.

It has been found that the cost of recovering ascorbic acid from lucerne depends on the ratio of ascorbic acid to total salt content. To obtain an economic value of this ratio it would be necessary to cut the lucerne 21 days earlier than is normal. This would involve a corresponding sacrifice in the yield of dried lucerne.

A large part of the cost involved in processes employing columns packed with synthetic ion exchange resins is due to the necessity of providing acids and alkalis for their regeneration, and to reduce this expense the use of multiple ion exchange membrane cells instead of columns is being investigated. Ions are caused to migrate through selective membranes under the influence of an applied electrical potential. The process is continuous and regeneration of the membranes with chemical solutions is not necessary.

Indications from experiments already carried out suggest that the cost of electrical power for this method would be small compared with the cost of chemical regenerants.

Phospholipids Isolated

Chemically the study of phospholipids and lipid-protein complexes has been slow in developing, and it is only recently that, by the application of chromatographic methods, the isolation and characterisation of these substances has become possible.

By using silicic acid column and eluting with methanol-chloroform followed by pure methanol, phosphatidylethanolamine and phosphatidylcholine have been prepared from crude egg phospholipid. This is the first isolation of phosphatidylethanolamine from natural sources.

Some important new developments in lignin chemistry are suggested by the observation that certain native lignins readily decompose in the presence of N-alkali at room temperature to give *p*-coumaric acid or *p*-hydroxybenzoic acid in about 10 per cent yield, together with traces of vanillic, syringic and ferulic acids. It seems that these acids are present in ester combination, a form of linkage which has hitherto not been suspected in lignin.

It now appears that lignin is not constant in composition even in one plant organ. Its

primary synthesis may lead to widely different structures in different plants, and because of its reactive nature it is probably continuously changing. In contrast to this is the fact that all lignins have the same characteristic phenolic absorption band in the ultra-violet at a wavelength of about 285 mμ. Based on this observation, a method is now being developed in which a tissue section is photographed in ultra-violet light and the absorption measured photometrically. This method has the advantage that the anatomical localisation of the lignin can be ascertained.

The Keto Acids

Pyruvic, oxalacetic and α-ketoglutaric acids (the keto acids) occur in most fruit and vegetable tissues and occupy an important position in the changes that occur during ripening. Accurate estimation, however, is difficult because they may be formed from other substances or one may rapidly be changed into another, both through the action of enzymes and by chemical processes.

The various methods of inactivating the enzymes in strawberry leaves as a preliminary to the chromatographic estimation of the α-keto acids have been studied. A hot acid media has been found to give higher yields of pyruvic acid because a labile compound in the tissue (enol-phosphopyruvic acid) is hydrolised. On the other hand alkaline media give higher yields of oxalacetic acids because certain amino- and hydroxy-acids are oxidised to α-keto acids in the presence of quinones derived from the phenols in the leaves. It is thought that any method of heat inactivation is open to suspicion on the grounds that the enzymes are not inactivated quickly enough to prevent a brief period of heat stimulation causing significant changes. The preferred method is to arrest all chemical changes by freezing and then inactivate the enzyme by macerating the frozen tissue with 8 per cent metaphosphoric acid at −3° C.

The Fish and Fish Products Division are carrying out intensive studies of the problem of smoke-curing. It has been found that by charging smoke particles in an intense electric field the amount of smoke which is deposited from the particle phase in a field-free space is greatly increased. This method also avoids the uneven smoke deposition that occurs when the target forms one of the accelerating electrodes. This method has been applied on a small scale and a patent application has been made.

It would be of great value to have some test to show the amount of smoking that a fish has undergone. Tests have been made on the fluorescence in ultra-violet light of split herrings. Although considerable changes do take place in fluorescence after smoking it is too early to conclude that these tests will provide more than an approximate assessment of the amount of smoking that has taken place.

Investigations on the antiseptic components of wood smoke have been continued. One of the bactericides has been identified as *1-0*-methylpyrogallol. Other phenols which are now being examined are believed to be 2:3-dihydroxy-5-methyl- and 2:3-dihydroxy-5-ethyl-anisole. Quantities of these and other compounds found in wood smoke are being synthesised for systematic bacteriological testing.

Tests have shown that the best yields of bacteriological phenols are obtained when the wood is pyrolysed in a restricted air-stream and at high humidities. Smoke of improved odour may be produced by pyrolysis in two stages, a small amount of acrid smoke being formed at low temperatures and a sweeter smelling smoke being produced when the temperature is then raised.

Rancidity of Fats

Rancidity of fats is known to be a result of oxidation and some method of controlling this oxidation is therefore necessary. It was previously thought that only one component, a hydroperoxide, was formed during the early stages of this reaction. It has, however, been established that when the peroxide isolated from partially oxidised methyl linoleate is reduced, two totally different products are formed. The most probable explanation seems to be that the initial peroxide consists of two components.

A study of the variation of nitrogen content of apples has been made by the Fruit, Vegetables and Plant Products Division. The results indicate that there is a definite relation between the protein and non-protein nitrogen in the apple, that the application of nitrogenous fertilisers to the soil increases the nitrogen content of the fruit, and that increases in nitrogen beyond a lower limit results in a more rapid increase in non-protein than in protein nitrogen.

Analytical Chemistry of Nb & Ta*

Part II—Separation of Metals †

FOR ores and minerals the scheme of analysis is largely dependent on the nature of the mineral and the elements and element concentrations present, but as a general guide a typical procedure for tantalite-niobite groups of minerals would be according to the following sequence:—

Decomposition by fusion with potassium bisulphate, extraction in tartrate, removal of the acid sulphide group, and the recovery of the major portion of the niobium and tantalum by tartrate hydrolysis, that is by merely boiling the tartrate solution with mineral acid, usually hydrochloric acid. The major tartaric hydrolysis fraction is usually pure, and while precipitation is never complete, usually less than 10 mg. remains in solution. To recover the minor fraction, iron and other sulphides are removed from ammoniacal tartrate solution and the residual niobium and tantalum (together with titanium) precipitated with tannin. This is added to the major hydrolysis fraction and the precipitates ignited and weighed as mixed oxides (Ta, $Nb)_2O_5$ and TiO_2.

For pyrochlore, a similar scheme may be used in outline but there are additional complications from cerium and other rare earths and further separations are necessary.

In the methods that have so far been outlined for steels, ferro-alloys, etc., conditions cited have referred to combined determination of tantalum and niobium and no account has been taken of the separate determination of either element in the presence of the other. Herein lies one of the most difficult problems of analytical chemistry.

There are three general approaches to the problem of separation:

(a) Fractional tannin precipitation

(b) Selective reduction of niobium with nascent hydrogen

(c) Chromatography.

(a) *Separation by Tannin*

This has already been discussed in outline principle in an earlier section. It is only necessary here to indicate briefly the practical schematic treatment by means of which the all important differentiation of the two elements is made.

Both elements are simultaneously and quantatively precipitated as tannin complexes from weak mineral acid solution and no separation of one from the other is possible. The important principle which is used in separation is the difference of behaviour imposed by first converting the elements to oxalo-complexes. It is the differential stability of these oxalo-complexes which makes possible a general order of precipitation of the elements:—

Group A: Ta_2O_5, TiO_2, Nb_2O_5—from acid oxalo sol
V_2O_5, Fe_2O_3—intermediate

Group B: Zr, Hf, Th, U, Al—from alkaline oxalo-solution.

The oxalo-tantalum complex is the most unstable in the series and it is, therefore, the first element in the series to be precipitated by tannin. The degree of differentiation is so narrow that titanium, next in the order, can never be separted from tantalum, neither can niobium be completely freed from vanadium, but when the differentiation is a little wider as in the case of tantalum and niobium, then by a repeated process of fractional precipitations a separation can be achieved. The marked difference in colour between the pale primrose tantalum-tannin complex and the orange-red niobium complex permits a degree of operational control over the progress of the reactions, i.e., the hot neutralised oxalo solutions can be titrated with tannin to precipitate the clear yellow tantalum complex and the point of incipient niobium precipitation (orange) can be observed and the tannin addition stopped.

1st Treatment	*1st Fraction* Tantalum	*2nd Fraction* Remaining tantalum and some niobium	*Filtrate* Niobium
2nd Treatment	*1st Fraction* Tantalum	*2nd Fraction* Residual tantalum and some niobium	*Filtrate* Niobium
3rd Treatment	Do.	Do.	Do.

The number of repetitions depends on the concentration and ratio of the two elements and the degree of accuracy required. It will be seen, however, what an involved and tedious undertaking the separation is. All

* *A paper presented at a meeting of the Midlands Section of the Society for Analytical Chemistry on 6 April at Birmingham University by B. Bagshawe, A.I.Met., from the Brown-Firth Research Laboratories, Sheffield.*

† *Part 1—Basic Chemical Reactions—appeared in last week's issue, p.* 1457.

the pure first fractions are combined, ignited and weighed as Ta_2O_5, and Nb_2O_5 is obtained by difference from the original weight of mixed oxides.

(b) Nascent Hydrogen Reduction

Methods based on the reduction of niobium with nascent hydrogen have had a chequered history but still persist, and there is no doubt they can be of value if used under properly defined conditions. The process depends on the selective reduction of niobium in an activated zinc column, e.g., a Jones type reductor, or by liquid amalgam reduction in an inert atmosphere. The reduced niobium compound is oxidised with an excess of ferric alum before contact with atmosphere is made and the equivalent of ferrous sulphate produced is then titrated with permanganate. In theory, reduction proceeds to the trivalent state but there appears to be evidence of variable and incomplete reduction; claims for intermediate oxide forms have been made and many empirical factors have been used. Schoeller, after studying the method, discounted it out of hand as being non-stoichiometric.

There can be no doubt that the failure to achieve consistent quantitative reduction is due to partial hydrolysis of the earth acids, which readily occurs during reduction with the formation of a colloidal phase which is not reduced by nascent hydrogen, i.e. a condition of true molecular solution is indispensable for stoichiometric reduction, but this condition is very difficult to maintain throughout the reduction process.

Cunningham (**4**) was the first to claim stoichiometric reduction to the trivalent state, and he did this by adding succinic acid and an accurately measured amount of titania which he claimed inhibited earth acid hydrolysis by forming complexes which remained in stable solution during reduction. He also used an enlarged type of Jones reductor with a 30 in. column of heavily amalgamated zinc. The reduction must be carried out in a hot solution 60-70° C and in moderately strong sulphuric acid solution (20 per cent by volume).

The lecturer had many times confirmed the validity of Cunningham's conditions on steel solutions, achieving stoichiometric reduction to Nb_2O_3 within normal experimental tolerances. The need to add titania is an obvious shortcoming as its value forms a large proportion of the total titre (Cunningham adds 200 mg. of TiO_2 for each 500 mg. or less of mixed earth acids) and must be deducted from this to obtain niobium. Also for niobium steels and alloys where the tantalum content is small or incidental, the minor element, tantalum, must be computed from a small difference value between the niobium titre equivalent and the weight of total mixed oxides. The most accurate results are obtained on tantalum rich alloys where the noibium titre represents only a small fraction of the total mixed oxides.

More recently Knowles and Lundell (**13**) have critically reviewed Cunningham's process. They concluded that under carefully defined conditions a near stoichiometric reduction can be achieved without titania addition, and this is obviously a most important point. For this the Nb_2O_5 should not exceed 300 mg. but otherwise Cunningham's conditions of acidity, temperature, and general manipulation are fully confirmed. Typical results are shown in Table XI.

TABLE XI
Hydrogen Reduction of Niobium in Zinc Reductor

Test No.	Nb_2O_5 taken (g.)	Error (g.)	Test Solution
1	0.1048	+0.0005	Reduction in 200 ml. of
2	0.2053	−0.0001	15 per cent H_2SO_4, 2 g.
3	0.3025	−0.0002	succinc acid and 1 ml.
4	0.3516	−0.0038	H_2O_2
5	0.0596	+0.0002	Reduction in 200 ml. of
6	0.1511	+0.0004	20 per cent H_2SO_4, 2 g.
7	0.3021	+0.0002	succinc acid and 1 ml.
8	0.3502	−0.0013	H_2O_2

Mr. Bagshawe had on various occasions attempted to achieve stoichiometric reduction of niobium by means of liquid amalgam reduction. Other workers, notably Oka and Miyamoto (**14**), have given conditions for stoichiometric reduction of small concentrations (< 10 mg.) of niobium. This requires a moderate acidity. 7N H_2SO_4, reduction of most of the niobium at room temperature to minimise hydrolysis, the reduction being completed at 60° C. The reduction is very slow, requiring 30 minutes shaking at room temperature and a further 15 minutes at 60° C.

Tomicek and Spurny (**15**) published conditions in which the reduction is made electrolytically over a mercury cathode in 26 per cent sulphuric acid, but a special apparatus assembly is required.

In his own experience Mr. Bagshawe had achieved nearly quantitative reduction using similar conditions to those of Oka and Miyamoto. For this a slightly modified form of Nakozono's reductor was used. By reduction in 30 per cent sulphuric acid at 80° C.

15 minutes contact with amalgam, shaking throughout, he achieved consistent reduction to an intermediate stage, corresponding to Nb_4O_7. His results, covering the range 0-50 mg. of niobium are shown in Table XII.

