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# The Chemical Age

VOL LXVIII

23 MAY 1953

No 1767



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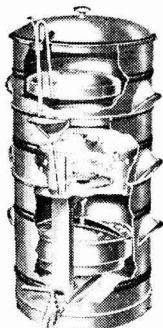
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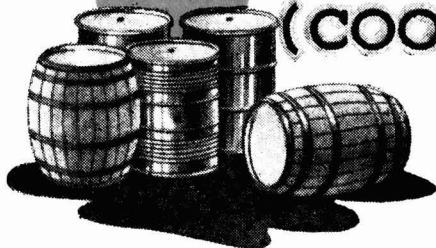
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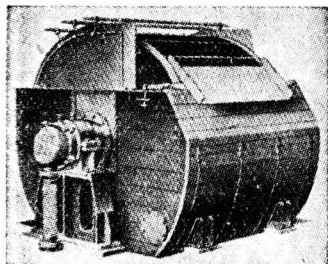
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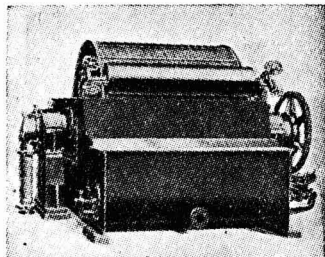
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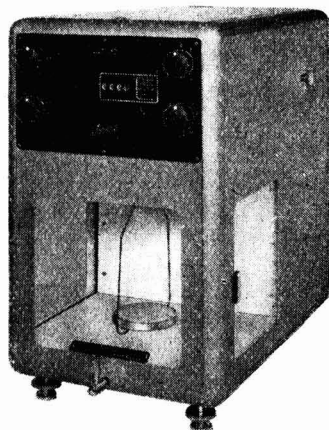
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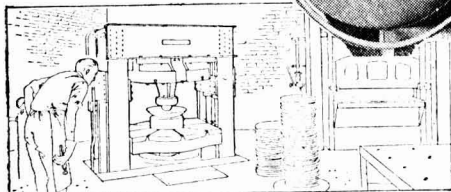
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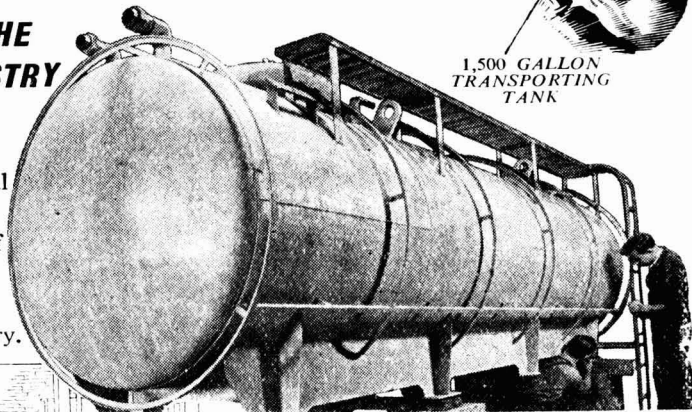
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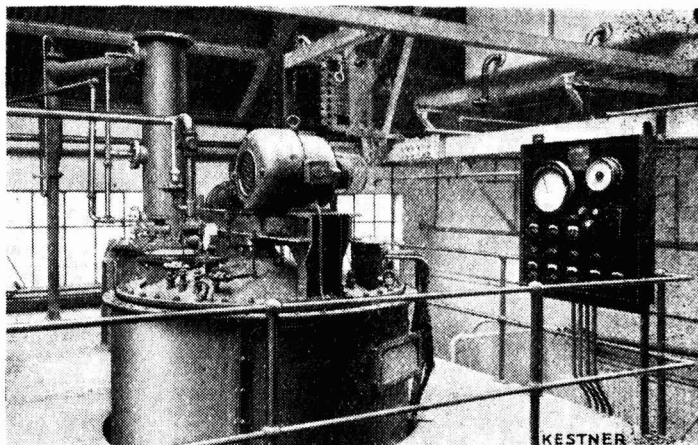
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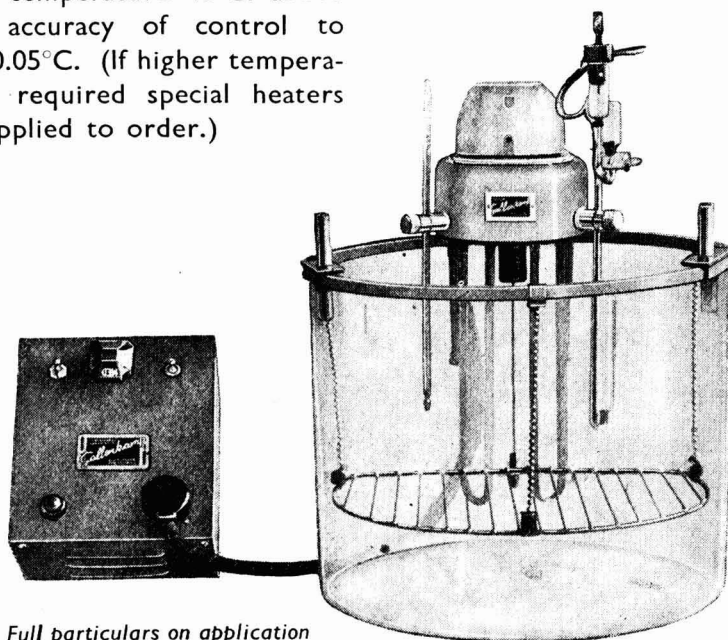
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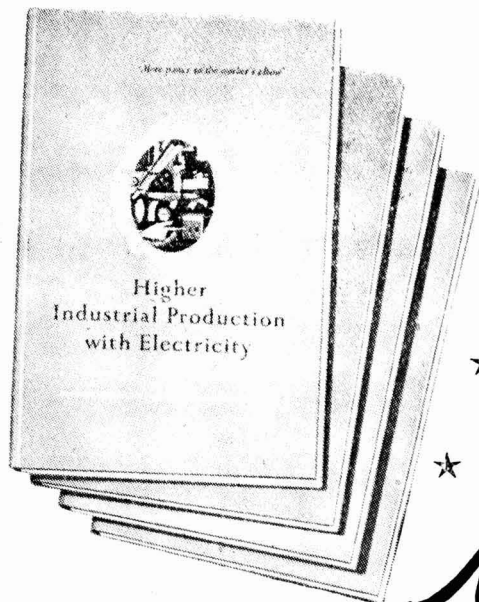
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*The post-free price of each of the books is 9/- and copies can be obtained from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2, or from your Electricity Board.*

The Association has produced a film called "A Case for Handling" which illustrates by practical demonstration the vital part that improved materials handling can play in all industries. It runs for 32 minutes, and is available on free loan.

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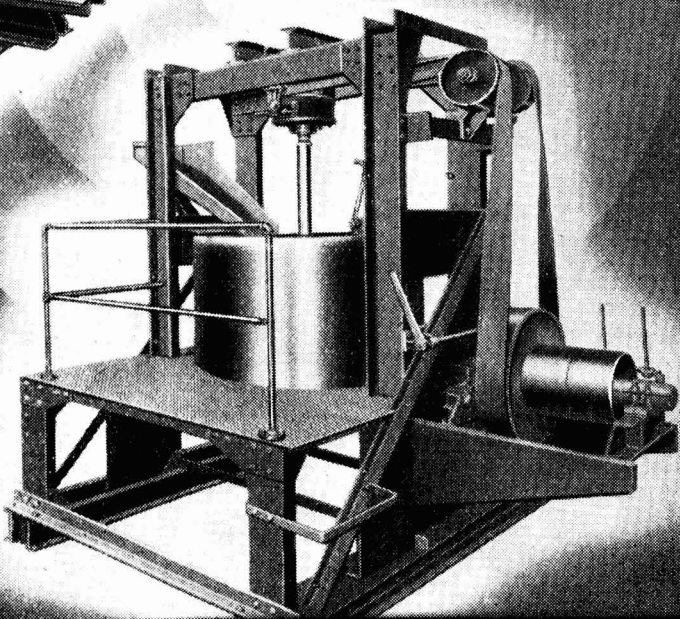
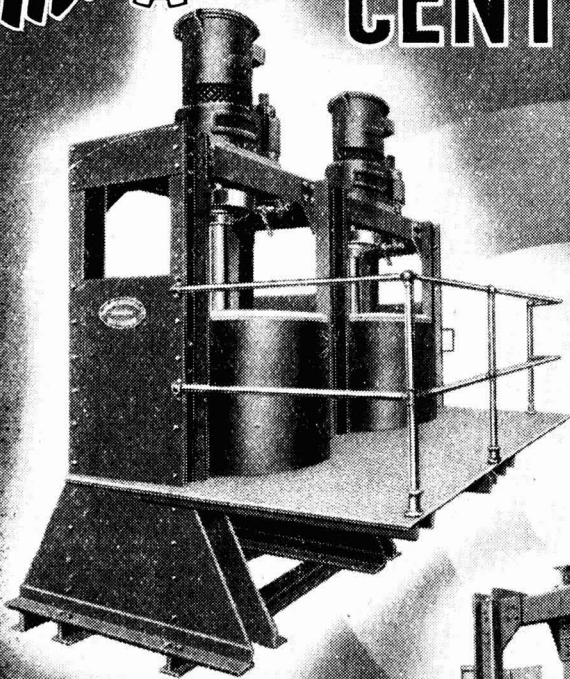
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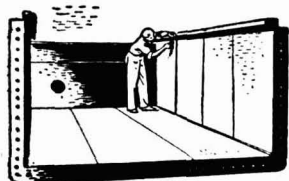
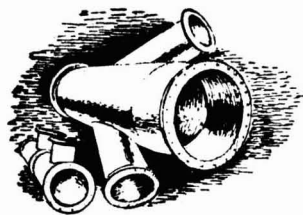
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Established 1919

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Volume LXVIII

23 May 1953

Number 1767

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## Safety—Men at Work

TO return so soon to the topic of safety in chemical factories may seem unenterprising; yet it is not a topic that can suffer from under-emphasis. Since the recent leader (THE CHEMICAL AGE, 68, 653-4), we have seen US figures for accident rates in the year 1951. There the chemical industry's rate of 'disabling injuries' was 5.48 per million man-hours worked. The British measure is the rate of 'reportable accidents' per 100,000 hours worked, and in the same year this was 1.15 for the fine chemical industry and 1.41 for heavy chemicals. For Anglo-American comparison, the British figures must be multiplied by 10. It would seem, then, that US chemical factories are between two and three times as safe as ours. Thus, although the safety record of the British chemical industry can be praised, it nevertheless begins to take on a somewhat inferior appearance if set against a background of US data rather than British data.