TABLE XII

Reduction of Niobium in Liquid Zinc Amalgam

Test No.	Nb_2O_5 taken (g.)	Nb_2O_5 found (g.)	Error (g.)
1	0.010	0.0093	−0.0007
2	0.020	0.0195	−0.0005
3	0.030	0.0306	+0.0006
4	0.040	0.0394	−0.0006
5	0.050	0.0500	None

(*c*) *Chromatography*

The development of quantitative chromatographic separation procedures has been the really outstanding development in the analytical chemistry of the earth acids in recent years. This derives mainly from the work of a team of investigators, Burstall, Williams, Swain, Mercer and others (**16**) (**17**) (**18**) at the Chemical Research Laboratories, Teddington. They have in fact given a new orientation to the analytical chemistry of tantalum and niobium, and while their studies have in the main had reference to mineral analyses, both high grade, and low grade phosphatic and siliceous ores, Sukulu soils, etc., applications of their work have already been made successfully to ferro-niobium-tantalum alloys and to a less extent to niobium-bearing steels.

A solution of the two elements in hydrofluoric acid containing ammonium fluoride, is taken up on a wad of cellulose, then placed on top of a cellulose column from which tantalum is selectively extracted by elution with a water saturated solution of methyl ethyl ketone. This is followed by an intermediate washing treatment with ketone containing a low concentration (one per cent) of hydrofluoric acid, which arrests or 'fixes' the movement of titanium, tin, zirconium, etc., and niobium is then extracted with the same ketone solvent containing a high concentration (12.5 per cent) of hydrofluoric acid.

The organic solvent in the two fractions is removed by evaporation and the two elements weighed as their respective pentoxides.

In some cases, as for instance medium and high grade ores, the chromatographic procedure may be applied directly to a solution of the ore in a hydrofluoric acid mixture. For low grade African ores a preliminary chemical separation and concentration treatment is necessary, e.g. by sulphurous acid hydrolysis on up to 10 g. of sample. The crude mixed oxides from this initial separation are then worked up for the application of the chromatographic separation. Similarly, with steels a preliminary separation from iron is made by one of the conventional procedures.

This process has not yet been used to any great extent on steels, but it is already established in commercial routine practice in the ferro-alloy industry. The results are accurate and consistently reproducible, but there are certain difficulties of a practical and manipulative nature. The solvent as commercially available is not sufficiently pure for direct use and a purification treatment with permanganate and sodium bicarbonate followed by re-distillation is necessary. The tantalum and niobium fractions taken from the column are in large volumes of solution and this entails a long and tedious evaporation to obtain the pentoxides as no ready means have yet been found of recovering the earth acids directly from the solvent extracts. Further, the solvent is toxic and objectionable, and evaporations must be conducted under properly controlled conditions.

Paper Strip Method for Steel

Wells (**19**) has described details of a simple paper strip method for steel in which the strips are spotted with an aliquot of the steel solution and suspended in the solvent, which is methyl *iso*butyl ketone + 4 per cent hydrofluoric acid, for 20-40 minutes for diffusion to take place. Niobium gives a distinctive yellow band away from the dark iron colour at the bottom. Tantalum is similarly extracted, but by spraying with tannic acid only the niobium is coloured and there is no interference from tantalum. By reducing the hydrofluoric acid concentration of the methyl *iso*butyl ketone to only two per cent, niobium is retained near the original spot, and tantalum alone moves in the solvent front and can be detected by spraying with quinoline.

Mr. Bagshawe thought that we can expect further and continued developments in the application of chromatographic techniques in the field of earth acid chemistry, including the use of column separations with ion exchange resins. Some of the fundamental data on the response of zirconium, niobium and tantalum in exchange resins have already been published by Krauss and Moore (**20**) (**21**), while Tompkins and co-

workers (22) have shown that niobium can be eluted from amberlite resin by oxalic acid, without affecting any of the bivalent or trivalent elements.

Of the few available colour methods, the thiocyanate procedure appears to be the most promising, although in its present state of development it is still far from satisfactory.

Alimarin and Podvalnaya (7) first applied the reaction to quantitative determinations of niobium in which the yellow niobium thiocyanate was selectively extracted with a variety of organic solvents including diethyl ether, ethyl and *iso*amyl acetates, cyclohexanol, and methyl ethyl ketone, of which diethyl ether appeared to be best. The reaction has since been studied by Lauw-Zecha *et al.* (23), while Freund and Levitt (8) published a modification in which the colour is developed in a homogeneous system wherein the aqueous solvent is modified by the addition of acetone which minimises the dissociation of the complex and permits direct measurement of absorbancy without organic extraction. Milner and Smales (3) have utilised Freund and Levitt's conditions for the analysis of low grade minerals and mineral dressing products. This requires preliminary chemical separation of niobium which is achieved by precipitation with tannin and cinchonine using silica as carrier. They have also given details of a similar method for steel.

Reducing Agent Necessary

The yellow thiocyanate colour must be developed in moderately strong acid, about 20 per cent by volume hydrochloric acid, and a reducing agent, e.g. stannous chloride is necessary to prevent iron interference. The niobium solution can be prepared by bisulphate fusion of an oxide residue and extraction in weak tartaric acid. The reaction is extremely sensitive and some idea of this is given by the fact that the test is operated on 5 mg. aliquots of steel containing niobium in the range of up to one per cent. There is little interference from other elements likely to be associated with niobium after a preliminary isolation from the steel solution. Table XIII taken from Freund and Levitt's paper shows the order of interference that might be expected at normal concentration levels.

Associated tantalum, titanium and tungsten are all shown to be without significant effect.

TABLE XIII
Determination of Niobium by Thyiocyanate
Effect of Other Elements
(All tests 0.125 mg. of Nb_2O_5)
Mg. Nb_2O_5 found when Weight Ratio of Interference to Nb_2O_5 is :—

Interference expressed as:	10/1	1/1
Ta_2O_5	0.139	0.129
TiO_2	0.132	0.125
ZrO_2	0.125	—
MoO_3	0.156	0.129
WO_3	0.151	0.127
CrO_3	0.128	—
Co_3O_4	0.126	—
Fe_2O_3	0.125	—
V_2O_5	0.142	0 .13

The speaker had himself attempted to utilise the reaction as the basis of a simple method for steels in which cupferron is used to precipitate niobium and, incidentally, tantalum, titanium and some iron, from a hydrochloric acid solution of 100 mg. of steel. As a means of preliminary separation, this proved to be simple and adequate, but his experience in applying the thiocyanate reaction has not been a happy one and he is quite unable to confirm the reliability of the reaction as testified by Milner and Smales.

The absorbance is critically influenced by minor changes of acid, thiocyanate and acetone concentration, temperature, and time of development. In fact every component and every step in the reaction system is of such critical significance that Mr. Bagshawe had found it quite impossible to prepare a stable calibration, and in his view the procedure is only workable on the basis of an individual calibration for each batch of tests.

It is disappointing that this has not been made clear in the published work, for the deficiencies are obvious. None the less, the reaction has distinct possibilities, but there is no doubt that some of the claims for it are premature and further detailed investigation is necessary before it can seriously be considered for general use.

At this stage of the proceedings the meeting was opened for discussion. Mr. Bagshawe was asked whether it was possible to evaluate the niobium and tantalum contents of steels spectrographically. It appeared that although this type of procedure could be used in practice the great difficulty was the need for a suitable calibration standard, otherwise spectrography would be the ideal approach to the problem. In response to an inquiry concerning the possible

application of ethylene-diamine tetra-acetic acid to the determination of niobium and tantalum, the lecturer said that he had no experience whatsoever of its use in the Sheffield steel industry.

Concerning the question of work on organic acid complexes of niobium and tantalum other than their oxalates and tartrates, Mr. Bagshawe thought that even though little or no work had been done on this aspect of the chemistry of the two metals since the pioneer studies of Schoeller and his associates, it might still prove to be quite a profitable line of research. One member wondered why the majority of the methods which had been mentioned referred to the determination of niobium rather than tantalum. The lecturer said that this had always been the easier method of approach to the analytical chemistry of niobium and tantalum, but a paper had been published recently on the determination of tantalum by applying the pyrogallol reaction to the oxalate complexes.

Question Period

There was much interest shown by those present in the thiocyanate method for the determination of niobium. One of the surprising things about this method was that it was little or no more accurate when being employed with pure solutions of niobium and tantalum than with steels. Mr. Bagshawe was questioned about the possibility of applying the thiocyanate method to the determination of niobium in niobium-titanium alloys and he replied that a combination of more than one method would probably need to be used to solve this problem. He suggested as possible approaches the formation of a titanium-ester or the application of chromatography.

The final few minutes of the meeting were devoted to questions on the qualitative analytical aspects of the chemistry of niobium and tantalum. Difficulties appeared to have been encountered, and especially so in the presence of titanium and zirconium, in obtaining a reasonably complete qualitative precipitation of the earth acids by concentrated hydrochloric acid in Group I, so that niobium and tantalum often also came down in later groups of separation. Mr. Bagshawe pointed out that this was one of those problems to which there was no complete answer, it being due to the great similarity between the properties of these elements and to their effect on one another. However, boiling and use of a lower acidity than 12N acid would tend to help make the precipitation of the earth acids more complete.

Thanks are due to Dr. C. Sykes, F.R.S., for permission to publish this paper.

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Exhibition in Bigger Hall

THE record attendance at the Oil & Colour Chemists' Association's Technical Exhibition this year has decided the committee to move to a bigger hall.

Next year's event to be staged on 20, 21 and 22 March will be held in the Royal Horticultural Society's New Hall in Greycoat and Elverton Streets, Westminster, London. Previous events have been staged in the Old Hall nearby.

The theme of the 1956 exhibition will be the presentation of technical advances in the industries supplying the paint, varnish, printing ink, linoleum, and allied industries.

Closing date for receipt of applications for stand space is September 9. Companies who have not exhibited before, and are interested in taking stand space next year, should apply to the general secretary, Mr. R. H. Hamblin, Oil & Colour Chemists' Association, Memorial Hall, Farringdon Street, London E.C.4.

Helicopters in Search of Oil

Shell are buying two Westland helicopters to help in their search for oil in the Persian Gulf. They will ferry men and supplies from shore bases to the drilling rigs 70 miles out to sea.

UK Vinyl Acetate

British Celanese Enter the Field

YET another firm is to commence production of vinyl acetate monomer in the United Kingdom following the example of British Oxygen and Hedon Chemicals Ltd. (THE CHEMICAL AGE, 1955, **72**, 371 & 1046).

British Celanese Ltd. announced last week that a plant for a substantial production of vinyl acetate monomer is now under construction at their Spondon works. The plant is designed to operate a process, developed by the Celanese group of companies, starting from acetaldehyde and acetic anhydride. These materials, which are already produced in adjacent plants in very large quantities from products of the company's oil cracking installation, are also used by the company as raw materials for their cellulose acetate production and other manufactures.

The British Celanese Ltd. plant will be the only one in Great Britain producing vinyl acetate by this route, although the process is being successfully operated in America by the Celanese Corporation of America. British Oxygen use the catalytic vapour phase reaction of acetylene with acetic acid in their Chester-le-Street plant and Hedon Chemicals Ltd. (which is jointly owned by Shawinigan Chemicals Ltd. of Montreal and British Industrial Solvents) will use the same starting materials at their plant at Hull.

It is expected that 'Celanese' vinyl acetate monomer will be available in bulk quantities in the early months of 1956.

Pakistan Dyestuffs Plan

PAKISTAN and Western Germany have signed an agreement in Karachi for the setting up of a dyestuffs factory in Pakistan at an initial cost of Rs.4,000,000. It is planned for the factory to produce Congo red and sulphur black. The agreement was signed by Mr. Naseer A. Shaikh, Director of Pakistan Industrial Corp., and Mr. H. E. Vogel, a representative of Messrs. Farbenfabriken Bayer and Farbwerke Hoechst.

Thirty per cent of the capital of the new company will be subscribed by the German firms, 70 per cent by the P.I.D.C. This is said to indicate the faith that foreign capital has in Pakistan's industries. Work on the project will start in September after ratification of the agreement. The factory, it is estimated, will save Rs.1,000,000 of foreign exchange each year.

The importance of the project is enhanced in that it may serve as a nucleus for the development of an organic chemical industry, and in particular a synthetic dyestuffs and drug industry in Pakistan.

The agreement provides that Farbenfabriken Bayer and Farbwerke Hoechst will serve as consultants for 10 years in the company. They have also undertaken to train Pakistanis in Germany so that they might later take over the management of the factory. It is hoped that eventually the factory will produce dyestuffs other than Congo red and sulphur black, thus making Pakistan self-sufficient in important chemicals.

NZ Tariff Inquiries

THE New Zealand Board of Trade proposes to inquire into and report on the question of what rates of duty should be imposed on disinfectants, insecticides and fungicides, etc. During the inquiry it will also consider the desirability of reclassifying all goods in question for the purpose of the customs tariff. In addition the Board will consider whether such goods now subject to import licensing should be exempted from the requirements of import licensing.

For the purpose of taking evidence, the New Zealand Board of Trade will hold a public inquiry beginning on 27 September in the Board Room, Departmental Building, Stout Street, Wellington. Notes for guidance of witnesses in preparing evidence for these tariff inquiries are available from: Export Services Branch, Board of Trade, Room 601, Lacon House, Theobalds Road, London W.C.1. Typewritten statements of evidence should be sent to Mr. E. P. Doogue, Secretary, Board of Trade, G.P.O., Box 2424, Wellington, C.1, NZ, on or before 13 September.

Firms in Britain are reminded that any changes made in the level of duties as a result of this tariff review are likely to remain in force for a considerable time, and they are advised to take part in the review. Firms intending to do so should advise the Board of Trade, Commercial Relations & Export Department, Horse Guards Avenue, London S.W.1.

Chemical Exports

Western Germany Buys More

BRITISH chemical exports during May showed a substantial gain over April, and the corresponding month last year. Sales to Western Germany which showed a marked downward trend in April, indicating that the country was returning to pre-war output, increased considerably, being almost doubled. Canada was another country which almost doubled its import of British chemicals during the month, purchases during May amounting to £878,856. With the exception of the US, South Africa, Nigeria, and the Gold Coast, all of the other leading importers increased their imports.

Plastics Demands Rise

Chemicals in demand were copper sulphate, which increased sales by nearly six times over April, and almost three times over that of May last year, aluminium sulphate, sodium hydroxide, and ammonium nitrate. The demand for plastics materials showed a marked rise. Of the principal commodities only ammonia, bismuth compounds, lead compounds (inorganic), and acids (organic and derivatives) failed to reach the previous month's levels.

TABLE 1

VALUE OF EXPORTS IN £ : PRINCIPAL BUYERS OF CHEMICALS

	May 1955	April 1955	May 1954
Argentine	293,979	292,140	322,472
Australia	1,568,354	1,555,784	1,453,495
Belgium	468,008	434,477	391,774
Canada	878,856	478,279	658,222
Denmark	388,689	334,814	355,304
Eire	570,928	544,338	603,476
Egypt	393,312	218,702	304,539
Finland	302,398	262,869	270,246
France	723,137	703,578	470,113
Gold Coast	323,630	338,356	325,231
Hong Kong	363,703	286,471	274,265
India	1,355,004	1,289,024	1,359,763
Italy	758,599	413,786	425,178
Malaya	314,231	272,591	259,494
Netherlands	615,154	589,259	622,911
New Zealand	757,721	721,225	536,379
Nigeria	407,331	440,537	302,928
Norway	342,800	272,458	265,190
Pakistan	260,128	233,375	530,895
Singapore	396,459	293,982	290,468
South Africa	913,653	1,230,792	849,358
Switzerland	249,907	248,280	235,834
United States	677,587	678,533	649,243
Western Germany	646,235	350,628	616,898
Total value of chemical exports	**21,094,905**	**18,795,346**	**18,258,830**

TABLE 2

VALUE OF EXPORTS IN £ : PRINCIPAL COMMODITIES

	May 1955	April 1955	May 1954
Acids, inorganic	53,676	43,741	63,611
Copper sulphate	681,209	162,374	232,700
Sodium hydroxide	514,908	361,454	637,494
Sodium carbonate	314,644	169,748	284,382
Aluminium oxide	93,283	55,034	45,671
Aluminium sulphate	70,178	15,215	42,060
Ammonia	33,577	38,135	31,776
Bismuth compounds	21,635	30,145	32,165
Bleaching powder	51,194	36,976	44,022
Hydrosulphite	58,326	58,048	28,316
Calcium compounds, inorganic	63,955	44,537	70,648
Lead compounds, inorganic	33,670	41,865	38,607
Magnesium compounds	67,612	63,153	50,501
Nickel salts	62,678	47,820	58,844
Potassium compounds	37,726	26,328	37,039
Acids, organic and derivatives	68,696	80,858	67,969
Ethyl, methyl, etc., alcohols	121,642	102,522	165,415
Acetone	31,688	61,040	33,063
Citric acid	20,764	34,399	27,765
Sulphonamides, unprep.	82,342	84,351	50,263
Dyestuffs intermediates	124,519	113,651	95,547
Total for elements and compounds	**5,228,050**	**3,981,339**	**4,759,687**
Coal tar	216,605	75,225	283,733
Cresylic acid	47,289	52,048	46,140
Creosote oil	129,323	123,559	55,720
Total for tar products	**468,075**	**322,214**	**625,644**
Indigo synthetic	52,856	41,579	104,564
Total for synthetic dyestuffs	**827,148**	**723,842**	**1,004,96**
Total for paints, pigments and tannins	**1,922,944**	**1,670,935**	**1,633,170**
Medicinal and pharmaceutical products, total	**2,977,959**	**2,908,068**	**2,774,481**
Essential oils :			
Natural	49,238	83,137	43,375
Synthetic	122,768	67,545	50,422
Flavouring essences	126,404	96,821	102,680
Total for essential oils, perfumes, etc.	**2,312,299**	**2,125,680**	**1,869,722**
Ammonium nitrate	22,075	17,823	13,945
Ammonium sulphate	290,079	109,710	345,496
Total for all fertilisers	**348,670**	**185,027**	**405,533**
Plastics materials, total	**2,071,922**	**1,962,575**	**1,768,285**
Disinfectants, etc.	105,134	102,574	191,578
Insecticides & fungicides	366,563	341,220	311,480
Rodenticides & weedkillers	107,619	107,834	96,784
Lead tetra-ethyl	1,003,931	1,194,609	692,583

Mb in Nitrogen Fixation

International Conference at Baltimore

A FARMER could expect a yield of three tons of hay when he sowed an acre of alfalfa, but he would not get it unless one-tenth of an ounce of molybdenum was available in the soil, Dr. W. D. McElroy stated in opening a conference on 'Molybdenum in Nitrogen Utilisation' at Baltimore, US, on 24 June.

Outstanding authorities on plant and animal nutrition attended the conference at the McCollum-Pratt Institute for Trace Metal Research, Dr. McElroy, chairman of the conference, is director of the institute, a division of the John Hopkins University.

Mr. Alfred J. Anderson, the Australian agronomist who first demonstrated the practical value of molybdenum on crops, reported that its use on pasturelands has worked a revolution in the agricultural economy of his country. Clover yields increased from literally nil to as much as three to four tons an acre after application of a few ounces of a molybdenum chemical, Dr. Anderson said.

Even where no increase in yield occurs, he emphasised, molybdenum-treated crops often have a higher protein content as a result of their improved ability to fix nitrogen from the air. This effect is so striking that treated crops often can be recognised at a glance.

Growing Use in Australia

Last year about 5 per cent of the superphosphate fertiliser used in the state of New South Wales contained molybdenum at the rate of 1½ lb. of molydic oxide (or the equivalent in sodium molybdate) per ton of superphosphate. This development is proceeding so rapidly that this year more than 10 per cent of all fertiliser in that state will contain molybdenum, Mr. Anderson estimates.

In discussing developments in the United States, Dr. Albert E. Kretschmer, Jr., of the Everglades Experiment Station in Belle Glade, Fla., reported that molybdenum treatments have recently been introduced in Florida to combat a mineral deficiency disease known as yellow spot of citrus. Many citrus groves lack adequate available molybdenum in the soil, he said. As a result, the trees can't utilise the nitrogen and it accumulates as nitrate in toxic quantities in the leaves. With the new treatment, however, the disease can be entirely cured or prevented. The procedure is to include a sodium molybdate application in the regular spray programme at rates of one-half to 1 lb. per acre.

In the US liming, which releases this acid-bound molybdenum, is so widespread a practice that many deficiencies have been masked. Recent work in Connecticut, New Jersey and Florida indicates that by the use of molybdenum farmers can greatly reduce the lime dressing formerly recommended.

Dr. Alick T. Dick of Australia stressed the importance of having the proper balance between all trace elements. He pointed out that chronic copper poisoning in sheep may result from a molybdenum deficiency, and that by introducing molybdenum into the animals' diet, severe stock losses have been halted in Australia. Molybdenum in conjunction with sulphate regulates the amount of copper a sheep can absorb into its system, he explained, and under some conditions can lead to copper deficiency disease in sheep.

Israel to Exploit Phosphates

PHOSPHATES at present found at Oranim and the Arava Depression, Negev, Israel, which are used in the production of superphosphates, are to be further exploited by the establishment of two enterprises. One to produce phosphoric acid, the other, various phosphoric salts.

It is believed that the two plants will require investments of I£1,400,000 and I£2,400,000 respectively. The enterprises will be established within a year. Meanwhile, the production of superphosphates in Israel has increased to 120,000 tons a year which more than supplies local requirements.

Plans have been drawn up for renovating and enlarging the potash plant at Sodom. It is expected that the new plant will produce 135,000 tons of potash a year and increase present production by 250 per cent.

In connection with the planned production of magnesium in Israel, an American expert has been invited to advise on the possibility of exploiting this metal commercially. It is also reported that an enterprise for the extraction of bromine is to be established at Sodom shortly.

The Industrial Atom

Research & Development at Culcheth Laboratories

A CHANCE to see some of the work of the Industrial Group of the United Kingdom Atomic Energy Authority was given to the press on 24 June at the Culcheth laboratories, near Warrington, Lancs. The industrial group, which has its headquarters at Risley, Lancs, is responsible for the design, construction and operation of plants for the production of fissile material and also for the prototype nuclear power stations at Calder Hall and Annan, together with advice and guidance to the industrial firms who will undertake the construction of the power stations for the CEA which were proposed in the white paper 'A Programme of Nuclear Power' published four months ago.

The Culcheth laboratories are concerned with the selection of suitable reactor materials, their chemistry and metallurgy and the initiation and planning of new reactors. The scale of working at these laboratories is small and toxicity hazards are reduced to a minimum.

Investigations being carried out at Culcheth may be divided into the following main groups; fuels, canning materials, breeder materials, coolants, constructional materials and general services to the laboratory.

Dimensional Changes

Uranium undergoes dimensional changes when it is irradiated and these may impose stresses on the container. Changes may also be produced by repeatedly varying the temperature of the metal. It should be possible to reduce these changes by alloying with a suitable metal but this is complicated by the extreme chemical reactivity of uranium. Once the alloy has been prepared its physical and mechanical properties have to be determined, together with corrosion tests where the fuel may come in contact with the coolant.

The most desirable property for canning materials in thermal reactors is that they should have small capture cross sections for neutrons and the most suitable elements include aluminium, beryllium, magnesium and zirconium. Unfortunately these metals are deficient in other important properties and attempts are being made to assess the effect of adding minor alloying metals.

The restriction of small neutron absorption is less critical in fast reactors and it is necessary instead to have a metal which can be operated at as high a temperature as possible. The refractory transition metals titanium, zirconium, vanadium, niobium, tantalum and molybdenum, tungsten and rhenium come to mind at once. Methods of extraction for obtaining these metals in a pure form have been worked out and for the first time vanadium and niobium have been prepared in a ductile form.

High Reactivity

The high reactivity of uranium at elevated temperatures is a difficulty here and many otherwise suitable alloys have to be rejected for this reason. Methods investigated to overcome this include the deposition of refractory metals from volatile compounds and the use of oxide coatings to separate the metal from the can.

Liquid alkali metals are possible coolants for reactors and for this reason the study of the ignition temperature of these metals is important. The safety precautions to be taken when these metals are being used should be adequate without being excessive. The tendency where the hazard is unknown is to include large safety factors which are unnecessarily expensive.

In all atomic work the constructional materials used must be of the highest quality and there must be no possibility of accidental breakages or leaks due to corrosion. The consequences of such an accident could be very serious. For this reason there is a section which carries out work for the inspection branch as well as acting as a works metallurgical laboratory.

In addition to the more specialised parts of the organisation there are the general service laboratories which deal with chemical analysis, X-ray diffraction techniques, optical and electron microscopy, and metallurgical examination. These laboratories are also carrying out development work on the techniques necessary for this comparatively new science.

New Synthetic Fibres

DURING the last 10 years British Celanese Ltd. has spent about £14,500,000 on capital equipment. In addition £4,000,000 is to be paid out of liquid resources over the next two or three years in respect of capital expenditure already sanctioned. Further considerable sums will be required for plant and equipment for the development of both new and established products.

In the chemicals and plastics sections both turnover and the variety of products have been increased, and this trend is expected to continue. One important development last year was the issue of the first samples of a new yarn which will be marketed in the form of a continuous filament yarn and staple fibre under the registered trade name of Tricel. The result of many years research, Tricel has for its base British Celanese's primary product, cellulose acetate, but unlike Celanese is tri-acetate.

Within the next few weeks the company also intends to market a synthetic polymer staple under the registered name of Cellon. This type of nylon-six polymer is not at present made in this country, but it should prove of interest to spinners, both of 100 per cent spun yarns and also for blends with other fibres.

The company's research programme has been extended by the opening of a new laboratory at Putteridge, Bury, Lancashire. As part of a plan to further increase the strength of research and development, Professor F. E. King, F.R.S., has been appointed a director.

Automatic Analysis

CLAIMED to be something new in automatic instrumentation is the 'Analmatic' laboratory which is being shown for the first time by Baird & Tatlock at the British Instruments Industries Exhibition at Earls Court. This apparatus will carry out continuously a series of analytical operations and will record the results in some convenient form.