At least two of the Anglo-American Productivity Council Reports provide supporting evidence for the view that safety at work is sought and secured more effectively across the Atlantic. To quote

from the Heavy Chemicals Report, the British team visiting the United States found that 'far more continuous on-the-job training in good safety habits was given in America than in Britain. . . . Safety propaganda was more effective . . . safety notices, frequently changed, were of a high standard . . . safety manuals and news sheets were good and widely circulated'. There is a basic difference in approach towards accident prevention. Thus, in the Fertilisers Report, 'many cases of unguarded belts, gears, and shafting were seen, though as far as could be ascertained the accident rate was low. In general, the emphasis was on propaganda and on promoting a competitive spirit to obtain the longest accident-free run, rather than on guarding moving machinery'. It does not seem too much to say that the British approach is negative and the American approach is positive. By guards and other devices we seek to make machinery foolproof. By propaganda in its educational sense, factory managements in America strive to convert the fools. To quote from the latter report again, one of the conclusions drawn by the British team was

that 'it would appear that the practice of making employees conscious of the danger of moving machinery was thought to be more effective than guarding the machinery'. One slogan quoted in the Heavy Chemicals Report sums up the US attitude perfectly—'No safety device has yet been invented to take the place of the one just above the ears!' As stated in this report, too, in both countries some 80 per cent of all injuries are of a 'personal' type which could not have been prevented by any guard but only by the worker taking a little more care.

Possibly there is a psychological weakness in a safety policy that emphasises guards and other mechanical devices. Workers develop safety-unconsciousness rather than safety-consciousness; safeguards are 'things' to be provided for them, not actions to be taken by them. That is not to say or suggest even faintly that British industry should lower its standards of guarding. We should recognise the weakness, however, and apply a compensating force of continuous training in safety-mindedness, adopting with full vigour the American approach. To do this would be to combine the best of two industrial worlds, and in time our accident rate might be even less than America's.

No set of safety rules can achieve an

accident rate of nil, for in the final reckoning there must always be the accident caused not merely by the unforeseen but by the unpredictable; but clear-cut rules, based upon accident-analysis, if they are widely enough known and followed diligently, can dispose of the known hazards. It is a trait in American character never to feel self-conscious about stating and re-stating the obvious; indeed, much verbal and pictorial ingenuity is spent upon disguising the obvious, presenting it with a grafted novelty. In the whole we lack this trait. The man who hammers away at the obvious is regarded with some distaste, and should he dress up the same obvious points in a variety of costumes, distrust takes the place of distaste. In fields where originality matters the most, this general atmosphere may encourage progress. But accident prevention must deal in monotony far more than in originality. In ordinary life the frequent dispenser of warnings is quickly labelled a bore; in industrial life it is essential to keep the obvious constantly publicised yet without incurring familiarity and its offspring, contempt. Undeniably the Americans are better at this, but there is no reason why we should not learn. In works safety there is no journey's end, no best that cannot be bettered.

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The annual subscription to THE CHEMICAL AGE is 42s. Single copies, 1s.; post paid, 1s. 3d. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784/5). LEEDS OFFICE: Martins Bank Chambers, Park Row, Leeds, 1 (Leeds 22601). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

# Notes & Comments

## A Silver Jubilee

INDIAN journals this spring have been reminding us that the discovery and announcement of the Raman Effect is now 25 years old. Not only did Raman observe the fact that radiations of changed frequency appeared in the light scattered by chemical media, but he immediately assessed its significance: 'We are obviously only at the fringe of a fascinating new region of experimental research which promises to throw light on diverse problems relating to radiation and wave theory, X-ray optics, atomic and molecular spectra, fluorescence and scattering, thermodynamics and chemistry. It all remains to be worked out.' Raman also gave a correct explanation of the effect in the original 1928 paper, though at the time it rested upon hypothesis rather than measured proof, i.e., the change in frequency was the result of an exchange of energy between the light-quantum and the chemical molecule. In a message marking this year's jubilee, Einstein has stressed the point that Raman was the first to recognise and demonstrate that the energy of a photon can undergo a partial transformation within matter. Raman's work was, of course, recognised by a Nobel award.

## Aided Organic Chemists

ANew branch of spectroscopy was quickly opened up. The study of the spectrum of light scattering soon became a major weapon in the armoury of chemists for the frequency shifts were able to give valuable information about the symmetry of molecular structure and particularly about the presence of special types of chemical bonds. For the organic chemist Raman Effect spectra have proved especially fruitful, sometimes confirming previous structural assumptions and in some cases even giving a first clue to entirely new structural hypotheses. Professor Ingold's work on the structure of benzene may be cited as one of the most notable examples of the Raman Effect in chemical harness. The science of the

new India is in a vigorous state of expansion. This anniversary reminds us that not all the greatness is entirely new, that Indian research has already made classical contributions to world science. If we are to judge from a 1953 photograph in one of the Indian journals, *Current Science*, Sir C. V. Raman has himself carried the years since 1928 with exceptional lightness.

## More About Sodium

OUR recent note about sodium (*THE CHEMICAL AGE*, 68, 441) brought inquiries from readers, so perhaps another industrial development with this difficult element will also be of special interest. The National Distillers Chemical Co. in USA has developed a highly reactive form of sodium by coating inert solids such as soda ash, salt, alumina, and even sand with what are called 'atomic layers' of the element. According to one report (*Chemical Engineering*, 60, 5, 110-112), the sodium-coated solids remain free-flowing over a wide range of temperature. Seven advantages are emphasised. Reaction rates and temperatures may be controlled easily above and below sodium's melting point. Batch reactions can be converted into continuous operations. Dry reactions can be carried out. Inflammable solvents are eliminated. Yields are high and induction periods are avoided. Finely divided and reactive products are given. These high-surface sodium materials can be made by mixing molten sodium with any inert solid. Between 100-200° C. sodium spreads readily over the surface of hot, dry solids. The operation is conducted in a steel vessel in an atmosphere of nitrogen. The inert carriers vary in their abilities to hold sodium. Thus, salt can carry from 2 to 10 per cent of sodium, alumina 20 to 25 per cent, but colloidal carbons can carry over 30 per cent. An appreciably long list of reactions in which high surface sodium is outstandingly effective is already claimed, e.g., reductions of salts and oxides of other metals to finely divided or colloidal forms of the metals, hydrocarbon refining, purification of

ether, and production of sodium hydride with a particle size less than 10 microns. To make available so fiery an element in a form of maximum reactivity yet with its natural aggression tamed is surely a remarkable achievement.

### *Maleic Hydrazide*

IT is now almost five years since the discovery of maleic hydrazide's unusual ability to suspend plant growth. Dilute solution sprays temporarily retarded shrub or hedge growth, thus reducing the frequency of trimming operations during the growing season. There has now been a usefully long period for realistic evaluation. One practical application is the checking of roadside grass growth. Testing by the Connecticut State Highway Department began in 1950 and altogether some 300 acres of plots have been investigated. It is now concluded that a routine programme of maleic hydrazide spraying can substantially reduce the frequency of mowing. The modern technique of low-volume pressure spraying has been found the most effective. The best times for spraying are in the spring or autumn; however, this finding may not have general validity—certainly the autumn

successes may have depended upon climatic conditions in Connecticut. Inhibition of growth is proportional to dosage. Thus, 4 lb. of maleic hydrazide per acre in the spring delayed the need to mow by six weeks; but 6 lb. per acre held off mowing for three months. The toxicity of maleic hydrazide has been carefully studied. It is pleasingly low. Cows and other animals have been fed with daily 5 per cent dosages of the sodium salt without adverse effects; nor does maleic hydrazide appear in the milk of cows grazing upon treated herbage. There appears to be no permanent inhibition of grass growth; when the period of checked development ends, re-growth has its normal vigour. However, it is suggested that only grass or turf that is two years old or more should be treated. Also, no grassland should receive more than two sprayings per season. These US results certainly seem worth examination here. Rough grass and herbage abounds at the sides of our country roads and rail tracks. Our cities and towns have thousands of plots of lawns and lawnlike grassland whose purpose is ornamental. Maleic hydrazide might save many hours of labour now spent on mowing and scything.

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### *Synthetic Detergents Inquiry*

A COMMITTEE has been appointed by the Minister of Housing and Local Government to inquire into the possible effects of the increasing use of synthetic detergents. In a written reply in the House of Commons on Monday the Minister, Mr. Macmillan, said that its terms of reference would be: 'to examine and report on the effects of the increasing use of synthetic detergents and to make any recommendations that seem desirable with particular reference to the functioning of the public health services.'

He had, he said, consulted with the Secretary of State for Scotland and the Minister of Health before appointing the committee. He had been fortunate enough to secure the services of Sir Harry Jephcott, chairman and managing director of Glaxo Laboratories Ltd., as chairman of the committee.

There have been a great number of complaints regarding foaming caused by the use of synthetic detergents in recent times and in January the Metropolitan Water Board demanded an inquiry owing to excessive foaming in the upper reaches of the River Lea.

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### *Screen Life of Research Chemist*

THE life of the late Dr. Chaim Weizmann, well known as a research chemist in Great Britain, famous for his discovery of the acetone-butanol fermentation, and first President of Israel, is to be made into a film. Mr. Arthur Krim, president of United Artists, announced on 18 May that he had signed an agreement with Mr. Meyer Weisgal, Dr. Weizmann's friend and literary executor, for the world distribution rights of a film based on 'Trial and Error,' in which the President described his struggle for Zionism and the State of Israel.

# Prevention of Water Pollution

## Director's Annual Report Describes Recent Experiments

THE growth of public interest in the prevention of water pollution is commented upon in the report of the Water Pollution Research Board for 1952. The report, which is signed by Professor D. M. Newitt as chairman of the Board, instances as an example of this the concern felt by the Ministry of Transport over the pollution of beaches by oil. A committee which has been set up by the Ministry to study this subject includes representatives of oil companies, ship owners, and other interests concerned; the Department of Scientific and Industrial Research is represented by the Director of Water Pollution Research, Dr. B. A. Southgate.

Work on possible methods of preventing the pollution is in progress in several laboratories and the oil companies have carried out large-scale trials at sea at which members of the staff of the Laboratory have been present.

Another matter widely reported during the year, the report continues, has been the increased production of foam both in sewage-disposal works and in rivers to which sewage effluents are discharged. It is generally believed that this is due to recent increases in the use of synthetic detergents of different types. Because of its heavy existing commitments the Laboratory has not begun any work on this problem, though it is clear that it is one to which serious attention will eventually have to be given.

### Further Progress

Some further progress, states the report, has been made in the work which is being done to determine the factors influencing the toxicity to fish of constituents of industrial wastes. One matter which is being studied, for example, is the effect on toxicity of varying the concentration of dissolved oxygen in a water. In a river polluted by poisonous industrial wastes the concentration of dissolved oxygen is often less than the saturation value. It is clear from the work carried out during the year that the effect of even small changes in oxygen tension may be of considerable importance. In order to understand the effects of pollution on a fishery both work in the laboratory and

observations in the field are required.