A demonstration model which was on show mixed measured quantities of two liquids and determined the *p*H, and then added a third liquid and compared the light absorption of the result with that of a standard liquid.

The makers claim that this apparatus could be modified for the solution of a wide range of problems. It is up to the chemist, they say, to bring his problem along and they will adapt the machine to solve it.

New Refinery

M. W. Kellogg Company Build Plant

WITH preliminary surveying now under way, construction of the American Oil Company's new 35,000 barrels-per-day refinery near Yorktown, Virginia, is expected to begin in midsummer, according to The M. W. Kellogg Company, which is designing and will build the plant's major processing units for the production of LPG, motor gasoline, middle distillates, and fuel oil.

This new refinery is planned to augment the gasoline production of American Oil's 145,000 bpd refinery in Texas City. The process units to be built by Kellogg for converting this crude oil will include a 35,000 bpd atmospheric and vacuum distillation unit, a 30,000 bpd Orthoflow fluid catalytic cracking unit and gas recovery plant for 95 per cent recovery of propane and propylene, catalytic polymerisation including a de-ethaniser in the fractionating section and units for treating 35,000 bpd of gasoline and 35,000 bpd of kerosene.

Inherent in the design of these units is flexibility of operation. Although the various process units are knit closely together—with products normally passing directly from one processing stage to another—sufficient intermediate tankage or by-pass facilities are being provided to enable major units, such as the catalytic cracker or polymerisation plant, to be taken off-stream individually.

The 30,000 bpd fluid catalytic cracking unit will be an Orthoflow design, in which the regenerator is positioned on top of the reactor. This design considerably reduces turn round time, and because of vertical catalyst carrying lines, minimises catalyst attrition, reduces erosion and eliminates need of multiple aeration points. The location of the catalyst carrying lines inside the convertor also promotes safety of operation.

The catalytic polymerisation unit is designed to process approximately 6,000 bpd of a C_3-C_4 mixed feed. Utilising a phosphoric acid catalyst, it will convert 93 per cent of the propylene and butylene contained in this feed into polymer gasoline. Removal of ethane-ethylene in the de-ethaniser allows the production of C_3 and C_4 LPG.

Wood Chemistry

Forest Products Research Board's Report

WOOD hemicelluloses have been studied by the Forest Products Research Board in co-operation with Professor E. L. Hirst, of the University of Edinburgh. An account of this work is contained in 'Forest Products Research 1954' which is published by HMSO, price 3s. 6d.

The objects of the investigations were to prepare reasonably pure specimens of both sapwood and heartwood hemicelluloses and to study them using the techniques of methylation, paper chromatography, etc., in order to obtain a better insight into the structure of these highly important wood constituents.

Sawdust prepared from the heartwood of English oak was extracted with alcohol-benzene and the bulk of the tannin was then removed with 0.1N sodium hydroxide. The hemicellulose was extracted from the residue with 1.0N alkali at room temperature and the product precipitated by Fehling's solution. The copper complex was decomposed with hydrochloric acid and the hemicellulose purified by dissolution and reprecipitation as above. The final product, about five per cent of the original wood weight, was a white powder which gave xylose (88 per cent) and uronic acid on hydrolysis.

No Success So Far

In earlier investigations products were obtained from oak sapwood which contained uronic acid and gave a blue coloration with iodine. It is now though that this product was a mixture of materials comprising a starch fraction and a hemicellulose fraction. So far all attempts to prepare a hemicellulose from oak sapwood which does not give a blue coloration with iodine have failed. After exhaustive extraction a product has been obtained which gave on hydrolysis, glucose, xylose and uronic acid.

This and the previous hemicellulose preparation have been sent to Edinburgh University for structural examination.

The free sugars were extracted from sawdust obtained from a 15 year old Scots pine and examined on the paper chromatogram. The extract contained, in addition to sucrose, glucose, fructose and a small amount of xylose, a range of oligosaccharides of lower R_G value. Each of these substances gave the characteristic ketose colour with acid naphtharesorcinol on the chromatogram and presumably contained fructose. It has been shown that these substances are present throughout the whole volume of the trunk. Their presence in wood does not appear to have been detected before. These oligosaccharides almost certainly arise from sucrose by enzymic transfructolysation and it is proposed to carry out an examination of them.

Saponins Vary Greatly

Considerable variations have been found in the constitution of saponins obtained from different specimens of morabukea wood. In some cases hydrolysis gave small amounts of galactose, while in other cases relatively large amounts were obtained. A detailed examination has been undertaken of a specimen of the saponin with low galactose content. So far it appears that this material has a similar structure to that previously described ('Forest Products Research 1953') and methylation experiments have shown that the galactose residues have similar linkages in each case. In both cases also a large proportion of glucose end groups is present as well, together with some xylose units linked through positions C_1, C_2 and C_4 and some linked through C_1, C_3 and C_4.

An attempt to obtain further information into the fine structure of the saponin molecules has been made by treating the periodate oxidised material with phenylhydrazine and methylating the product. It is hoped that information on the arrangement of the constituent sugar residues within the molecule will be obtained by examination of the methylated fragments.

Fractionation of the saponin acetate of low galactose content is to be attempted on a magnesium silicate column.

A procedure has been worked out for the extraction of dihydroquercetin from Douglas fir. Waxy material was extracted with benzene and the residue air dried and extracted with ether. Evaporation of the ether solution yielded a brown solid which was extracted with a small quantity of hot water.

The extract was decolorised with charcoal and filtered hot. On cooling crystals of dihydroquercetin separated and were purified by repeated crystallisation from water.

Among other work being carried out by the Board's laboratories may be mentioned studies of the properties of adhesives. A testing procedure is being developed for the examination of plywood bonds.

The effects of various preservatives are also being investigated. These tests are still in progress but the results obtained during the period 1923-53 have been published in a bulletin (Smith, D. N. Field Tests on Wood Preservatives Used for Pressure Treatment, *Bull For. Prod. Res.*, **32**, 1954).

Plastics Industry Fund

AT their meeting on 3 June, the trustees of the Plastics Industry Education Fund elected Mr. C. S. Dingley, as chairman until the end of 1957. In accepting office Mr. Dingley, on behalf of the trustees, thanked Mr. P. C. Allen for his excellent work in starting the fund in 1951. Dr. Yarsley was elected vice-chairman of the trustees.

The appeal on behalf of the fund issued in April to firms in the plastics industry for increased support for a target income of £10,000 a year, has met with encouraging response, and the income of the fund for 1955/56 may amount to over £7,000.

From the available resources the trustees have allocated to the Borough Polytechnic, London, a further £500 for grants to students studying full-time for the Diploma or Associateship of the Plastics Institute, in addition to £1,000 already promised for bursaries to students entering the second year of their full-time diploma course next September. The trustees also allocated £500 to the Birmingham College of Technology for use as scholarships to students studying full-time for the Associateship of the Plastics Institute, in addition to the £1,000 promised for students taking this course at the 1955/56 session.

As income of the fund increases, larger grants will be made to the Borough Polytechnic and the Birmingham College of Technology. For training grants to men and women who take up full-time study for a science or engineering degree £1,000 has been set aside, and applications for these grants will be considered in July.

In addition to the amount already held in reserve, a further £1,000 has been allocated for publishing monographs. It has also been decided to make available to the Plastics Institute £300 for purchasng books to augment libraries at technical colleges.

Coal Dust Gasification

IN our issue of 30 April (THE CHEMICAL AGE, 1955, **72**, 986) we published a short article concerning a plant owned by Typpi Oy Company at Oulu, Finland, for producing ammonia from low-grade coal. In the second paragraph of this article it was stated that the plant for gasifying coal dust was built by the Koppers Co. Inc., of Pittsburg, US.

It has now been drawn to our attention that the process for gasifying coal dust according to Koppers-Totzek was developed by Heinrich Koppers GmbH, Essen. Owing to conditions in Germany after the war the first pilot plant was built in Louisiana by the Koppers Co. of Pittsburg from plans supplied by the Essen firm. All other coal dust gasification plants using the Koppers-Totzek process have been designed and erected by Heinrich Koppers, including the one at Oulu in Finland. This particular plant is now being extended to double its capacity and it is now being fed on coal as well as coal dust. Koppers-Totzek plants for the production of ammonia (and in one case methanol) are in the course of construction in France, Japan and Spain. The fuels used are coal, coal dust, lignite dust, oil and peat.

Moisture Proofing

CONTAINERS made of steel, brass, copper and aluminium can be moisture-proofed using a new moisture barrier known as a 'Humid-Trol', which has been demonstrated by Lavoie Laboratories Inc., of Morganville, NJ. The company have not revealed the basis of this new product, but have merely described it as a 'fluor-carbon elastomer.'

It is claimed that there is no limit to the size of container with which the Humid-Trol may be used, and the company says it will be of use for the protection of expensive equipment and medical supplies.

Safe Equipment for Chemical Factories

The Industrial Health & Safety Centre

EXAMPLES of safe practice in the chemical and associated industries, as well as an occasional exhibit illustrating the dangers of unsafe equipment and methods, can be studied at the Industrial Health & Safety Centre.

This unique establishment, which is situated at 97 Horseferry Road, Westminster, London S.W.1, is administered by the Factory Department of the Ministry of Labour and National Service. Specially designed to serve as the Safety, Health and Welfare Museum, the building was completed in 1914, but could not be used for its original purpose until 1927, when it was opened by HM King George V. On 22 March of the current year, its name was changed to the Industrial Health and Safety Centre.

The Wellsian Viewpoint

In 'Work, Wealth and Happiness of Mankind,' H. G. Wells wrote these words about the old Safety, Health and Welfare Museum:

'It is not a popular place of resort, but everyday businessmen of the better type, who are building or reconstructing factories, come there for warning, advice, information and inspiration; problems of industrial diseases and discipline are brought there by Factory Inspectors and employers and studies are pursued by students of social and economic problems'.

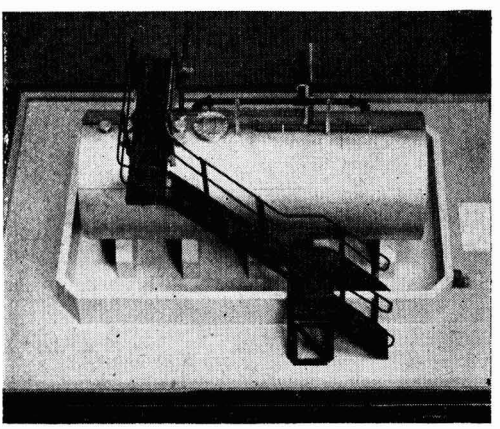
This description is still an accurate one, so far as it goes, but nowadays industrialists are concerned not only with safety and output, but also with the health and comfort of employees. Examples of seating, washing and cloakroom facilities, and first-aid equipment and methods are accorded the same attention as, for example, the proper guarding of machinery and the suppression of dust. Many progressive firms, accident prevention societies and other organisations have helped the Factory Department to assemble a large and representative collection of exhibits illustrating almost every aspect of industrial health and safety.

The storage and handling of dangerous liquids and gases present hazards which are encountered to a varying extent in many chemical factories. As might be expected, considerable emphasis is laid at the Centre on the importance of ensuring that all equipment used in this connection should be of safe construction and design.

A display of safety containers includes polythene jugs, which are chemically inert to most acids and alkalis and are also sparkproof and non-brittle. The jugs are filled by the spout, using a tube or a filling funnel. The design is such that splashing or spillage is prevented and the amount of liquid exposed to the atmosphere is minimised.

A safety container for cellulose lacquers and other inflammable liquids is provided with a spring-loaded cap fitted with a leather washer to reduce evaporation to a minimum. In a container of a different type the cover is held by a celluloid link, which would immediately be destroyed by the presence of any flame, thus causing the lid to drop into the closed position and extinguish the fire.

Another interesting exhibit is a spotting bottle made of polythene, which is intended for handling hydrofluoric acid in the removal of rust from fabric. Since the container is flexible, drops of the acid may be discharged from the nozzle as required by gentle pres-



This model shows a tank with a wall to retain dangerous or inflammable liquids which may escape from it. The wall should be high enough to retain entire contents. There is also safe means of access to the tank

Industrial Safety

sure. The design ensures that the acid is always under careful control and that no large quantity is ever exposed.

The display includes two items of acid handling equipment made in Oxythene (PVC). A pump used for delivering acid from a carboy to a container fits tightly into the mouth of the carboy and has a special cap to prevent any leakage from the top on to the hands of the operator, thus reducing the hazards when decanting acids and other dangerous liquids. The second item is an acid safety bucket of two gallons capacity, which is provided with a moulded cap giving safe closure. Acid can be conveyed without risk of splashing and there is a long spout for easy pouring.

Safe Types of Valves

Prominence is given to safe types of valves for chemical pipelines, compressed gas storage, etc. A valve for compressed gas storage is of stainless steel construction and is suitable for corrosive gases such as sulphur dioxide. To protect it from the action of the gas, the spring is housed in a chamber which is intended to be filled with oil.

A control valve for chemical pipelines has rubber diaphragms, which are easily replaceable. Although limited in use to certain substances, it offers important advantages. There are no mechanical seatings to wear, no glands to leak, and no working parts in contact with the flow, which is controlled by a positive action diaphragm closing upon a weir. This type of valve would not be suitable for high temperature operation nor for oily fluids.

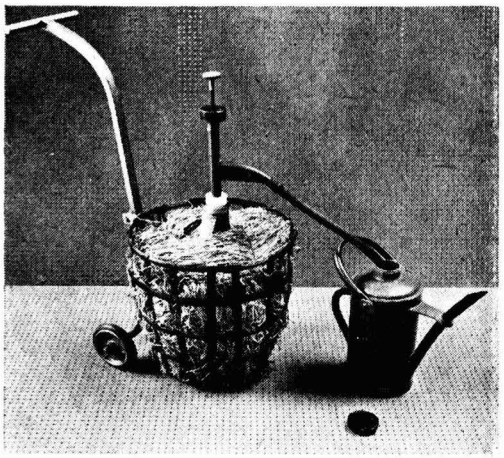
Another exhibit is a glandless lubricated parallel plug valve, which gives quick operation, is suitable for pressures up to 3,000 lb./sq. in., and can be made of corrosion resistant metals.

The hazards presented when disconnecting pipelines handling inflammable or toxic liquids can be minimised by the use of self-sealed couplings. Spring-loaded valves inside the coupling close automatically as the outer ring is loosened, thus allowing sections to be disconnected quickly without any spillage of the piped liquids.

Safe storage of dangerous liquids is illustrated by a model of a tank surrounded by a wall to retain any liquid which may escape from it, thus preventing flooding of a large surrounding area. The wall should be high enough to retain the entire contents of a full tank. Safe means of access to the tank in the event of leakage is provided from outside the retaining wall.

The growing use of radioactive isotopes in laboratories and factories presents special safety problems with which many firms are still unfamiliar. Industrialists venturing for the first time into this relatively new field might well benefit from a visit to the Centre, where various types of equipment for the safe handling of radioactive materials can be seen. One example is a safety container and trolley designed for the requirements of gamma-ray photography. The insulation

Handling aids for dangerous liquids: A Winchester carrier, a container with a safety spring cap, a stainless steel container for nitric acid with a screw cap, unbreakable polythene containers, a heavy container for bench use and a container with the lid held open by a celluloid link. If the material in the latter catches fire the link is destroyed and the lid drops



Acid handling equipment: a wheeled carboy carrier, an Oxythene acid carboy pump with leakage proof cap, and an Oxythene bucket with moulded cap to give safe closure

of the container reduces the radiation dosage below the allowable maximum and a further reduction is obtained by the use of a long-handled trolley.

Another exhibit is a manipulating box suitable for work with radioactive materials and also for the handling on a small scale of other highly toxic substances, where there may be risks of inhalation of vapours or gases, or ingestion of powdered materials. Provision is made for electrical connections and for exhaust ventilation, if required.

The dangers associated with equipment of unsound construction or with failure to take adequate safety precautions are effectively demonstrated by several examples drawn from accidents which actually occurred. Among them is a drum converted into a home-made air receiver which was used at a pressure it was never intended to withstand. Its failure resulted in an explosion which caused fatal injuries.

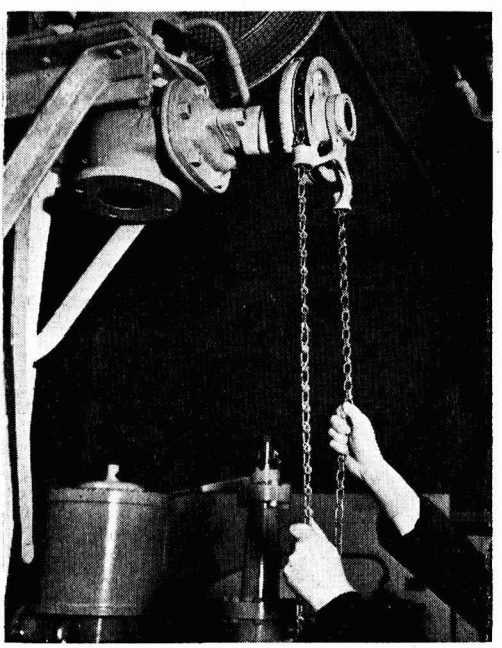
Another example of unsound practice is afforded by a valve which was used in a compressed air pipe line. The grade of oil used for lubricating the compressor was too light for such a purpose, with the result that ignition of the oil vapour and air during operation of the plant burst a cast iron air receiver, and at the same time ignited a quantity of oil which had accumulated in a plugged end of the pipe line. The effect of the explosion and the burning action of the flame can be seen from the damaged valve.

Industrial Safety

In presenting this exhibit, attention is drawn to the precautions recommended for the avoidance of explosions of oil vapour and air.

A wrecked petrol tank illustrates what can happen when an oxy-acetylene flame is applied before a tank has been properly cleared of petrol vapour. The tank was filled with cold water and left for eight days and was then flushed out three times. In spite of this it blew up when a flame was applied. In exhibiting the remains of the tank, the opportunity is taken of emphasising once again that the only way to ensure that a receptacle is clear of inflammable vapour is by steaming it out for several hours.

The exhibits also include automatic equipment for the detection of coal gas, petrol and other inflammable liquids. Enclosed in the apparatus is a small porous pot within which is a wire filament heated by an electric battery. Any gas that is present in the atmosphere will diffuse through the pot and be slowly burned by the heated wire. The



A method for operating an overhead valve from the floor. The chain operated wheel can be fitted to any wheel valve

combustion causes a partial vacuum in the pot, the degree of which depends on the percentage of gas present. The detector can be set to show the presence of a given percentage of the gas. When this quantity is present in the air, the vacuum caused operates a diaphragm which lights a red lamp. In the case of coal gas the signal lamp is illuminated in the presence of ½ per cent gas in the air.

Among the safety devices on view is a diaphragm type safety valve which cuts off the gas supply to an appliance when the mains pressure fails. Once the valve has been shut it will not re-open even when the gas pressure has been re-established. To re-set the valve all appliance cocks must be closed and a push-button must be depressed for approximately 30 seconds.

There is also a flame-failure device, designed on the thermo-magnetic principle, whose function is to supply a pilot light to ignite the main burner and to cut off the gas supply should be pilot flame be extinguished.

Examples of safety flooring include a rubber-link matting woven on cadmium wire, for use where corrosive liquids or atmospheres would attack galvanised and other wires.

The exhibits are supplemented by photographs showing safety devices of many types, such as a wicker basket designed to carry two Winchester quarts in safety; a simple, cheap and safe method of storing gas cylinders; and a portable carrier for radioactive sources, which is fitted with an automatic timing and exposing device to enable the operator to get out of the chamber before the element is raised.

Another photograph shows a spanner fitted with a shield, which is used for operating valves in a chemical works. If liquid should leak past the valve glands, the shield prevents it from squirting across the factory.

HM Inspectors of Factories are employed full-time at the Centre to instruct parties and answer inquiries from individual visitors, who come from all over the world.

Safety Notebook

HOW factory safety is being accomplished was shown at the seven-day Safety & Factory Efficiency Exhibition & Congress which ended at Bingley Hall, Birmingham, on 1 July. No fewer than 72 organisations and firms took stand space, with the emphasis on protective clothing, industrial detergents, and non-slip floor surfaces. Eye protection aids against every known industrial hazard were on view.

Fleming Safety Goggles, of Clerkenwell Road, London, displayed the improved Hyaline goggle and demonstrated the testing of Armorglas toughened lenses, designed to protect against glare, infra-red or ultra-violet radiations. The Hadley Co. Ltd., of Surbiton, Surrey, showed their metal industrial safety glasses, and the new 'Duraplas' plastic frame type. Among models displayed on the Parmelee (G.B.) Ltd. stand was the Saf-I-Chem, a goggle designed to protect against corrosive liquids and dust. Safety Products Ltd., of Hatton Garden, London, displayed a wide range of goggles, spectacles, respirators, etc., including the Pulsafe nylon goggles for foundry use.

Protective clothing covered a wide range, and a variety of industrial gloves were on view. H. G. Bennett & Co. (Gloves) Ltd. showed their Meddo plastic gloves for use in the chemical and dye manufacturing industries, as well as rubber gloves useful for workers handling acids, alkalis and salts.

Six firms displayed safety and protective footwear. They were: Briggs Industrial Footwear Ltd., Leicester; Protective Footwear Service Ltd., Bristol; Wilkins & Denton Ltd., Rushden; Safirst Footwear Ltd., Kettering; and O. Wiltshire & Co. Ltd., Bristol. Dunlop included a wide range, as well as rubber floorings and protective clothing.

* * *

TWO leaflets just published by Horwitch Smith & Co. Ltd. describe acid handling equipment and a new acid carboy pump. In the handling equipment leaflet several

types of rigid PVC tanks and buckets are introduced. The new acid carboy pump is a direct action, dual stroke hand pump delivering ¼-litre per stroke. Constructed from rigid PVC, it will handle most concentrated acids and alkalis. Used with the acid safety bucket it reduces hazards when decanting strong acids.

* * *

EACH year in the United Kingdom, 600 people die and 20,000 receive hospital treatment as a result of the burning of textiles. One contribution to the reduction of these distressingly high figures would be a standard method of flammability test for textiles. If such a method was adopted, much of the trouble would be prevented at the source. In accordance therefore with the Textile Institute's Unification of Testing Methods Policy, the Institute has formed a panel to survey critically the existing methods and to recommend a standard method of flammability test. The members of the panel are: T. H. Morton, M.Sc., Ph.D. (Courtaulds Ltd.); R. C. Derry, A.R.I.C. (British Cotton Industry Research Association); D. I. Lawson (DSIR-FOC Joint Fire Research Organisation); J. C. MacCallum, B.Sc. (Lace Research Association); R. O. Scott, B.Sc., A.T.I. (Ministry of Supply); L. B. Tansley, M.C., M.A., M.Sc., F.R.I.C. (Manchester Chamber of Commerce Testing House). Professor C. S. Whewell, Ph.D., F.R.I.C., F.T.I. (Leeds University); and E. Wilson, B.A. (Bradford Dyers' Association Ltd.).

* * *

THERE appears to be little hope of purchase tax being taken off protective clothing. When he asked the Chancellor of the Exchequer recently if he would take steps to remove it, Mr. John Hall was told: 'The suggestion has been considered on many occasions, but found to be impracticable.' Mr. Hall replied that it is illogical to discourage the purchase of protective clothing by imposing a tax, the proceeds of which are likely to be swallowed by the cost to the nation of the casualties which will arise.

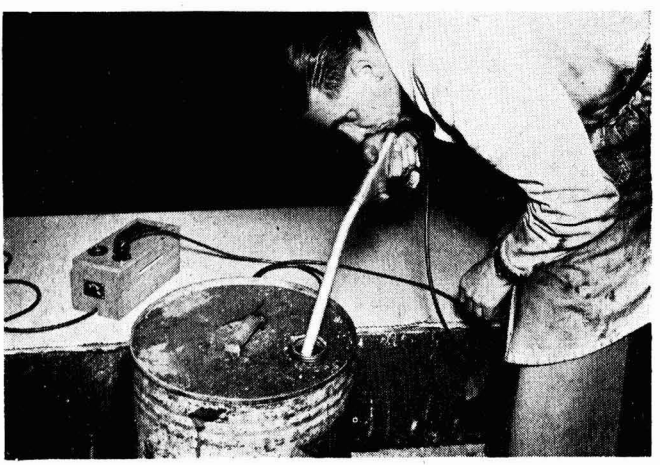
Safety Notebook

* * *

TO simplify interior examinations of drums and barrels, Engineering Developments Ltd., of 1 Adams Place, Georges Road, London N.7, have designed a probe illuminator which gives a powerful light from a six-volt bulb. Mounted at the end of an extendable arm is a tubular cylindrical lamp unit with a diameter of 1¾ in. which permits entrance to almost any container through the filling aperture. The bulb is encased in a heat and shockproof glass shield protected by a wire cage. A push-button switch in the finger-grip handle gives the operator complete control, and avoids all chance of leaving the unit switched on for longer periods than necessary, so eliminating risks of overheating.

* * *

A SMOULDERING ember concealed in coal dust was the probable cause of a fire and explosion which killed nine men at the works of J. & J. White, chemical manufacturers, Rutherglen, Lanarkshire, on 6 March.



The probe illuminator of Engineering Developments Ltd. provides a safe method of examining the interior of drums and other containers

Safety Notebook

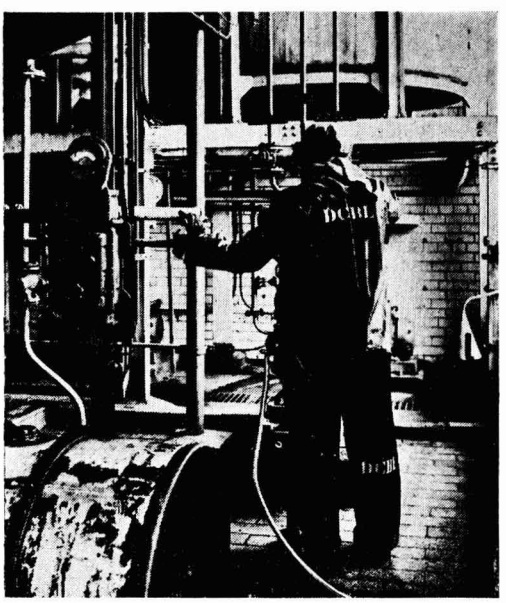
This was stated in Glasgow after an inquiry into the accident, which occurred in the attritor house, where coal is pulverised and blown into a furnace by a fan. The inquiry was conducted by Sheriff J. Wellwood Johnson before a jury of five men and two women, who returned a formal verdict.