During the year the Ministry of Agriculture and Fisheries, with some assistance from the Laboratory, began an investigation of the River Colne, near Watford, which receives effluent from a recently built sewage-disposal works. This work is being correlated closely with the results of laboratory experiments, the whole programme being co-ordinated by a committee of the Development Commission under the chairmanship of Professor C. M. Yonge, a member of the Board. It is hoped that as one of the results of this work it will be possible to formulate a standard test for toxicity of effluents; this will be used by the Ministry of Agriculture and Fisheries in assessing the toxicity of samples of effluents sent to them by river boards, local authorities, and industry.

### New Stevenage Laboratory

Pleasure is expressed at the fact that the building of the central Water Pollution Research Laboratory referred to in the 1951 report has now been authorised and that work on the preparation of the site at Stevenage is in hand. This site was chosen so that experiments on the treatment of sewage could be carried out there in pilot plant using sewage, containing no significant admixture of industrial wastes, pumped from a sewer very near to the Station.

Having this facility available, the Board proposes, when the Station is occupied, to transfer to the one site at Stevenage not only the work being done at Watford and Garston, but also that which is at present being carried out at Birmingham and Coventry. This, the Board feels, will greatly simplify the working of the organisation and besides effecting economy should lead to an increase in efficiency. It is expected, however, that, as at present, it will still be necessary from time to time to undertake work in other parts of the country, for example on treatment of particular industrial waste waters, which often can be satisfactorily investigated only at the place of origin.

The extensive report of the Director of Water Pollution Research, which is combined with the Board's report, begins by dealing

with some factors affecting the bactericidal action of chlorine.

The disinfectant power of chlorine, it states, is greatly modified by the presence in the solution being chlorinated of substances which react with it chemically. Although it is a highly active substance there is, in fact, a somewhat restricted group of compounds with which chlorine in very dilute solution reacts in this way. Thus the chlorine demand of the following solutions was found to be less than 1 part per million (p.p.m.): 0.005 per cent sodium palmitate, 4 per cent sodium acetate, 0.1 per cent glycerol, 0.1 per cent starch, 0.1 per cent acetaldehyde, 0.1 per cent furfural, 2 per cent methyl alcohol, 2 per cent ethyl alcohol, 2 per cent lactose, 2 per cent glucose. Substances with appreciable chlorine demands were acetoin (0.1 per cent solution, chlorine demand 10 to 11 p.p.m.), ascorbic acid (62.5 p.p.m. solution, chlorine demand 17 to 18 p.p.m.), and catechol (5 p.p.m. solution, chlorine demand 8 to 9 p.p.m.).

#### Chlorine Reactions

Chlorine reacts with ammonia to form simple chloramines and with amino-acids to form chloro-amino compounds, the report continues. These compounds are much less effective disinfectants than chlorine itself, and as their formation takes an appreciable time it follows that, when the chlorine is added to a solution of ammonia or an amino-compound in the presence of bacteria, disinfection is at first due largely to the diminishing quantity of the residual free chlorine and only later to the chloro-amino compound which is formed.

For example, when 1 p.p.m. chlorine was added to a solution of glycine containing *Bacterium coli* in suspension, 99 per cent of the organisms were destroyed in 22 minutes. When, however, the same concentrations of chlorine and glycine were mixed 15 minutes before they were added to the bacterial suspension, nearly four hours elapsed before the bacteria were destroyed.

Striking differences were observed between the effects of sewage and of solutions of peptone on the disinfectant action of chlorine. With most brands of peptone concentrations of chlorine up to and even slightly above the chlorine demand showed no bactericidal action during a period of contact of six hours; in fact, appreciable growth usually occurred. Proliferation in the chlorinated

samples was, however, definitely lower than in the unchlorinated samples and at some stage in the first 24 hours there was usually a marked fall in count. With sewage, on the other hand, concentrations of chlorine equivalent to comparatively small fractions of the chlorine demand commonly resulted in destruction of most of the bacteria after a short period of contact, although the survivors might rapidly proliferate on more prolonged standing.

Further tests showed that the bactericidal action of chlorine in the presence of peptone was greatly enhanced if ammonia was also present. The experiments were made with peptone water (chlorine demand 18 to 19 p.p.m.), and with peptone water containing 250 p.p.m. ammonia as ammonium sulphate. With 15 p.p.m. chlorine presence of ammonia made comparatively little difference to the bactericidal action, but with 20 p.p.m. chlorine the destructive effect was much greater in the presence of ammonia, 99.997 per cent of the bacteria being destroyed after contact for six hours, although in the absence of ammonia only some 60 per cent were killed in the same time. Higher doses of chlorine (25, 30, and 35 p.p.m.) virtually destroyed the culture after one hour and no aftergrowth appeared during the period of experiment (96 hours).

#### Ammonia Effects

The effect of ammonia on the rate of destruction of bacteria was followed more closely by obtaining time-survivor curves with points at frequent intervals during the period of contact, choosing a concentration of chlorine which provided a suitable rate of disinfection for this purpose. Separate solutions (both at pH 8.0), containing respectively 0.1 per cent peptone and 0.1 per cent peptone plus 250 p.p.m. ammonia as ammonium sulphate, were prepared in glass-distilled water and were sterilised by autoclaving. A bottle of each solution in a water bath at 26°C. was inoculated with a suspension of *Bacterium aerogenes* to provide an initial count of about 50,000 per ml. and 20 p.p.m. chlorine (as hypochlorite) was added to each bottle. Samples were abstracted at frequent intervals over a period of 45 minutes and on each sample six determinations of the plate count were made. The curves obtained by plotting the logarithm of the percentage of bacterial surviving at each interval of time showed that the



presence of ammonia enhanced the bactericidal effect of the chlorine.

These results are of interest, says the report, in view of the fact that ammonia is commonly regarded (for example in water-works practice) as one of the substances mainly responsible for reducing the bactericidal action of chlorine. It is clear that in the presence of certain other substances, ammonia may, in fact, increase its activity. The explanation of these effects may lie not only in the different bactericidal powers of the various chloro-amino compounds formed, but in the relative speeds with which they are formed and subsequently decomposed.

On the subject of waste waters containing cyanide, the report states that the original object of the experiments described in the 1951 report was to find the effect on treatment of sewage in percolating filters of the complex metal cyanides which commonly occur in waste washing waters from electroplating, and to compare this effect with that of potassium or sodium cyanide which had previously been found to have a detectable but small influence on the quality of a filter effluent when applied in a concentration of 2 p.p.m. HCN, and to be tolerated by a filter after acclimatisation at a concentration of 30 p.p.m.

Referring to further more extended experiments, the report states that the results of these have shown that the effects of the complexes of zinc, cadmium, and copper were similar in a general way to that of potassium cyanide; after acclimatisation the cyanides of zinc and cadmium could be applied at a concentration of 1 p.p.m. HCN without causing cyanide to appear in the effluent.

#### Important Result

However, the remarkable and important result emerged that in concentrations up to 100 p.p.m. HCN, potassium (or sodium) cyanide and the cyanide in the complexes of zinc, cadmium, and copper, could be almost completely destroyed by biological oxidation under suitable conditions in a percolating filter. It seems possible, therefore, that chemical methods of removing cyanide might in some circumstances be replaced by a biological oxidation process and this possibility is being investigated. Metals from complex cyanides would be present in the effluent from biological treatment, and would still have to be removed by a chemical

method, for example, addition of an alkali.

The report goes on to say that a very effective method of destroying cyanide in waste waters from electroplating is by treatment with chlorine or a hypochlorite in strongly alkaline solution. Results of a detailed investigation of this method were published a few years ago.\* Some of the advantages of the process are that little sludge is formed and that the cyanides are almost completely destroyed; the treated liquor can be discharged to a small sewage works without interfering with its operation.

#### Plants Being Installed

Plants using this process are now being installed at works in several parts of the country. In a small plant built by the Ministry of Works to treat waste quenching water from a cyanide hardening plant at a Ministry of Supply depot, the waste waters, which are discharged intermittently, are treated in batches in a tank fitted with a mechanical stirrer; treatment is controlled from a small hut. Samples for testing are drawn up into the hut by hand pump, lime and sodium hypochlorite are added, and the stirrer is set in motion. After about one hour excess hypochlorite is removed by addition of thiosulphate and alkali is neutralised by hydrochloric acid. During a recent test the content of cyanide was reduced from 122 parts to 0.62 part HCN per million by this treatment.

In the 1950 and 1951 reports, descriptions were given of experiments on the effect of various factors on the toxicity of potassium cyanide to rainbow trout. This work, states the current report, is being done with two main objects—(1) to provide information from which can be developed a standard method for determining the toxicity of waste waters, and (2) to provide information which can be correlated with the results of surveys of rivers which will be made jointly by the Ministry of Agriculture and Fisheries, the Freshwater Biological Association, and the Laboratory. Any standard method of testing effluents which may be developed will be used by the Ministry of Agriculture and Fisheries, who are to set up a laboratory in which will be determined the toxicity of samples of waste waters sent to them by

\* *Water Pollution Research*, 1948. H.M. Stationery Office, London, 1949. EDEN, G. E., HAMPSON, B. L., and WHEATLAND, A. B. Destruction of cyanide in waste waters by chlorination. *J. Soc. chem. Ind., Lond.*, 69, 244 (1950.)

industry and by public authorities, including River Boards.

In the 1951 report results were given which showed that the relation between concentration of cyanide (within the range 0.07 to 0.25 part CN per million) and period of survival of trout exposed to it, is of the form  $C^nT=k$ , where  $T$  is the median survival time,  $n$  and  $k$  are constants, and  $C$  is the concentration of cyanide. At any given concentration within this range the logarithms of the survival times of individual fish were symmetrically distributed about their mean, the distribution being approximately normal.

### Susceptibility Increases

In order to investigate in more detail the toxicity of comparatively high concentrations of cyanide, some further experiments have been made. The fish used appear to have been considerably more susceptible to cyanide than those used in the earlier work. The reason for this is not known, states the report; it may have been due to inherent differences between the two stocks of fish, or possibly to a seasonal effect, since the later experiments were made in mid-winter and the previous experiments in early summer. In both cases the temperature of the solution of cyanide to which the fish were exposed was 17.5°C. In both sets of experiments the relation  $C^nT = k$  was departed from when the concentration of cyanide was higher than a certain value. At any concentration below this critical value, in both sets of experiments, the logarithms of the survival times were normally distributed; at a given concentration above the critical value, however, this was not so but the times themselves were distributed approximately normally.

Experiments have been made on the effect of temperature, between 12° and 22°C., on the toxicity to trout of cyanide in concentrations between 0.125 and 1.0 p.p.m. In one series of experiments the period of survival decreased with rising temperature in solutions containing from 1.0 to 0.3 part CN per million; this agrees with results obtained by other workers. With slightly lower concentrations of cyanide, however (0.25 to 0.175 p.p.m.) temperature had apparently no effect. Moreover, in water containing 0.15 and 0.125 part CN per million, increasing temperature appeared to prolong the period of survival. These ex-

periments are being repeated since it is clearly of importance to know accurately the effects of temperature on toxicity—for example in a river which may be heated artificially by the discharge of cooling water. It may be significant that the concentration of cyanide which divides the region where the period of survival is reduced by rising temperature from that where no temperature effect can be discerned, is also approximately that at which the distribution of survival times for any given concentration changes from the normal to the log-normal form. It is at about this concentration also that the relation  $C^nT = k$  ceases to be obeyed.

Work has now started on the effect of concentration of dissolved oxygen on the toxicity of poisons, of which the first one investigated has been cyanide. Previous work had suggested that the toxicities of cyanide and *p*-cresol are increased by lowering the concentration of oxygen, even from saturation value to say 70 per cent of this value. These experiments, however, were made in static conditions and for this reason were not altogether satisfactory.

In the present experiments water at a constant temperature, and with a constant concentration of poison and of dissolved oxygen, flows continuously through the tank in which the fish are confined. The water is divided into two streams, one of which passes down a tower in which its oxygen tension is brought to the saturation value by blowing air through it, while the other is passed down another tower where almost all the oxygen is removed by a stream of nitrogen. The two streams are then united in the desired proportions and the poison is added to the mixture.

### No Automatic Control

Although this apparatus is not yet controlled automatically it is possible to obtain a reasonably constant concentration of dissolved oxygen; for example, when it was set to maintain a concentration of five parts of oxygen per million, the observed values over a period of five hours had a mean of  $4.97 \pm 0.14$  parts per million.

Results of the first experiments agree with previously reported work in indicating that the toxicity of cyanide is much increased by a fall in concentration of dissolved oxygen.

\* 'Water Pollution Research' can be obtained from H.M. Stationery Office, price 2s. 6d.

# A Year's Interesting Work

## But Time Taken up with Short-Term Research

**I**NADEQUACY of staff is holding back the carrying out of the National Physical Laboratory's traditional and fundamental tasks, according to the annual report for 1952, published on 15 May. The Executive Committee deplore the fact that research work for defence and other pressing needs has taken up an increasing amount of the NPL's resources in short-term investigations. In spite of these handicaps, however, the report shows that the NPL is still performing a very useful part in fundamental research in this country.

### Work on Dielectric Losses

Among much interesting work in the Electricity Division, the work on dielectric losses carried out for the British Electrical and Allied Industries Research Association has now reached a stage where it has been possible to prepare a comprehensive report for publication. It describes and co-ordinates the main features of the dielectric behaviour of four classes of dielectrics: (a) silicones and other silicon-oxygen structures, including mica and glass; (b) non-polar plastics, hydrocarbon and fluorocarbon; (c) pure resins of the phenol-formaldehyde and aniline-formaldehyde classes; and (d) a chlorinated fluorocarbon which resembles the above resins in being polar but has a negligible water absorption so that its dielectric properties are not dominated by absorbed water.

Some measurements are also in hand of the dielectric constants of pure liquids to serve as standards in physico-chemical work. Standards giving values round about two, six and 30 are desired and measurements on benzene, which has a dielectric constant of about 2.3, have been completed. The value obtained is in good agreement with that obtained at the laboratory some 20 years ago. The improved chemical techniques of the Chemical Research Laboratory have combined with improved electrical methods to increase the precision with which the value can be given. The main interest lies however in the other liquids, the dielectric constants of which are not yet known with comparable accuracy.

The increasing use of fluorescent pig-

ments and inks for advertising posters and also 'fluorescent brighteners' in detergents has raised new problems in colour measurement. The striking brilliance of these colours is due to the absorbed light being transformed and re-emitted as fluorescent light. Thus it is possible for a red ink to emit more red light than is present in the illuminant. The usual colour measuring spectrophotometers such as the Hardy recording spectrophotometer give quite misleading curves with fluorescent colours. Colorimeters are more reliable but they give results for illuminants A, B and C and not for daylight. A general method for measuring fluorescent colours has therefore been devised by the Light Division which applies to any variety of daylight. In principle, the method is a combination of spectrophotometry and colorimetry in which the specimen is illuminated by monochromatic light, but the reflected light is measured by a colorimeter. Thus, instead of a single reflection curve, a fluorescent colour is described by four curves, one for the ordinary reflection and three more showing the tristimulus values of the fluorescent light.

### Biological Stains

At the request of the Medical Research Council, and with their collaboration in the provision of specimens, an investigation has been started into the spectral absorption, in the ultra violet and visible spectral regions, of biological stains and stained microscopical specimens. The Carey recording spectrophotometer, which covers this spectral range, has been adapted to handle microscopical specimens.

A slight adjustment to the laboratory's colour temperature scale was made on 1 July, 1952, and the scale is now based on the 1948 Temperature Scale. A pamphlet describing the change was prepared for those requiring a detailed explanation. In seeking a suitable filter for use in steel-melters' spectacles, measurements have been made of the least perceptible colour temperature difference detectable when the observer wears blue, green or neutral glasses. The measurements confirmed, within reasonable limits,

the values calculated from existing data on colour discrimination.

A particularly interesting development has been the work carried out for the Ministry of Supply on electrically conducting coatings for glass. Half-wave films of cadmium oxide have been prepared with resistance as low as 35 ohms per 'square' and white light transmission (unbloomed, on glass) of 82 per cent, while new methods of producing conducting films of stannic oxide have also been studied with some success. Remarkable results have, however, been obtained with gold films on a substrate of bismuth oxide. These can be prepared, on glass, so as to be of a pale straw colour, with white-light transmission at least 75 per cent, and electrical resistance 6-7 ohms per 'square.' Suitably cooled, such films have withstood a loading of 3 kW/ft.<sup>2</sup> for several days without change of properties. The current density in the film, at this loading, is well over half a million amperes per square centimetre cross-section of conductor.

This film appears to be suitable for lamination, as required, and small-scale production for further tests is in progress commercially.

The building of an extension to the Metallurgy Division laboratories began in April, and is scheduled to be completed in 1953. The extension will provide additional facilities for the staff concerned with X-ray and electron diffraction and electron microscopy, a group of rooms designed for the application of radioactive tracers to metallurgical research, and a new kiln room and laboratories for the Refractories Section. The kiln room is already in use, and contains a newly-built recuperative gas-fired kiln suitable for temperatures up to 1,800°C., which replaces an older furnace now in the foundry. The space liberated in the foundry will be occupied by vacuum melting furnaces required for the expanding work on the mechanical properties and brittleness of iron.

### Tensile Stresses in Alloys

Measurements have been made of the tensile yield stresses of a series of alloys in which elements of progressively increasing valency were added to silver, and it was concluded that determination of elastic constants can throw much light on the bonding mechanism in metals and the part played by the valency electrons. Such measurements,

to be most useful, must be made on single crystals, and it has been decided to attempt the preparation of the necessary crystals. A procedure for making single crystals of iron was established, and more intensive work will be undertaken during 1953.

Discussions also revealed considerable uncertainty about the effective valency of a solute element in a solid solution, particularly when the valency of the solute differs widely from that of the solvent. Experiments were made to discover whether the migration of the solute in a potential gradient can throw light on the effective valencies, and local distortion of the lattice has been studied by X-ray reflection.

### Brittleness of Metals

A study of the brittleness in notch-bend test of solid solutions of antimony in copper has been carried on, and work done on the deformation of  $\alpha$ -brass, aluminium alloys, and other metals. Some investigations of the effect of phosphorus on the embrittlement of iron at low temperatures have been made, and much effort has been devoted to developing the discovery that iron containing quite small amounts of carbon possesses both great toughness at low temperatures and high yield stress when it is cooled sufficiently rapidly from above 900°.

Studies of the free energy-concentration curves at 1,000°C of the titanium-oxygen system have shown that magnesium is capable of reducing titanium dioxide until no more than 2.4 per cent of oxygen remains and that calcium is capable of reducing the oxygen content to below 0.1 per cent. There is consequently no chemical objection to a process for producing ductile titanium by the method already explored by the Dominion Magnesium Co., of Canada, which involves reducing pure titanium dioxide first with magnesium and then with calcium. The details of such a process have been examined, and titanium that is workable when hot has been produced. The difficulties of effecting clean separations at the various stages are appreciable, and must be overcome before titanium made in this way can compete with that made by reduction of the tetrachloride.

The  $\alpha/(a + \beta)$  and  $(a + \beta)/\beta$  boundaries have been worked out in the equilibrium diagrams of the titanium-oxygen and titanium-iron oxygen alloys, mainly by microscopic and X-ray methods. The

presence of oxygen in titanium-iron alloys raises both the temperature and the rate of formation of the undesirable  $\alpha$ -titanium-FeTi eutectoid constituent. The lattice structure of the  $\gamma$  constituent of the titanium-aluminium alloys has been examined. This constituent, which is rather strong, and has a marked capacity for taking third metals into solid solution, is of interest because it has a higher modulus of elasticity than other titanium alloys. It has no useful ductility. Titanium-aluminium-vanadium alloys have been examined, and some of these have shown high strength combined with a useful amount of elongation in the tensile test.

Work on magnesium-cerium alloys has been concluded and a paper has been accepted for publication. Work on the constitution of zinc-zirconium and magnesium-zinc-zirconium alloys has shown that zinc-zirconium compounds precipitate very slowly at high temperatures from magnesium-zinc-zirconium alloys of commercial composition, and that the commercial alloys are generally very far removed indeed from their equilibrium condition.

In collaboration with the Physics Division, some very remarkable changes of elastic properties in samples of chromium near room temperature have been investigated. These changes appear in some way to be associated with the impurities introduced when chromium is made by the 'thermit' process, and further investigations will be made. Work on the equilibrium diagrams of uranium alloys has been continued on behalf of the Directorate of Atomic Energy.

#### Work in Chemistry Section

In connection with the programme on titanium, spectrographic methods have been developed by the Chemistry Section for the quick determination of calcium and magnesium, which are of particular interest in the reduction of titanium dioxide. An investigation into the possibility of applying direct reading methods to the Hilger large spectrograph has begun. Titanium alloys of known nitrogen content have been prepared for a comparison of the chemical and vacuum fusion methods for the determination of nitrogen.

A considerable amount of co-operative analytical research has been carried out in collaboration with BISRA Committees. The Physico-Chemical Sub-committee determined during the year British Standard methods for

the determination of cobalt and tungsten in all types of alloy steels. The methods were described in a paper to the 1952 BISRA Chemists' Conference. Work is continuing on the determination of molybdenum and boron, and a new project on the determination of copper has been commenced. A group of analysts, co-operating with the Laboratory, issued an interim report on the determination of nitrogen in mild steels, in which satisfactory procedures were recommended. Studies of the products of deoxidation of iron using different deoxidants were terminated in March. The study of deoxidation by titanium had been completed, but the Gases and Non-Metallics Sub-Committee of BISRA has expressed its wish that the work should be resumed at the earliest possible moment.

#### Iron & Steel Analysis

Some work is also being done, for the Spectrographic Sub-committee of BISRA, on solution methods applied to the analysis of iron and steel. It is hoped to obtain an independent check on chemical analysis and if the limit of sensitivity can be made sufficiently low the method may find considerable application in the Division's work on pure iron. The Chemistry Section is playing a leading part in an investigation into the methods of analysis for silicon transformer sheet, which has been found to be necessary in the course of the British Electrical and Allied Industries Research Association's researches on this material.