The Sheriff, describing the accident as 'most distressing and of a very unusual sort', told the jury: 'I think we should bear in mind at the outset that if there be any question of blame the man who was over-all responsible for everything that went on in these works (Mr. Ronald E. G. Thompson, the works manager) himself lost his life and is not here to answer for anything he may have or may not have done'.

Evidence relating to the nature of a coal dust explosion was given by Professor George Hibberd, Professor of Mining at the Royal Technical College, Glasgow, who examined the attritor house after the explosion. He said that for such an explosion to result it was essential to have coal dust in suspension in the atmosphere, and a source of ignition. In this case he considered the source of ignition was a flame passing through an opening in the pulverised fuel system and originating from an ember concealed in dust shovelled from the overhead platform. The presence of coal dust in the building was, in his opinion, a potential danger.

Mr. A. Orr, Lanarkshire deputy firemaster, said that the fire in the attritor house was not a serious outbreak. After it had been extinguished the works manager came to him and said he wanted to get rid of some of the accumulation of coal dust in the loft of the attritor house. When shovelling began he heard a tremendous swish and everything was enveloped in flames.

Addressing the jury the Sheriff said it was unlikely there would have been an accident if there had not been an initial outbreak of fire. There could not have been an explosion but for an accumulation of coal dust, but in this case it would appear that it was not the coal dust lying about which caused the explosion, but the fact that the works manager and his staff took upon themselves to start shovelling the caked or loose coal dust from the roof or rafters of the building on to the floor, while apparently an ember of the fire remained.



Photograph by courtesy of Distillers Co. (Biochemicals) Ltd.

This chemical process worker is clothed in protective clothing made from Geon PVC, which resists most acids, alkalis and other corrosive elements

To Engage in Chemical Age

HAMILTON, Ontario, will have a new industry as a result of Dominion Foundries & Steel Ltd.'s expansion scheme which will include the manufacture of chemicals allied with the manufacture of coke.

Announcing this, Mr. Frank A. Sherman, chairman of the board, said that Defasco hoped to engage in the rapidly-widening chemical age which is creating countless new products from natural and manufactured gases. He said that the new oxygen steelmaking plant Defasco put in production last November was the key to the expansion scheme.

'Four hundred tons of nitrogen are dissipated into the air each day as the plant makes 100 tons of oxygen, and this will be combined with hydrogen stripped from the coke oven gases to make anhydrous ammonia and other chemicals', Mr. Sherman said.

Preliminary studies indicate that Defasco's project will permit cheap production of chemicals owing to the fact that the raw materials are already available at the plant.

HOME

Head, Wrightson in Nuclear Power Pool

Head, Wrightson & Co. Ltd. have accepted an invitation from C. A. Parsons & Co. Ltd., Newcastle-on-Tyne electric engineers, to pool resources in a new corporation with an authorised capital of £1,000,000 for developing nuclear power plant for industrial use. Several other firms have agreed to pool resources, and already Parsons are working on a plant for the atomic power station at Calder Hall, Cumberland.

Four New Reactors Planned

The United Kingdom Atomic Energy Authority announce that they are to build four reactors near Annan, Dumfriesshire, Scotland. Merz & McClellan, consulting engineers of London, are to collaborate in their design.

Work Study System Raises Productivity

Addressing the engineering works and workshops section of the Billingham Division of I.C.I., Dr. A. M. McKay, division engineering director, said the increased acceptance of the work study system had earned his praise. He said that 60 per cent of Billingham's 13,000 employees had now followed the lead given by the machine shop in accepting the system, and the company's productivity had increased by two or three times the rate of the rest of the country.

Fisons Agents for du Pont Weedkiller

Fisons Pest Control, a member of the Fisons Group, have been appointed agents for the du Pont range of agricultural chemicals in the UK, Eire, and British possessions in Africa. The first chemical for farmers' use to be marketed under the agreement is Karmex W which was first marketed in 1952 in the US. It is a non-selective herbicide which kills all vegetation and sterilises soil up to two years.

Dunlop's Faith Shown

Several thousand acres of what is now pure jungle are to be cleared by Dunlop in Nigeria, Lord Baillieu, chairman, told the annual general meeting in London. 'We have decided to establish new rubber plantations there', he said, 'and negotiations with the Nigerian Government are progressing in a most satisfactory manner. We are confident that in due course these can become as efficient as our estates in Malaya.'

Fertiliser Society's Overseas Influence

Speaking at the 8th annual general meeting of the Fertiliser Society in London recently, Mr. J. T. Proctor, the retiring president, referred to the growth of the society and stressed the expanding overseas membership which is now 18 per cent of the total, and is drawn from 22 countries. He considered this to be a result of the growing recognition of the Society's transactions which were closely concerned with the science and technology of fertiliser manufacture and usage. He drew attention to the international character of the AGM, the authors of the papers read being Swedish and Italian.

Fourth Factory Equipment Exhibition

The 4th Factory Equipment Exhibition will be held at Earls Court, London, next year from 9 to 14 April. Following the success of this year's event, at which 241 organisations exhibited, the management has reserved the whole of the ground floor of Earls Court. Exhibits may include any materials or products used in the construction, furnishing, maintenance or operation of a factory, works, or other industrial establishment.

Three Company Atomic Power Group

The English Electric Co., Babcock & Wilcox, and Taylor Woodrow have formed a group to undertake atomic power projects similar to the Calder Hall scheme. Although the group was formed last year, it has only now been officially announced.

BP Chemicals Expansion Plan

Expansion plans costing over £8,000,000 have been announced for British Petroleum Chemicals which is jointly owned by BP and the Distillers Co. They will double the olefine capacity of the Grangemouth plant by mid-1957. Output will include butadiene, and a propylene polymer to be used in a catalytic process with indigenous benzene for the production of detergent alkylate. Main contracts for construction have been placed with Stone & Webster, and Kellogg International. With a few specialised exceptions, plant and equipment will be bought and fabricated in the UK. Fuller details will be published in next week's issue of THE CHEMICAL AGE.

• OVERSEAS •

To be Quoted in Paris

Last Monday, the Bulletin des Annonces Legales Obligatoires, an official publication for companies, announced that the shares of Unilever NV would be introduced on the Paris Stock Exchange on 4 July. The introduction will take place in the form of ordinary bearer certificates.

Dutch Oil Strike

Netherlands Petroleum, a company owned jointly by the Royal Dutch and the Standard Oil Co. of New Jersey, has made an oil strike at Pynacker in the province of South Holland.

Varennes Ammonia Plant

David C. Gattiker, a director of Quebec Ammonia Co., has conducted talks with Olin-Mathieson Co. of Baltimore preparatory to building a $9,000,000 plant at nearby Varennes. He said the plant, construction of which will begin 'within 15 months', will produce 155 tons of ammonia daily, a large proportion being converted into fertilisers. The firms will have a joint interest in the plant.

OEEC Cement Production

Cement production in OEEC countries last year was 62,000,000 tons, almost double the 1948 figure. Although production is still rising, it is felt in the Paris headquarters that in the near future export markets may fail to follow this expansion.

Demand for Alberta Crude Oil

Customers for Alberta crude oil have asked for a record production of 362,327 barrels daily during this month. This is 42,977 barrels more than the nominations for June, and 84,184 more than for July last year. Imperial Oil, the largest nominator, has asked for 159,000 barrels. Shell nominated for 19,000 barrels a day to be used at the new Anacortes refinery.

Splitting Atomic Costs

The Canadian General Electric Company, who are to build Canada's first atomic power plant, will also subscribe between £1,071,000 and £1,250,000 towards its cost. Mr. C. D. Howe, Canada's Trade Minister, said the Federal Government would contribute between £2,500,000 and £2,850,000. The Canadian Atomic Commission will subscribe a similar sum.

Edmonton Plant Planned

Polychemical Industries Ltd., of Edmonton, Alberta, is preparing plans for a $250,000 plant in Edmonton. The plant will produce plastics sheeting, tubing and packaging.

US Uranium

Mr. Lewis Strauss, chairman of the US Atomic Energy Commission, has announced that President Eisenhower had doubled the amount of uranium to be made available to non-Communist countries for nuclear research.

Polish Sulphur Discovery

Sulphur deposits have been discovered in the region of Szydlow, Busko District, Kielce, Poland. Boring and prospecting work is being carried out in the region of the newly found deposits.

I.C.I. Melbourne Plan

Imperial Chemical Industries plans to erect a 20-storey tower-type building in Melbourne if permission to exceed the building height limit is obtained.

Shawinigan's Titanium

Titanium produced at the Shawinigan Water & Power Company's pilot mill at Shawinigan Falls is as good as any in the world, say Government scientists who have been conducting experiments. The plant which has been operating since last autumn, uses the continuous electrolytic reduction process. No production cost figures have been announced, but it is understood that they are below those current in the US at $4.50 a lb.

Aqualig

Ontario Paper Company announce that it has developed a dust-laying material as a by-product from its newsprint mill at Thorold. The company calls the product Aqualig and says it is a neutralised lignin sulphonic acid containing some wood sugars, although most of the wood sugars have been removed so that treated road surfaces will not become sticky when wet. It is said to be non-corrosive to the bodies or tyres of cars. Officials say the product proved effective in a year of testing on parking lots, gravel roads and playgrounds by municipal authorities and large public utilities undertakings.

• PERSONAL •

At the 8th AGM of the Fertiliser Society held in London recently, DR. R. STEWART was elected president and DR. J. MANNING being elected vice-president. DR. B. RAISTRICK, DR. E. M. REID and DR. D. WILLIAMS were elected to fill three vacancies on the council.

PROFESSOR NORRIS F. HALL, one of the few American scientists to study under MME. MARIE CURIE, will retire from the University of Wisconsin on 1 July to become senior chemist emeritus at the Argonne National Laboratory for atomic research. Professor Hall's career also includes study under PROF. T. W. RICHARDS of Harvard, the first American chemist to receive a Nobel Prize. Professor Hall worked with Mme. Marie Curie in 1919 when he was a member of the US Army. He was one of 12 men selected to study at the Radium Institute while awaiting transportation back to the US. When he returned to the US, Professor Hall became instructor in chemistry at Harvard, moving to the University of Wisconsin in 1929 to teach analytical chemistry.

The board of British Filters Ltd. announce that DR. R. G. ALLEN, head of their research laboratories, has been appointed the first director of the newly formed Water Research Association. Until a successor is appointed, the British Filters' Research team will be led by the joint managing director, MR. T. C. WORTH.

On 23 June MR. S. J. CLIFTON, M.Inst.F., a senior sales executive of George Kent Ltd., left for Malaya by air on the first stage of a tour of overseas markets. He expects to spend three or four days in Malaya and will then go to Sydney, Australia, where he will work with the Kent New South Wales branch company, Davies-Kent Pty. Ltd.; and later with George Kent (Victoria) Pty. Ltd., in Melbourne. He will also spend time in Adelaide and Brisbane with the Kent agents, Pascoe & Co. Ltd. and Underhill, Day & Co. Pty. Ltd. On leaving Australia Mr. Clifton will fly to Vancouver, BC, for further negotiations, then to Toronto for meetings with executives of Kent-Norlantic Ltd., the Kent branch company in Canada.

MR. J. C. MELLOR, B.Sc., who retired last year after 35 years' service with the Clayton Aniline Co. Ltd., of Manchester, has been re-elected chairman of the Upper Agbrigg Divisional Education Executive at the annual meeting at Huddersfield. Mr. Mellor has been a councillor for 25 years.

MR. E. A. DULIGAL, B.Sc., A.R.I.C., A.R.T.C.S., has been appointed technical manager of the Paints Division of Evode Ltd., Stafford. Formerly, Mr. Duligal was technical director of G. A. Willis (Middlesbrough) Ltd., and, prior to this, was senior research chemist at North British Chemical Co. Ltd. (Paints Division), Manchester. Consequent to this appointment, considerable expansion will take place in the Paints Division of the company.

MR. J. H. BRIANT, Assoc. I.N.A., has been appointed technical manager of the Evode Mastics Division. Prior to his new appointment, Mr. Briant was for five years with J.B. Products of Redruth, where he has been primarily engaged in the development of mastics, sealing compounds and caulking guns. After leaving the Forces in 1945, Mr. Briant was for five years a shipyard manager and it was during this period that he became interested in gap and joint sealing compounds, and the lack of suitable compounds for his purposes caused him to concentrate on this particular field of industrial chemicals. Shortly, Evode will market a full range of gap and sealing compounds in highly convenient packs to give extreme ease of application.