The report is published by HMSO for DSIR, price 2s. 6d.

#### Technical Surveys

FOR some years the Copper Development Association has prepared and issued to its members, every six months, a review of recent technical developments in the production, properties and application of copper and its alloys, with a comprehensive bibliography. It is believed that these reviews should be available to a wider public, and they are now being published in January and July each year, under the title 'Technical Survey.' No 1, January 1953, is now obtainable, and a copy will be sent free of charge upon request to anyone who is interested. Those who wish to take advantage of this service should write to the Association at Kendals Hall, Radlett.

## Newton Chambers & Co.

### Taxation Took 77 per cent of Profits

**G**REATLY increased tax liabilities and a higher reserve for the replacement of fixed assets resulted in Newton, Chambers & Company, Ltd., having substantially reduced profits available for distribution in respect of the year ended 31 December last.

The chairman, Sir Samuel Roberts, said this in the course of a statement which was circulated with the report and statement of accounts presented at the annual meeting in Sheffield on 15 May.

Gross profit for the year was £671,973, compared with £577,292 for the previous year, according to the statement, while net profit of £152,696 compared with £201,992. Although profits before deduction of depreciation, etc., were £126,909 greater than the previous year, taxation was £143,977 higher—that is, £17,068 more than the increase in profit.

The amount added to the replacement of fixed assets reserve had been increased from £67,773 to £95,390 and accounted for £27,617. This sum, unlike ordinary depreciation, was not allowed as a deduction from taxable profits, resulting in both income tax and excess profits levy being chargeable thereon. Taxation liability for the year increased from £375,300 to £519,277, due to the excess profits levy and to taxes, on the amount put to the replacement of assets reserve, so that of the net profits before taxation of £671,973, no less than 77 per cent went to the Collector of Taxes. In the circumstances it was satisfactory that the company could maintain the dividend and increase the amount carried forward by £45,754.

### Successful New Product

Sir Samuel said a record turnover in the chemicals department was achieved by increased sales of Izal, Zalpine and Izal toilet paper, together with the successful introduction of Zalpon, the new soap for use with the company's patent dispenser. Reductions in the price of paper were immediately passed on to the public.

Profits for the year were appreciably higher than the previous year and once again they could congratulate the excellent sales and production teams which, under the direction of Mr. P. J. C. Bovill, were making profitable use of the new buildings and

equipment with which they had been provided.

Referring to the subsidiary companies, Sir Samuel said Thorncliffe Coal Distillation, Ltd., had paid the full preference dividend and the customary ordinary dividend of 1s. a share for the 12 months ended 31 December last. N.C. Thorncliffe Collieries, Ltd., showed a small profit for the same period.

## Polythene Piping

### Publication of British Standards

**F**OR several years many millions of feet of polythene tubing have been in use in Britain; now, with the publication on 15 May of British Standards 1972: 1953, 'Polythene Tube for Cold Water Services,' and 1973: 1953, 'Polythene Tube for General Purposes,' the engineer knows that he is no longer pioneering, but is using an officially approved material. At a reception in the conference room of the British Plastics Federation some examples of the standard extruded tubing and of various polythene manufactures were on show.

Both standards give details of composition; marking; packing; hydraulic, tensile and reversion tests; and measurement of melt viscosity. For cold water services the tubing is to be black, and standards are given for up to 2 in. bore; general purpose tubes may be black, white or natural, and are obtainable in sizes up to 12 in. Both are available in standard lengths up to 500 ft.

The well known resistance to attack of polythene renders it eminently suitable for water supply, particularly where the piping is to be buried in corrosive soils—a great advantage when an estimated £5,000,000 a year is spent on replacement of corroded water pipes. Moreover, because of its good insulating properties, polythene is less likely to be frozen up in cold weather, and will not in any case burst, due to its elasticity. In chemical industry and brewing, its inertness, the smooth surface of the material, and the ease with which it can be worked, make it ideal for complicated installations where the liquids to be carried are not at a temperature higher than 60°.

Various sizes of polythene tubing conforming to the British Standards will be on view at the forthcoming British Plastics Exhibition (Olympia, 8-18 June).

# Funds for Civil Research

## Lord Salisbury on the Application of Science to Industry

THE adequacy of funds which the Government is making available for civil research was referred to by the Lord President of the Council, Lord Salisbury, when addressing the general committee of the Parliamentary and Scientific Committee recently.

He said the vital importance of the research carried out by the research associations was borne in on him more and more every week. This country had always held its own with other countries in pure science, but there had lately been a certain tendency, perhaps owing to lack of funds, to fall behind in the application of science to industry. It was, of course, a platitude to say that if they were able to export in competition with other countries, industry must be kept at a peak of modern efficiency, but that meant adequate research and its application to industries large and small.

For this, as the Government fully realised, more funds were necessary. On the other hand, the straitened financial position of the country meant that expansion in the field of civil science had to a certain extent to be checked. They must recognise the Chancellor's difficulties, although he (Lord Salisbury) was encouraged by the recent Budget to hope that the present difficulties might perhaps be fairly temporary.

### Increased DSIR Grant

He was glad to be able to say that it had been possible to make provision in the current estimates for an increase of £250,000 for the DSIR. That was not a large sum compared with what was spent in other spheres, and, of course, part of it would be swallowed up by the rising cost of the current work. The Government was not at all complacent about the position. In the field of industrial science in particular desirable lines of research were being delayed for lack of funds and it had been necessary to restrict the staff of some of the research establishments.

Lord Salisbury said one of the biggest questions facing them today was: 'How effective are the present arrangements for ensuring that the results of scientific research make a proper contribution to our national

economy?' This question had been referred by Lord Woolton to the Advisory Council on Scientific Policy and their report, which had now been received, covered the whole question of the exploitation of science by industry. So important did he consider the report that he had, by agreement with the committee, arranged for its publication as part of their annual report.

Closely linked with the preceding subject was that of higher technological education, on the progress in which depended very much how far it might be made possible for the results of science to be given practical application in industry.

### Imperial College Expansion

Referring to the Government's decision to embark on a major expansion of the Imperial College of Science and Technology, Lord Salisbury said he hoped the time taken to bring this about would be as short as possible. He added that the Government would make resources available for further developments in other parts of the country. He was unable to say more on that point at the moment, but the matter was not being allowed to slide.

Certain definite progress had been made with the proposal to build a Science Centre on the South Bank. The real difficulty was the enforced limitation, for economic and other reasons, of the Government building programme.

Two committees had been set up to consider the human factor in industry. One, the Committee on Individual Efficiency, was dealing with personnel selection and training, the design of equipment to suit the operator, work study methods, etc. The other committee was dealing with such questions as health, management organisation and human problems arising out of new production methods and techniques.

Lord Salisbury stressed the importance of these two committees and went on to say that the danger in modern industry, whether state-owned or privately owned, was that it tended to be increasingly inhuman and more and more a great machine, and the actual contact between employers and employed tended to be impossible.

## Phosphorus Insecticides

### Serious Accidents on Prolonged Exposure

WHETHER the benefits to be gained from the use of highly toxic insecticides, fungicides and herbicides sufficiently offset the risk of using them is a question raised in a leading article of the BMJ for 16 May. The query is inspired by a paper which appears on another page of the BMJ, describing two cases of paralysis following poisoning by a new organic phosphorus insecticide, Mipafox (*bis*-(mono-*isopropyl*-amino) fluorophosphine oxide).

Mipafox belongs to a large family of organic phosphorus compounds sharing the property of inhibiting cholinesterase, although varying considerably in their toxicity to animals. Preliminary tests had indicated that the new compound was effective as an insecticide, and that the oral toxicity to rabbits and guinea-pigs was very much less than that of parathion or TEPP. These same tests, however, would have indicated that tri-*o*-cresyl phosphate—TOCP, which gave rise to the notorious 'ginger paralysis' in the days of prohibition in the USA—was also relatively harmless. The symptoms in the cases described were in fact very similar to those due to TOCP poisoning.

### Doctors' Recommendations

The conclusions of the medical workers are: (i) that patients who have had acute organic phosphorus poisoning should be kept resting, and entirely out of contact with the compound until a normal cholinesterase level is again established in the blood; (ii) that the cholinesterase activity of workers at risk of absorbing organic phosphorus compounds should be estimated at frequent intervals; and (iii) that substances in this group should not be recommended for use until both acute and chronic toxicity have been studied in several species of animals.

The two casualties were both experienced in the handling of toxic chemicals, one being a research chemist and the other a process worker. Mipafox was originally proposed because it was thought that its apparently low acute toxicity would make it acceptable for general use among farmers and gardeners. This unfortunate accident may well have prevented many more, and the need for much greater care in these matters is apparent.

## New Chemical Centre

THE second and third floors of Dechema House, Frankfurt am Main, Rheingau-Allee 25, are to be made into the 'Dechema-Institut für Apparate- und Stoffkunde' (Dechema-Institute for Chemical Apparatus and Chemistry). It is hoped that it will be possible to hold the opening ceremony on 3 July, 1953.

The aims and objects of this new institute are as follows: to gather together and to display, as far as is practicable, all forms of chemical apparatus and equipment, metering and control apparatus, materials used in the construction of chemical apparatus and new raw materials for use in the industry. These will be classified in accordance with their design, mode of operation, theoretical foundations on which they are based and possibilities of utilisation. The Institute is thereby undertaking a task, the necessity for which has been apparent for a considerable number of years. The Dechema Institute, with its many collaborators in leading chemical and engineering circles, will be the first institution of its kind, not only in Germany but in the whole world. Further particulars concerning this new development and participation in the benefits thereof, will be found in a four-paged pamphlet, which may be obtained gratis upon application to Dechema, Frankfurt am Main-W. 13.

## Corrosion Research Station ?

THE setting up of a corrosion research station was suggested by Dr. W. H. J. Vernon in an address to the Corrosion Group of the Society of Chemical Industry at Burlington House, Piccadilly, W.1, last week.

Dr. Vernon, who was speaking as the retiring chairman of the group, emphasised that corrosion is not a problem confined to a single industry. The time had come when corrosion research must be regarded as a science on its own, based on the study of metals in their non-metallic environment.

Although the importance of corrosion was more widely realised today than ever before, it was a shocking fact that notwithstanding the larger number of committees considering the problem, the number of workers engaged in organised research was no more than in 1939.



# A Unique Service for Research Workers

## L. Light & Company Supply the Unobtainable

THE name of Light is known to every organic chemist in search of an unusual, maybe unobtainable, reagent. A company which will willingly supply chemicals in quantities as small as one-tenth of a gram, from acenaphthene to yohimbine hydrochloride, by way of cytochrome C and pregnenolone, is bound to achieve a certain fame. And the story of the way in which the firm has, literally, built itself up is not without interest.

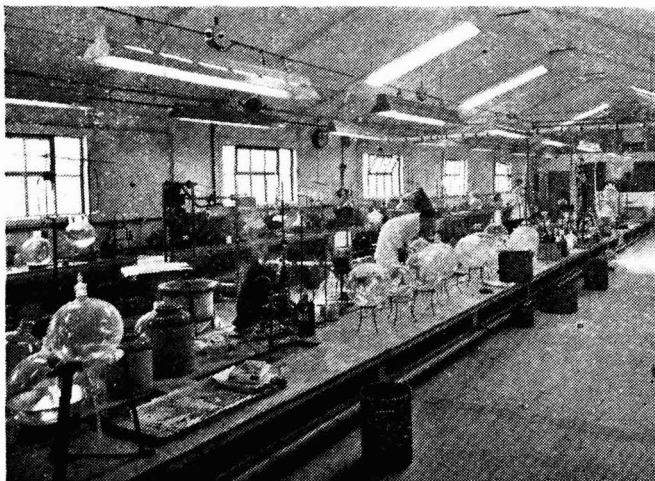
L. Light & Company began in the Grays Inn Road in 1935 as a concern which provided unusual reagents in small quantities for academic research purposes; when business improved they transferred to premises in High Holborn, and moved from there—fortunately, it transpired, for the building was afterwards bombed—to a site at Wraysbury. Here they undertook the manufacture of very small quantities of specialised drugs, such as choline chloride, stilbestrol, gold salts and German drugs unobtainable because of the war, and received a number of Government contracts for photographic chemicals, most of which were made literally in the back garden, in an autoclave sunk into a hole in the ground.

When the war ended the company had made a name for itself, and managed to weather the ensuing two years. In 1948 the laboratory was completely burnt out; Light's rebuilt it with their own labour, and at the

same time looked out for another suitable site. Eventually they founded an estate at Colnbrook, where, largely by their own efforts, they erected a second laboratory of 16,500 sq. ft. and still have room for considerable expansion. They are justly very proud of the fact that, not only did they design and build much of the premises themselves, but also some of the furniture and fittings.

The expansion of business has proceeded very rapidly: between 1947 and 1952 the turnover increased five times and the proportion of total business concerned with export has risen from 27 per cent to 60 per cent. In 1947 the number of items in the catalogue was under 1,000; the 1953 list contains 2,500 and in the few months since its publication a further 95 have been added.

Light's continually stress the point that their interest is in the provision of research quantities of rare chemicals; they themselves make about 500 preparations a year of otherwise unobtainable substances, but directly these become available from another source, they cease manufacture and purchase for their stock requirements. Their aim is to obtain as wide a collection of chemicals as possible, by exchange or purchase from research establishments, by purchase of new intermediates from manufacturers, and by obtaining raw materials from all over the world. Among the



*The laboratory at Light's, showing some of the large-scale glass apparatus*

many interesting things which arrive regularly from every corner of the earth are the Chinese toad poisons from Japan, sinobufarin and bufotalin, and Ti plant from Hawaii, from which a rare glycoside is extracted.

On the manufacturing side, Light's claim to have been the first in Great Britain to manufacture stilbœstrol, thioglycollic acid and such drugs as synthalin and adenosine. In recent years they have synthesised a number of carcinogenic substances, including 20-methyl cholanthrene and 9,10-dimethyl-1,2-benzanthracene, and during the last six months 3 kg. of one of these, together with 150 gm. of benzpyrene, were prepared at a total cost of £7,000.

The laboratory plant has been designed for ready adaptability: all preparations are carried out in glass vessels of 20-100 litre capacity—except those requiring the use of autoclaves and stainless steel or 'Vitreosil' pots—and the instruments, such as recorders or Variac transformers, are left completely mobile. Steel scaffolding is used extensively in the erection of plant, and every set-up is designed specifically for the job in hand.

After the previous unfortunate experience at Wraysbury, the fire risk is kept to a minimum, and all benches are of concrete construction topped with sheet lead. Autoclaves are isolated in a reinforced room, and handled by remote control.

The establishments at Wraysbury and Colnbrook employ 50 persons, and have a total floor area so far of nearly 20,000 sq. ft. Light's have erected nearly the whole of this themselves, in two or three years, and almost entirely from their own capital. Business is still increasing, and they now have agents in most parts of the world. Dealings with the United States have been very difficult in the past, owing to the complex American tariff regulations. These, fortunately, are now being modified and business with the American market is rapidly increasing.

Let us hope that this company, who perform a double service both in making chemicals available for the research worker and in increasing, thereby, the possibilities of their subsequent commercial exploitation, will continue to be successful.

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## NPL Open Day

### Crystal Theory Agrees with Observation

THE National Physical Laboratory held its annual display of scientific apparatus and work on Friday 15 May. In addition to the now familiar displays in the wind tunnels, ship tanks, and high-voltage laboratory, there was an exhibition of historical instruments recalling the early work of the organisation. The accurate calibration of barometers which began at Kew Observatory in 1853 was represented by two standard barometers of that era and records of tests. A representative of the instruments available now, one century later, was the ACE Pilot Digital Computer. It has now been in operation for over a year carrying out calculations in mathematical physics to an accuracy of one part in 100,000,000. A new type of 'memory' has been devised consisting of a magnetic-surfaced drum rotating at high speed between small electromagnets.

The most striking example of the contribution to general scientific knowledge made by exact measurement has been in the field

of metal structure. For many years the NPL has been measuring the elastic and plastic properties of metals. While the results have been one of great value in the investigation of the crystalline structure of metals it was not possible to relate the imperfections of metal crystals visible under the microscope with those postulated in theories of plastic deformation.

This year however there was a demonstration of an apparatus for the study of one such imperfection which can be simply related to theory, the tilt boundary which is formed by the slight mis-orientation of adjacent portions of a single metal crystal. Specimens containing individual tilt boundaries have been prepared with metals such as zinc and subjected to shear while the imperfection was kept under observation. Mobility of the boundary was observed at shear stresses of the order known to cause glide in single crystals.

Among the other exhibits was an apparatus for the determination of the melting point of the reactive metal titanium, and instruments designed for the accurate measurement of radioisotopes.—J.R.M.

# I.C.I.'s Year of Difficulties

## Good Progress Made in Research and Development

**A**LTHOUGH the value of sales by Imperial Chemical Industries, Ltd. in the home market during 1952 was the highest in the history of the company, there was a slight fall in volume according to the directors' report which is to be presented at the annual meeting in London on 18 June.

The total value of consolidated sales to customers in 1952 was £276,300,000, compared with £262,800,000 in 1951. Direct exports reached the record figure of £62,000,000, an increase of seven per cent compared with the 1951 figure of £58,000,000.

Despite the increase in turnover, the manufacturing and trading profits are shown to be £10,070,295 less than the 1951 figure, the total being £28,234,168.

A sharp decline in industrial activity during the second and third quarters of the year was due to several causes.

The most important of these were the continued fall in the demand for certain consumer goods—which led to a recession in the textile industries and in other industries serving the retail trade—the import restrictions imposed by certain overseas countries in their efforts to balance their overseas payments, the tendency throughout industry to reduce stocks, and the temporary dislocation of some industries while reorganising for rearmament work.

This resulted in a fall in the demand for some of the company's products, but there was a general improvement towards the end of the year as consumer demand increased and firms completed their stock reduction programmes.

### Value of Sales Increased

The value of the company's sales during the last three months of 1952 was slightly greater than for the comparable period in 1951.

Difficulties formerly met in obtaining adequate supplies of raw materials diminished during the year. The upward trend in commodity prices was halted and in some cases prices fell appreciably.

Decontrol of many materials simplified the task of obtaining supplies, but shortages of steel, metallurgical coke and certain capital equipment still caused difficulty.

For the first time since the war, supplies of most products were freely available for export, but after the first quarter of 1952 full advantage could not be taken of the situation because of restrictions on imports or on exchange in many important markets, notably Australia, India, Argentina and Brazil.

It was mainly the revival of Far Eastern trade in alkali and fertilisers in the second half of the year which enabled the company to end the year with record export figures.

Exports to the dollar area countries amounted to £4,400,000, compared with £4,755,000 in 1951. Additional dollars were earned by shipments to other countries for payment in dollars.

### Other Difficulties

The world-wide recession in textiles also reduced the overseas demand for dyestuffs and other chemicals and towards the end of the year currency difficulties in Brazil and Argentina almost closed those important markets to the company's alkali exports.

Competition from Germany and Japan was severe during the year in a number of products and European producers also competed strenuously, particularly for USA Government fertiliser tenders.

The company had continued to devote much effort to engineering standardisation, and this was already leading to substantial benefits. In the drive for higher productive efficiency, the rate of development and application of work study techniques was increased. The work-study departments now had a staff of 916.

Principal activity in this field was the improvement of operation of existing plants, but attention had also been given to the application of work study techniques to chemical plant design.

The development of process control and the use of improved and new measuring equipment had received continued attention. This had made a valuable contribution to the increase of plant efficiency by improved stability and consistency of operation.

Under the heading of 'Research and Development,' the report refers to studies

of polymers, which have given fresh insight into the relation between their physical properties and molecular structure. This work, together with other related background studies, was leading to greater certainty in the prediction of the properties of new polymers from a knowledge of their chemical constitution.

Considerable progress had been made in the application of physical methods to the routine analytical control of plant processes. In particular, the installation of a mass spectrometer at Wilton for the routine analysis of hydrocarbon gases made in the 'cracking' plant had greatly increased the speed of analysis and resulted in a considerable saving in manpower.

New methods of analysis of paint components and products had been devised, making full use of the newer physical techniques.

The Metal Division creep test station at Birmingham, opened by the President of the Royal Society in January, 1952, was enabling much valuable data to be obtained relating both to the company's products and to the materials used in the construction of the company's plants.

Certain halonitrobenzenes had been found to be promising as fungicides for the protection of timber and other materials against moulds and rot.

### Billingham Extension

As a further step towards the full use of all the materials that the Wilton olefine plant could provide, the carbonylation plant at Billingham had been extended to make butanols from propylene, and the plant for the production of *isopropanol* had been brought into service.

The project for making long-chain alcohols for the detergent industry had made good progress.

The range of products from the alkylamines plant which was brought into service early in the year was being steadily extended, and further progress had also been made in establishing uses for products arising from the manufacture of phenol.

Work on the production of sulphur and sulphur dioxide by the desulphurisation of anhydrite in a vertical retort had given promising results on the laboratory scale, and it had been decided to proceed with the erection of a prototype full-scale retort.

Substantial progress had been made in

the search for new and more effective anti-oxidants, and pioneer plants had been started up to make the petrol inhibitor 'Topanol' M. required for the stabilisation of 'cracked' petrols, and to make the oil antioxidant 'Topanol' O.

Arising from the strong trend towards the use of paints comprising synthetic resins in the form of a water emulsion, new paints of this type had been formulated and research work was continuing in order to provide new products for a wider range of applications.

Advances had been made in the formulation of under-water paints for ships.

### Pioneer Plants

A pioneer plant erected by the Nobel Division for the manufacture of glycerine by fermentation of molasses was now in operation and was providing data for a proper examination of the technical and economical aspects of large-scale production.