E. A. Duligal

J. H. Briant

The appointment of MR. T. N. BEAUPRE as vice-president of Canadian Chemical & Cellulose Co. Ltd., is announced by MR. M. W. MACKENZIE, president of the company. Mr. Beaupre joined the company in June 1954 as secretary, which position he will continue to hold. He is a former assistant minister of defence production and director of aircraft production.

Consolidated Zinc Corp. have announced the appointment of MR. L. B. ROBINSON as acting chairman of Consolidated Zinc Proprietary Ltd. in Australia. MR. M. A. MAWBY has been appointed vice-chairman.

Wills

MR. HENRY CHARLES GUTHRIE, Thorney Hedge Road, Gunnersbury, London, director of Parsons Fletcher & Co., printing ink manufacturers, left £15,577 net (duty paid £1,687).

MR. JOHN STEWART CLARKE, Sheen, Longhurst Lane, Mellor, Cheshire, director of James Beard Ltd., paint and varnish manufacturers, of Manchester, left £16,938, duty paid £1,614.

Obituary

The death has occurred at the age of 68 of MR. HARRY WATSON SMITH, who resigned as production director of the East Midland Coal Board in 1948 as a protest against the way nationalised mines were being run.

The death occurred on Saturday, 18 June, after a short illness, of MR. LOUIS GEORGE VEDY, an Assistant Secretary of the Ministry of Fuel and Power. Mr. Vedy who was 59, had been a public servant for almost 43 years, during the course of which time he served in the War Office, The Board of Trade, and the Ministry of Labour. In 1947 he became the Administrative Head of the Fuel Efficiency Branch of the Ministry. He devoted his energies in the post-war period to the large scale expansion and development in this field which led, after the publication of the Ridley and the Pilkington Reports, to the formation of the National Industrial Fuel Efficiency Service, and was loaned to the new company as commercial manager. He gave himself unsparingly to the task in the first year of the company's activities and had the satisfaction of seeing the production of the company's first Progress Survey at the beginning of June of this year.

Pyrex Glass Element

HEATING panels of Pyrex glass may replace the wire element in electric fires of the future if experiments now being conducted at the laboratories of James A. Jobling & Co. Ltd., of Sunderland, progress favourably.

Their efforts—the first made successfully by a British glassworks to produce a glass to radiate electric heat—have been in progress for some time. In addition to the panels, electrically-conducting coated glass tubes for use in scientific distillation have been produced. Tubing and panels are coated with a thin, electrically-conductive film bonded to the glass, which has been furnace-heated to a high temperature.

The 'panel fire' of the future will have no wires to burn out. The exposed heater is completely insulated and, strangely enough, the side of the glass panel insulated from the current will be the one radiating most of the heat. All the panels will be transparent.

Shell Scholarships

TWO Canadian students, one a physical chemist, the other a nuclear physicist, have been granted scholarship awards worth £1,500 each as winners of the first Shell Science and Engineering Post-graduate Scholarships sponsored by the Shell Oil Company of Canada on behalf of the Shell Petroleum Company in the UK.

Similar to scholarships awarded to students in other Commonwealth countries, they will be awarded annually. Open to men under 25 years of age they carry a two-year course of study to Oxford, Cambridge, London, or any other British University.

In addition to awarding these two scholarships in Britain, the Shell Oil Company of Canada will continue to sponsor seven fellowships at Canadian universities for post-graduate work leading to a masters' or a Ph.D. degree in the same fields of study as are covered by the UK scholarships.

Australian Eucalyptus

AUSTRALIA's exports of eucalyptus oils have been meeting with competition from other countries, in particular Spain, and in Sydney, New South Wales, scientists are tending an experimental plantation of eucalyptus to breed a tree with a high yield of foliage, which it is hoped will produce a higher quality oil.

Exporters hope that research which is being conducted by the Museum of Applied Arts and Sciences, Harris Street, Sydney, will result in a eucalyptus strain whose output will offset the lower labour costs of Spanish exporters, and the State Government of New South Wales has allocated £A9,000 for the building of a distillery at the plantation, so that test samplings can be made on the spot.

At the present time the function of the oil is not known. In the distillation process the leaves are brewed in tanks, and the steam condensed. The oil floats on top of the resultant liquid and is skimmed off.

The American import trade buys large quantities of eucalyptus oil for use in medicinal preparations. The industrial group of oils is used for making synthetic menthol, germicides and citronella for perfuming toilet soaps.

C-I-L Ammonia Plant

NEGOTIATIONS covering design and construction of the process area of the C-I-L ammonia plant at Millhaven, Ont., are now under way with the Girdler Corporation of Canada Limited and are expected to be completed in the near future. The remaining portion of the new plant will be engineered by C-I-L engineers and constructed by general contractors still to be chosen. Advantage will be taken of existing installations on the site for steam, water, electricity and other services.

The new ammonia plant will bring to Canada a patented new process involving the partial oxidation of fuel oil under pressure. This process, which uses a heavy residual oil as starting material, was recently developed and is now being incorporated in a complete plant for the first time in the United States at Searsport, Me., in a project engineered and being built by the Girdler Company, specialists in processes involved in the synthesis of ammonia.

Extension of facilities at Beloeil, Que., to manufacture ammonia solutions for agriculture using ammonia from the Millhaven plant will be carried out by plant personnel.

Parke, Davis Dispute

THE Purchasing Agents' Association of Toronto in their latest business survey stated that negotiations at Parke, Davis & Co. over an employee demand for a guaranteed annual wage are being watched with interest in the chemical industry. It is likely that a solution will be found by the end of the summer, giving a clue as to the ultimate effect of the demand on the Canadian industry.

The report stated that expansion is continuing with plants planned by du Pont of Canada near North Bay, Ont., for commercial explosives, and Canadian Industries Ltd., at Millhaven, Ont., for explosives. The Canadian Chemical Co. at Edmonton is planning the use of the aldol process for the manufacture of methyl *iso*butyl ketone and related products.

Water Conservation

AN IMPORTANT new method of preventing water evaporation in low rainfall areas has been developed in Australia by scientists of the Scientific and Industrial Research Organisation.

The method is comparatively inexpensive. Results to date have been most promising, but it will be another 12 months before final judgment can be given.

The Australian Minister in charge of the Department, Mr. Casey, said cetyl alcohol has been the basis of experiments to date. In laboratory tests a film of cetyl alcohol of microscopic thickness had reduced evaporation by up to 80 per cent.

In out-of-door pool tests the saving had been up to 50 per cent, while tests during the summer on fairly large expanses of water had shown a reduction of the order of 30 per cent.

Nordac Limited Expanding

Nordac Ltd., Uxbridge, Middlesex, chemical engineers and specialists in rubber and lead linings, have placed a contract for considerably extending their works.

Law & Company News

Commercial Intelligence

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

Mortgages & Charges

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

PENN PLASTICS CO. LTD., London E.C.—20 May, charge, to Midland Bank Ltd. securing all moneys due or to become due to the bank; general charge.

Satisfactions

BIOREX LABORATORIES LTD., London E.C.—Satisfaction 25 May, of debenture registered 26 March, 1954.

TILTMAN LANGLEY LTD. (formerly Tiltman Langley Laboratories Ltd.), Redhill.—Satisfaction 23 May, of series of charge notes registered 8 May, 1952, to the extent of £16,400.

Change of Address

Food Colloids & Chemicals Ltd., chemical manufacturers, have moved from Victoria Street, London S.W.1, to 15 Coopers Row, London E.C.3. Tel.: Royal 5186.

Increases in Capital

MILTON ANTISEPTIC LTD., 42/46 Weymouth Street, London W.1, increased by £150,000 in 10 ordinary shares, beyond the registered capital of £200,000.

New Registrations

Law Chemical Co. Ltd.

Private company. (30,802). Registered in Edinburgh. Capital £1,000. To carry on the business of chemical manufacturers, exporters and merchants, etc. Directors: T. W. Torrance and W. Rogerson. Registered office: Law Muir, Law, Lanarkshire.

Photo-Synthetics (Distributors) Co. Ltd.

Private company. (549,683). Capital £100. To carry on the business of manufacturers of and dealers in photo chemicals of all kinds and other supplies for the photographic trade, etc. Directors are: Kurt Jacobson, director of Photo-Chemicals Ltd., Liselotte Jacobson and Helga Jacobson, of 15 College Road, Epsom.

Aerojet Ltd.

Private company. (549,670). Capital £100. To acquire from Aerojet Venturi A.B. a licence in relation to British Patent No. 686779 and to acquire inventions relating to air filters or apparatus for the agglomeration of gas-borne particles, etc. Subscribers (each with 10 shares) are: Paul A. Franck, 35 Rodway Road, Bromley, Kent, silk merchant, and W. Fortman, 30 Burghley Avenue, Boreham Wood, Herts, engineer. The first directors are not named.

Silverton Tannery Ltd.

Overseas company (F4,449.) Capital £456,200. Registered in Union of South Africa as 'South African Alkali Ltd.' and renamed as above on 20 December, 1954. To deal in and manufacture salt and soda and to carry on the business of tanners, curriers, etc. British address: 34 Nicholas Lane, London E.C.4. Directors: Richard L. Broad, M.C.; Fdk. A. G. Bush, Bruce D. Donaldson, Sidney L. Segal and Cecil F. E. Benham.

Warner-Lambert Pharmaceutical Co.

Overseas company (F.4,447.) Capital 2,500,000 shares of par value of $1. Registered in Delaware, US. To prepare and manufacture, and deal in drugs, medicines, proprietary articles, etc. British address: Victoria Road, South Ruislip, Middlesex. Directors are Jas. C. Adams, Wm. C. Bird, Elmer H. Bobst, Alfred E. Driscoll, Gerald B. Lambert, Marion L. J. Lambert, and ten others, all resident in the US.

Theta Products (Macclesfield) Ltd.

Private company (550,299.) Capital £300. To carry on the business of manufacturers of, and wholesale and retail dealers in sponges, sponge substances and materials, cleaning materials, scouring and other compounds, soap, soap powders and substitutes, etc. Directors: Gerald H. Russell, Anthony G. Russell and Mrs. Lucy Russell. Reg. office: Lynwood, Wood Lane Ends, Adlington, Macclesfield.

Manchester Drug Houses Ltd.

Private company (550,294.) Capital £100. To carry on the business of wholesale manufacturing, pharmaceutical, analytical, photographic and dispensing chemists and druggists, etc. Subscribers: Chas. J. Sharratt and Arthur E. Turner. The first directors are not named.

Dunstan Hill Chemicals Ltd.

Private company (550,271.) Capital £1,000. Subscribers (each with one preference share): Henry H. Martin and Kenneth R. Coleman. The first directors are to be appointed by the subscribers. Solicitors: Stafford Clark & Co., 3 Laurence Pountney Hill, London E.C.4.

R. A. Chandler Ltd.

Private company (550,402.) Capital £100. To acquire letters patent, etc., and to manufacture and deal in machinery, chemicals, chemical products, drugs and medicines, etc. Directors: Roberta Chandler, and Mrs. Mrs. Maud E. Chandler. Reg. office: Bilbao House, 36 New Broad Street, London E.C.2.

Company News

Powell Duffryn Ltd.

Powell Duffryn Ltd. have announced the following dividend, payment to be made on 1 July to holders registered at close of business 3 June: 4¾ per cent cumulative preference shares—2⅜ per cent actual, less tax at 8s. 6d. in the £ on the 3,600,000 4¾ per cent cumulative preference shares of 10s. each for the six months ending 30 June, 1955.

Celanese Corp. of America

Directors of Celanese Corporation of America recently declared a dividend of 12½ cents a share on the common stock, payable 24 June, to holders of record 3 June, 1955. The board also voted regular quarterly dividends of $1.12½ on the 4½ per cent preferred stock, series A, and $1.75 on the 7 per cent second preferred stock. Both preferred stock dividends are payable 1 July to holders of record 3 June.

The Morgan Crucible Co. Ltd.

Proceeds from sales of The Morgan Crucible Co. Ltd. were a record, exceeding the previous year by 15 per cent. Group trading profit too, was a record, exceeding the previous year of 1951/52 by about £200,000.

Amber Chemical Industries

Mr. Arthur Mortimer, O.B.E., chairman of Amber Chemical Industries, in his statement at the 7th AGM reported that the main interests of the company were still in the manufacture of industrial chemicals, cutting fluids, wire drawing and lubricating oils for engineering and textile finishes, and importing and exporting and merchanting of waxes, essential oils, drugs and chemicals. Openings in other fields are being looked for and by next year it is hoped extensions could be reported. The board approved the payment of two instalments of the arrears of preference dividend in December, 1954.

Reckitt & Colman Holdings

The directors of Reckitt & Colman Holdings have recommended a final dividend of five per cent, plus a special bonus of one per cent, to make a total payment of 11 per cent on the ordinary capital for 1954. The increased earnings of the operating subsidiaries and the results expected for 1955 caused the directors to propose that the ordinary dividend be raised to 10 per cent per annum by the payment of a final five per cent. As far as can be foreseen, they expect this rate will be maintained in respect of 1955, in which case their present intention is to declare one interim of four per cent payable 1 January, 1956.

Evershed & Vignoles

Evershed & Vignoles, electrical and mechanical engineers, have acquired the whole of the share capital of the Record Electrical Company of Altrincham, Cheshire. In future the two companies will work in co-operation.