Also during the year a pioneer plant for polytetrafluoroethylene came into commission. This polymer was relatively expensive to produce but was resistant to most chemicals and combined good electrical properties with a high softening point.

A new copolymer based on polyvinyl chloride, specially designed for the manufacture of long-playing gramophone records, had been developed and successfully put into production.

Good progress had been made in the development of copolymers based on butadiene for use in the production of hard-wearing shoe-soling materials.

For the past two years the company had been making special lubricants based on fluorine compounds. These lubricants had a very high resistance to chemicals and trials in the company's works had shown that for these uses the savings more than compensated for the present high cost of the lubricants.

Study of all stages in the manufacture of 'Terylene' fibre continued throughout the year to ensure sound design and satisfactory operation of the full-scale plant which was being built at Wilton. The existing pilot plant made a substantially increased quantity of 'Terylene' yarn of marketable quality, and production of staple fibre was started in the middle of the year and increased rapidly.

In addition to its use for fibre, the polymer

from which 'Terylene' was made also showed great promise as a film-forming material. To obtain the best properties, the film had to be stretched simultaneously both lengthwise and crosswise. This presented considerable engineering difficulties, but small samples of satisfactory film, possessing exceptionally high strength, had already been produced and a pioneer plant was nearing completion.

In the industrial field the development of fire-resistant conveyor belting and other textile materials was being actively pursued.

The large amount of coated fabric normally employed in railway coach construction was now being replaced by new fabrics based on polyvinyl chloride, which maintained the decorative function of those previously used, but minimised the spread of fire.

A material had been developed for use as a suit to protect workers who had to operate close to open furnaces or fires. Combining the high heat-reflecting power of polished metal with the flexibility necessary for clothing, this material had been remarkably successful in tests.

Research on the production and properties of wrought titanium metal had been continued by the General Chemicals and Metals Division, and good progress had been made.

#### **Titanium Metal in Sponge Form**

A plant was being erected to produce 100 tons of wrought titanium metal a year. This would provide sufficient material for prototype applications by customers in the engineering and aircraft industries. Moreover, active consideration was being given to the design and construction of a much larger plant, to produce annually 1,500 tons of titanium metal in sponge form and to convert this by melting to massive metal.

The Metals Division had devoted much attention to the welding, brazing and soldering of aluminium and its alloys, and important practical results had been obtained.

A notable development in the field of chemotherapy had been the introduction by Imperial Chemical (Pharmaceuticals) Ltd., of the new drug 'Mysoline' for the treatment of epilepsy.

In a review of the work of the divisions, the report states that sales of alkalis in the home trade were 15 per cent lower by value than in 1951, which was the busiest year

recorded in the history of the industry. Business in the home trade reflected the reduced activities of consuming industries, notably the rayon industry, during the spring and summer, and also the tendency to recovery in the autumn.

Export sales of alkalis were high in the first few months of the year when overseas consumers were still anxious to build up stocks. This was soon accomplished and demand then fell to about 70 per cent of the 1951 level. Exports were also adversely affected by the serious exchange problems, particularly in the important markets of Brazil and Argentina.

As a result of the reduced demand for sulphuric acid during the greater part of the year, the effect of the sulphur shortage was not so pronounced as in 1951.

#### **Sulphur Plants Converted**

Continued progress was made in the conversion of sulphur-burning plants to use alternative raw materials in order to meet the possible effects of future reductions in sulphur supplies.

Extensions were completed at Cassel Works, Billingham, to give additional production of sodium and chlorine by the modern process of electrolysis of molten salt.

There was continued interest in the development of new fluorine compounds and the General Chemicals Division had made commercial supplies of chlorine trifluoride available to investigators requiring supplies of fluorine reagents for use in organic and inorganic fluorination processes.

Progress was made during the year with the General Chemicals Division's extensive post-war capital construction programme, and among projects completed was a 13-mile pipeline to transport by-product lime slurry from the Castner-Kellner works at Runcorn to a works near Northwich.

#### **Indian Mica Exports**

The Indian Government is examining a suggestion for the creation of a central organisation for taking over export operations in regard to mica. Announcing this to the House of the People recently, the Minister for Commerce and Industry, Mr. T. T. Krishnamachari, added that omitting the 1951-52 period of stockpiling, when there was an unusual rush to obtain supplies, the overall level of mica exports had been fairly well maintained.

# Shrinkage of Wool

## New Australian Treatment Prevents Felting

A SHRINK-PROOFING process for woollen fabrics which has no detrimental effect upon any of the natural qualities of wool has been perfected by wool textile scientists of the Australian Government's Commonwealth Scientific and Industrial Research Organisation after four years of research.

Scientists have for many years known that continued shrinkage of a woollen garment is caused not by contraction of the wool fibres, but by a fabric consolidation known as 'felting.' Wool fibres, when initially woven or knitted into a fabric, can readily extend within the mesh to provide the fabric with elasticity or stretch; felted fibres seize, the individual strands that can no longer move against each other pack more closely together, and the fabric consequently suffers an overall shrinkage. The felting is caused by the presence of microscopic scales on the surface of each strand of wool-scales which allow the fabrics to move in one direction only and which, with continued friction, cause a migration of the fibres and the ultimate felting-shrinkage.

Among the widely used agents that have been used for modifying the scale structure were chlorine and even caustic soda. Recent processes on the other hand have tended to leave the scale structure unchanged, and have aimed instead at covering it with synthetic resins. It was found that a deposit of resin on the fibre surface had the effect of apparently binding together adjacent fibres in the fabric, and virtually 'spot-welding' each fibre-junction, so that the fibres could no longer migrate when rubbed together and thus produce felting-shrinkage of the fabric. The resin processes explored however had disadvantages for a variety of reasons.

Four years ago in CSIRO's Wool Textile Research Laboratory at Belmont, a suburb of Geelong, two scientists began work on a new method of scale resination. After considerable experimentation they finally obtained the perfect resin from scrap nylon, which in the new Belmont process is converted to a form which becomes soluble in methylated spirits. After treatment in this solution, the woollen fabric is immersed in

acid, which regenerates the polymer as a surface deposit on the fibre-scales.

Economics were important and laboratory methods had to be modified to suit industrial conditions. Wools vary greatly in quality, and the experiments were continued over a four-year period to ensure that the treatment was effective on each specific quality and type of wool and fabric used commercially. Continued refinement of the process has now produced an industrially simple method of shrink-proofing woollen socks by the use of only three pounds of polymer to 100 of wool—much smaller ratio of resin than was required in any of the earlier processes. The additional weight to the woollen fabric, a bare 3 per cent, is not noticeable, nor is there any detrimental effect to the natural qualities of wool.

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## Canadian Industries, Ltd.

AMONG new products introduced recently by Canadian Industries, Ltd., are a small parts and carburettor cleaner, an improved chlorinated rubber finish, a fuel oil additive and a British vat dyestuff.

The small parts and carburettor cleaner is designed for the quick and safe removal of grease, dirt, sludge, carbon, polymerised oil and gasoline, and ethyl stains from small automobile parts such as carburettors and fuel pumps.

The improved chlorinated rubber finish is said to be resistant to acids, alkalis and other chemicals and is expected to be widely used in chemical plants, pulp and paper mills, commercial laundries and other industrial establishments. Developed by the Paint and Varnish Division, the product is marketed under the trade name 'Vitakote.'

The new fuel oil additive acts as a dispersant and stabiliser for distillate fuel oils. It is being marketed under the name 'Du Pont Fuel Oil Additive No. 2.'

The new vat dyestuff, Caledon Printing Brown 4R, gives attractive red-brown shades capable of being built up to rich, dark red-browns and has features of importance to printers of high quality cottons, linens and rayons. It is being marketed by the Chemicals Department.

# Match Industry in the UK

## Monopoly Against the Public Interest

THE system under which the supply and export of matches and the supply of match-making machinery operates in the United Kingdom forms a complete and integrated monopoly which, as a whole, operates against the public interest. This was the conclusion of the Monopolies and Restrictive Practices Commission, whose report was recently published (HMSO 4s. 6d.).

The Commission bases its conclusion on the following main grounds:—

(i) The absence of competition between manufacturers with the UK and between the UK manufacturers and principal importers to this market has resulted in profits and prices being higher than they would otherwise have been.

(ii) Development of competition by independent British manufacturers has been hampered by:

(a) Their being unable to buy machinery from manufacturers controlled by Swedish Match—the main source of supply in Europe—as they are in consequence of the agreements between the British Match Corporation Ltd. (BMC) and Swedish Match;

(b) The practice sometimes adopted by BMC of temporarily underselling competitors in particular areas while maintaining the general level of its prices; and

(c) The BMC practice of charging competitors higher prices for certain materials distributed under its control.

(iii) Subject to the limitations imposed by the withdrawal in March, 1952, of the Open General Licence for the import of matches, the decision as to what proportion of the UK market for matches is to be supplied from home manufacture and what proportion from imports rests, in effect, with the BMC.

(iv) Payments are made to Swedish Match as a method of reducing supplies of foreign matches to Britain.

### Supervision Necessary

In its recommendations the Commission urges that the Government should assume for the future a definite and continuing responsibility for the supervision of the costs and prices of manufacturers, importers and

distributors of matches. Such supervision should be a great deal stricter than the price control which was exercised by the Board of Trade during and after the war. Maximum prices should be fixed for both home-produced and imported matches at all stages of distribution.

It is also recommended that:—

(a) The prices charged for materials by companies controlled by BMC should be the same to all United Kingdom match manufacturers, subject only to a reasonable extra charge for purchases in small quantities, which should also be uniform for all buyers;

(b) The modifications of the present arrangements of the BMC with regard to trading agreements both in the British Isles and overseas which it has stated it is prepared to make, should be carried out.

### Board of Trade & Agreements

Finally, it is recommended that full details of changes in existing agreements and in the financial relationships between match manufacturers and match importers in Britain, and between them and match manufacturers or exporters in overseas countries, and any new agreements, formal or informal, between such parties, should be lodged with the Board of Trade. The Board, it is advised, should receive copies of the annual statements of settlement between BMC and Swedish Match showing the proportion of supplies made to the home market by each company and the compensation incurred.

The statement made by BMC that it is now making more of its machinery in Britain is welcomed, as also is its decision to increase the amount of work done on improving and modifying British machines. The obligation to notify the Board of Trade in the event of any new agreement or change in existing agreements or financial arrangements should also apply in the case of match-making machinery.

Further points are: First that the payments made by BMC to Swedish Match as BMC's contribution towards the sum paid to a Finnish company to cease supplying machinery should end and no further agreements of this kind should be

entered into. Second, the offer made by BMC to release Swedish Match from its undertaking not to manufacture match-making machinery in the UK should be accepted.

Formation of the British Match Corporation in 1927 is claimed to have 'brought about the fullest exchange of technical knowledge between The Swedish Match Company and the British factories, the pooling of research activities and the production of new machinery' and that 'except during the war years the closest co-operation has been maintained on the technical side.'