London Aluminium Co.

Profit of the London Aluminium Co. for the year ended 31 December, 1954, was lower than that for the previous year, although it in no way reflects on the trading of the parent company whose profit remained about the same as last year. The loss resulted mainly through losses incurred by a subsidiary and an associate company. Delays in delivery of plant, and teething troubles now being overcome slowed production, and provision had to be made for these losses with the result that the profit, before charging taxation, of the parent company has been reduced by £24,292 in respect of the loss of the subsidiary and by £17,000 in respect of the investment in the associated company. After providing for tax, the consolidated profit for the year amounts to £31,769 compared with £63,711 in the

previous year. The directors recommended the declaration of an ordinary dividend of 7½ per cent, less tax, as compared with 10 per cent and a bonus of five per cent, both less tax, for the previous year.

Woodall-Duckham Ltd.

The consolidated profit and loss account of Woodall-Duckham Ltd. for 1954 shows a profit subject to taxation of £1,039,932 compared with £951,610 for the previous year. Group earnings have been widespread in the gas, and iron and steel industries. After providing for tax and deducting the proportion of profits applicable to outside interests of £23,912 the group net profit is £435,783 compared with £271,518 for the previous year. Of the net profit of £435,783, £226,828 was retained in the subsidiary companies, compared with £58,320 in 1953. The directors recommended a final dividend of 20 per cent on the ordinary shares, which with the interim dividend paid on 31 December 1954 gives a total ordinary dividend of 25 per cent for the year.

H. J. Enthoven & Sons

The directors of H. J. Enthoven & Sons recommend a dividend on the ordinary shares for the year ended 31 December, 1954, at the rate of 20 per cent, less tax. This results in a small increase in the carry forward after transferring £25,000 to general reserve which now stands at £389,800. The consolidated profit for the year shows an increase of £39,000 over the previous year. In the chemical section, the upward trend in turnover of Pure Chemicals Ltd. was maintained, and this subsidiary is contributing its share to group earnings. Pure Chemicals' factory is at Kirby, near Liverpool, and additional premises were recently acquired. Expenditure on premises and plant in 1954 amounted to £40,000 and further development is being undertaken. Pure Chemicals Ltd. entered the field of stabilisers for polyvinylchloride plastics by starting the production of organotin compounds. It has since been found desirable to extend these activities to the production of the complete range of stabilisers. To achieve this an agreement has been made with Ferro Chemical Corp. of Bedford, Ohio, US, by which Pure Chemicals Ltd. has been given the exclusive licence for manufacturing their stabilisers in Europe.

Minimax Accepts Pyrene Offer

It is announced that the boards of the Pyrene Co. and Minimax have agreed on the offer made by Pyrene to acquire the share capital of Minimax at 16s. 3d. per 5s. ordinary share. Acceptances have been received in respect of more than 90 per cent of the Minimax shares and the offer has become unconditional.

Market Reports

LONDON.—An active demand has been reported from most sections of the industrial chemicals market. Some pressure for deliveries has been in evidence with buyers anxious to restore the stock position at the users end. The price position of the soda and the potash products remain steady and no important changes have been reported elsewhere although the undertone is strong. Carbolic acid, creosote oil and the light distillates are attracting a good attention in the coal tar products market with prices steady at recent levels.

MANCHESTER.—Trading conditions on the Manchester chemical market during the past week have been pretty well back to normal and deliveries of most heavy products are coming through satisfactorily. The dock disputes, however, continue to interfere with overseas shipments. Inquiries have been steady and a fair aggregate weight of new business has been placed in the bread-and-butter lines, with prices held throughout the range. As usual at this time of the year trade in fertiliser materials follows a humdrum course. In the tar products section all the leading light and heavy materials, including carbolic acid, refined tar, creosote oil and benzol, are going steadily into consumption.

Next Week's Events

TUESDAY 5 to 7 JULY

Inst. Phys. (Electron Microscopy Group)
Glasgow: Chemistry Department, University of Glasgow. Group Annual Conference.

FRIDAY & SATURDAY 8 & 9 JULY

The Society for Analytical Chemistry
Edinburgh: Department of Biochemistry, University of Edinburgh. Joint meeting with the Scottish section of the Society on 'The Use of Isotopes and Radioactive Materials in Biological Assay'.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

A. BOAKE, ROBERTS & CO., LTD., CARPENTERS ROAD, LONDON, E.15. manufacturers of Industrial and Fine Chemicals, have vacancies in their Production Dept., for **CHEMISTS & CHEMICAL ENGINEERS** to manage manufacturing plants. Applicants should possess an honours degree in chemistry or chemical engineering, or should be members, by examination, of an appropriate professional institution: in addition, they should have some years' industrial experience, preferably in chemical plant control. Initial salary will be in accordance with age and experience, but will not be less than £750 per annum. The prospects of advancement are excellent, as the company is undertaking a programme of development and expansion. Applications should be addressed to **THE WORKS DIRECTOR.**

A. BOAKE, ROBERTS & CO., LTD., CARPENTERS ROAD, LONDON, E. 15, manufacturers of Industrial and Fine Chemicals, require the services of **SHIFT CHEMISTS** for plant control and supervision. Academic qualifications will be an advantage, but are less essential than industrial plant experience. The work is interesting and varied, and the appointments will be progressive, with every opportunity for advancement. Initial salary will be in the range of £600 to £700 per annum. Applications, plainly marked "Shift Chemists," should be addressed to **THE WORKS DIRECTOR.**

CHEMICAL PLANT MANAGER is required by well known and progressive chemical manufacturing company in S.W. Lancashire. The successful applicant will probably be between 23/35 years of age; hold a University degree or an equivalent qualification; have had some industrial experience; possess unlimited energy, drive and the personal qualities required to manage effectively.
The initial salary will be commensurate with age, qualifications and experience; in the range £650-£850 per annum.
Please send full particulars of qualifications, positions held, age, etc., quoting Ref. P.52 to **PERSONNEL MANAGER, BOX NO. C.A. 3417, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

GRADUATES in **MECHANICAL** and **CHEMICAL ENGINEERING** required for progressive positions in the Research, Design and Production Divisions of THE POWER-GAS CORPORATION LIMITED. Training given to men without previous industrial experience. Apply to:—**STAFF PERSONNEL MANAGER, PARKFIELD WORKS, STOCKTON-ON-TEES.**

INDUSTRIAL CHEMIST required by leading container closure manufacturers in Midlands. Progressive position requiring knowledge metal printing. varnishing, stoving, and metallurgy, associated with food packaging industry, Maximum age 35 years.—Written applications, with details of experience previous appointments, etc., to **P. A. METAL CLOSURES LTD., BROMFORD LANE, WEST BROMWICH, STAFFS.**

SENIOR DRAUGHTSMEN required, experience in heavy plant work, mechanical handling, preferably with a structural background. Five-day week, luncheon facilities, three weeks' holiday, pension scheme. Initial salaries depending on age and experience up to £800 per annum. Write **SECRETARY, HUNTINGTON, HEBERLEIN & CO., LTD., 114 CROMWELL ROAD, S.W.7.**

CHEMISTS, capable of occupying responsible positions in Australia, required by **LEWIS BERGER & SONS (AUSTRALIA) PTY. LTD., SYDNEY.** Minimum qualifications B.Sc. Age 30-40. Senior posts require at least 8 years' experience in the Paint, Varnish and Lacquer Industry. Applicants must have had service in a position of responsibility calling for organising ability and initiative. Suitable applicants will be interviewed in London during July or August. Apply in strict confidence, giving full details, to **PERSONNEL OFFICER, BERGER HOUSE, BERKELEY SQUARE, W.1.** marking applications "Australia."

ENGINEER, CHEMICAL ENGINEER OR CHEMIST with Engineering, Chemical & Technical Sales experience for developing and marketing Petroleum Chemical Plant, required by **THE POWER-GAS CORPORATION LTD., STOCKTON-ON-TEES.** Age about 30 years. The appointment will be confirmed on a permanent basis if satisfactory after a trial period of twelve months. It is anticipated that the post will involve periodic journeys abroad and in making the appointment emphasis will be placed on ability to grasp new ideas and techniques, together with initiative and commonsense.

IMPERIAL SMELTING CORPORATION, LIMITED, invites applications from **METALLURGISTS, CHEMISTS** or **CHEMICAL ENGINEERS,** for openings in the Plant Investigation Departments at the Avonmouth and Widnes Works. Honours Degree is preferable, previous experience not essential and applications will be welcomed from persons completing their National Service. Opening also available for **PHYSICAL METALLURGIST** in Research Laboratory for investigational work on alloys. Applications, giving full details, to Personnel Manager, Imperial Smelting Corporation, Ltd., St. Andrew's Road, Avonmouth, Bristol, quoting reference **GRA/CA.**

FOR SALE

SACK AND BAG MERCHANTS AND MANUFACTURERS. New and reconditioned for Home and Export. (Use **JUTEX** for sack repairing). **ALTRINCHAM JUTE LTD., WRIGHT STREET, BROADHEATH. ALTRINCHAM, CHESHIRE.** ALTrincham 4360.

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MORTON, SON AND WARD LIMITED offer **TWO** 50g **STAINLESS STEEL AUTOCLAVES,** 50 lb. p.s.i. internal pressure 20g stainless steel **JACKETED PAN,** bottom outlet, 40 lb. p.s.i., w.p. **NEW** stainless steel **CONTAINERS,** outlets optional, closed or open. **MIXERS 'MORWARD' 'U'** shaped **TROUGH MIXERS** in s.s. or m.s. made in all sizes, jacketed or otherwise. Scroll or paddle type agitators. 3 cwt. **TROUGH MIXER** by **CHALMERS,** s.s. lined tilting trough. 3 cwt. **TROUGH MIXERS** by **GARDNER,** s.s. lined troughs. **STRUCTURAL** and general **FABRICATION** requirements catered for **PUMPS.** A selection of new **MONO** and other second hand **PUMPS** in stock. 2″ to 5″. **ENQUIRIES INVITED, MORTON, SON AND WARD LIMITED, WALK MILL, DOBCROSS, NR. OLDHAM,** Lancs. Telephone: Saddleworth 437.

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PATENTS

THE Proprietor of British Patent No. 652641, entitled **"PROCESS OF PREPARING ANTIBODY-RICH GLOBULIN FRACTIONS,"** offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG, 14 E. JACKSON BLVD. CHICAGO 4, ILLINOIS, U.S.A.**

IT is desired to secure the full commercial development in the United Kingdom of BRITISH PATENT NO. 653942 which relates to **"CONTINUOUS PROCESS FOR THE MANUFACTURE OF ALIPHATIC ANHYDRIDE"** either by way of the grant of licences or otherwise on terms acceptable to the Patentee. Interested parties desiring copies of the patent specifications should apply to **STEVENS, LANGNER, PARRY & ROLLINSON, 5 TO 9, QUALITY COURT, CHANCERY LANE, LONDON, W.C.2.**

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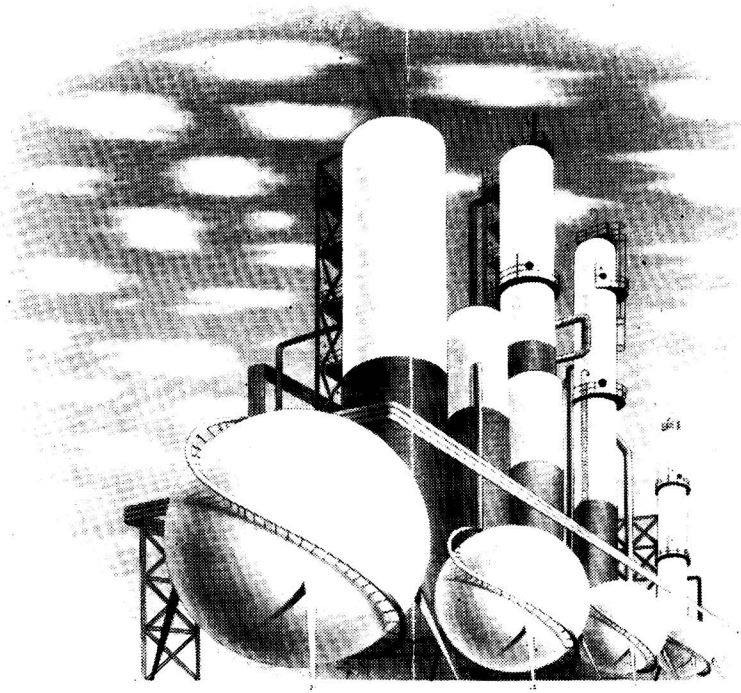

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The solvent action of certain of these products for undesirable impurities has been investigated and no doubt many other applications can be found—in our Research Laboratories investigations are being conducted in an endeavour to make the greatest use of these chemicals.

ANHYDROUS HYDROFLUORIC ACID · HYDROFLUORIC ACID
BORON TRIFLUORIDE · BENZOTRIFLUORIDE
FLUOSULPHONIC ACID

The above compounds are of great value in the manufacture of fluorinated materials and are available in commercial quantities. Industrial applications include catalysts, lubricants, plastics and specialised welding. Should you have any problems or theories on these or any other applications, please consult us.

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