From evidence submitted to the Commission it would appear that the exchange of technical information between Swedish Match and BMC has in practice generally related to the development of match-making machinery rather than to the introduction of fundamental modifications to the match itself.

#### Re-ignitable Matches

In some Continental countries over the past 20 years research has been carried out to discover a substitute for the ordinary match which could be ignited by friction in the normal way, extinguished, and re-ignited a number of times.

Claims have been made that such matches, which have generally been in the form of a rod with a central igniting core inside a combustible mass containing methaldehyde, could be re-ignited as many as 600 times. BMC, however, regards such claims as exaggerated.

There have been three main groups of patents covering re-ignitable matches, resulting respectively from the researches of the Austrian Dr. Ringer, the Hungarians Dr. Földi and Mr. König and their associates, and Swedish Match. The inventions developed by the three groups were in many ways similar and according to BMC some features 'were more or less universal, and they were not patentable.' All three groups made applications for patent rights in many countries of the world, including Great Britain, between 1929 and 1934. Dr. Ringer met opposition in many cases from Swedish Match and his British patent applications in 1929 and 1930 were, at the suggestion of Swedish Match, contested by Brymay, but unsuccessfully.

In 1931 Swedish Match knew about Ringer's 'so-called' invention and was of the opinion that it was entirely useless, being

difficult both to light and to extinguish, and after tests at the State laboratories application for a Swedish patent was turned down.

Between 1931 and 1936 Swedish Match opposed patent applications in various countries and subsequently purchased Dr. Ringer's patent rights for a sum not exceeding the amount which it would have cost the company to pursue its policy of patent opposition.

To test the re-ignitable match in the UK some matches were made in Masters' factory in 1936 with laboratory apparatus loaned by Swedish Match, with a Swedish technician in charge of installation and production.

Some 8,700 re-ignitable matches were produced and offered for sale as 'ignition rods.' About 2,500 were sold, but in many cases the rods were returned with complaints and adverse comment. None of the big stores could be interested in the article and the balance unsold is still in stock.

Since 1942 four further applications for British patents covering re-ignitable matches have been granted.

According to a statement by Swedish Match that company has since 1930 'been occupied with the solution of the problem of the "everlasting" match in its own laboratories' and up to 31 December 1949, it incurred expenses to a total of Swedish Kroner 105,496; the company 'has . . . attempted without success to produce an article which is a commercial proposition.' Under the 1935 agreement between Brymay and Swedish Match, Brymay had paid to the Swedish company a total of £7,586 up to February, 1950.

#### Patents Lapsed

By February 1952 in the opinion of Swedish Match the small number of re-ignitable match patents held by it which were still in force were then 'of very little value.' After consultation with Brymay, Swedish Match has since suspended all payments of renewal fees and the 1935 agreement between the companies is now terminated.

The two main problems of the re-ignitable match appear to be the difficulty of arriving at a satisfactory composition and the danger of manufacture. The re-ignitable matches produced by BMC gave off an objectionable smell while in addition it has not proved possible to produce matches of this type at prices to compete with the ordinary match or with mechanical lighters.



# British Oxygen Company

## Chairman's Encouraging Review at Annual General Meeting

**L**ARGER sales in all departments and increased consolidated profit were reported at the annual general meeting of the British Oxygen Company, Ltd., on 14 May, by the chairman, Mr. J. S. Hutchison.

The year 1952, he said, benefited from an unusual coincidence of favourable circumstances resulting in an increase of consolidated profit, after depreciation, of £732,000. This increase was composed firstly of profit accruing directly from development work of recent years; secondly, of materially improved profits of overseas and home associated companies; and thirdly, and to a less extent, of increased earnings from home business where a satisfactory and steady increase in sales helped to offset increased costs and still give modest additional profit.

The special impact of taxation on rising profits was heavily felt with an increased charge of £493,000, and after allowing for outside interests, the consolidated net profit was increased by only £169,000.

Of the year's profit, £366,000 had been left in the hands of subsidiary companies—an increase of £72,000 compared with the previous year; £250,000 had again been placed to general reserve; and the ordinary dividend payments required an additional £161,000, leaving undistributed profit of the parent company to be carried forward amounting to £483,000, which was about £36,000 more than the amount brought in.

### Sudden Flood of Supply

Dealing with the company's activities during the past year, Mr. Hutchison said the scarcities of chemical and other raw materials, together with difficulties of obtaining light engineering products which existed in full measure in the early part of 1952, were overtaken with phenomenal rapidity towards the end of the year by a sudden flood of supply.

This arose from a combination of factors. On the one hand supplies were increased through slackening of stockpiling by Governments and through cumulative operation of the forces of natural correction of scarcity. On the other hand consumer demand was retarded by the growing effect of the compulsive financial and other mea-

asures adopted by the Government early in the year. The resultant rapid change was reflected in the 31 December figures for stocks and work-in-progress which were now being restored to more normal levels in the ordinary course.

An increase in sales was general to all departments, was above anticipation and was of a very steady and gratifying nature. Despite further heavy increases in costs affecting the whole of the company's output, and largely as the result of operating steadily at full load, they had emerged with a margin of additional profit on home trading, although the margin was not proportionate to the additional output.

### Planning Well Justified

The company's confident early planning of large new plant installations and works now in operation, about to come into operation, or still in an early stage of construction, was felt to be well justified. In fact, had the company not gone ahead a year or two ago when the outlook was less certain they would not have been able to meet the high demands made upon them in recent months.

Mr. Hutchison, remarking that he had been speaking so far mainly of the company's home business in oxygen and dissolved acetylene, added that they had also had satisfactory increases in the sales of other gases, including a notable development in the use of argon for welding non-ferrous metals and certain alloy steels which could not easily be welded in other ways. There was great interest in industry today in the fabrication of high-duty alloys and the company believed that the present expansion of the argon processes would continue.

Through their research and technical departments they were now reaping to a steadily increasing degree the benefit of much basic work carried out in previous years. A great deal of attention continued to be given to fundamental technical investigation of the problems affecting their main lines of business where the field was very wide and their difficulty was much more to select priorities than to find things to do.

On the chemicals side the teething

troubles of the rather complex process for the manufacture of dicyandiamide and the subsequent manufacture of melamine had been successfully overcome by the research officials concerned. The coming into operation of that plant coincided with the recent decline of activity in the plastics industry, which was the main outlet for melamine, but he was glad to say there was now a steadily growing improvement. Other developments in the company's own province of the chemical field were coming along satisfactorily without there being anything deserving of particular remark at the present juncture.

The application of process oxygen in the basic production of primary materials continued to find enlarged and novel fields in the metallurgical and chemical industries. Moreover, in the iron and steel industry today there was regular use of large quantities of oxygen in iron and steel production, as well as for the more familiar uses for finishing steel and its subsequent fabrication. There was keen interest throughout industry in the new basic use of process oxygen and through the company's team of experienced specialists and their research groups they

devoted great attention to the extensive prospect before them in their sphere.

Large-scale or 'tonnage' oxygen producing plants were a further development in certain cases where quantities required were unusually large or where the entire project was on an unusual scale. Such plants were now figuring prominently in the company's development and manufacturing programmes.

They were favourably placed in respect to such plants as a result of their long practical experience in the manufacturing and handling of gas separation plants at all descriptions, and through their strength of engineering specialists and research and design staffs. A number of industrial projects in various parts of the world with which the company was in touch would require 'tonnage' plants and were nearing the stage of final decision and practical execution.

The company had a propitious year overseas in 1952 in that the total of their profits from overseas sources increased materially and almost every unit, large or small, contributed to the increase.

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## Sulphur Solidification

### New Apparatus Reduces Costs

WHAT is considered to be the first major improvement in sulphur solidification since Frasch developed his sulphur mining process 50 years ago is revealed in the May, 1953, issue of *Chemical Engineering Progress*, news publication of the American Institute of Chemical Engineers. The new technique, which avoids the dangers and reduces the cost of the conventional method is described by Seymour Schwartz of S. Schwartz & Associates, New York, consulting engineers specialising in the sulphur-chemical industry.

The method, tested by almost two years of continuous operation, utilises a patented water-borne belt conveyer designed by the Sandvik Steel Corporation of New York City.

In this new process a continuous stream of molten sulphur is poured on to a horizontal steel conveyor belt 32 in. wide by 184 ft. long between pulley centres. The belt is fabricated of special stainless steel imported from Sandviken, Sweden. Narrow

rubber edging holds a pool of liquid sulphur on the upper strand of the belt which in turn drags along the top of shallow tanks from which cooling water overflows. The belt, in effect, floats on the overflowing water and in so doing cools and solidifies the sulphur pool. A ribbon of solid sulphur separates from the belt at the discharge end and is broken into glass-like chips of sulphur about 5/16th in. thick by 3 to 4 in. on a side.

In the conventional method molten sulphur is pumped into a shallow enclosure formed by temporary walls and allowed to harden. When the form is filled the walls are raised and additional sulphur pumped in until a monolithic block is formed, 30 ft. wide by 60 or more feet long and 30-45 ft. high. This block must be drilled, blasted and crushed to 2-3 in. lumps before the sulphur can be loaded for shipment.

In the report, Mr. Schwartz estimates the cost of solidifying 240 tons of sulphur per day at 29 cents per ton using the Sandvik solidifier. This compares with 60 to 90 cents per ton using the 'vat' storage-blasting technique.

# The Chemist's Bookshelf

**CHEMICAL PROCESSING OF WOOD.** By A. J. Stamm and E. E. Harris. Chemical Publishing Co., Inc., New York. 1953. Pp. x + 595. \$12.

The chemical utilisation of wood is an important branch of chemical industry in many countries, leading not only to the production of modified woods, wood base plastics, pulp and paper but also of cellulose and its derivatives, wood extractives and important products of hydrolysis of wood. The aim of this book, written by two well-known experts of the US Department of Agriculture Forest Products Laboratory, is to assemble all the available information on chemical processing of wood, particularly wood residues and inferior woods.

As a preliminary to the later consideration of industrial processes, about one-third of the book is devoted to the chemistry and physics of wood, including a fairly detailed consideration of the constituents, particularly lignin, and their chemical reactions. The effects of various environmental conditions such as air, light, heat and water are discussed and the structure, surface properties and results of mechanical and thermal treatments considered.

A further third is concerned with the production of modified wood and wood pulp products, including preservative, fire-retardant, antishrink, heat and surface treatments. Methods of treating wood with synthetic resins and the compression, assembly and cure of such treated woods are considered in some detail as are processes involved in the production of wood-base plastics, boards, pulp, paper, pulp-boards and paper-base laminates.

The remainder of the book deals briefly with chemical products derived from wood, including chapters on cellulose derivatives, tree exudates, destructive distillation of wood and extractives such as essential oils and tannins. A chapter on the hydrolysis of wood gives an account of the production

of sugar, alcohol and other fermentation products. The hydrogenation of wood and wood products is also considered and the book concludes with a chapter on some miscellaneous products and applications of wood, including the production of oxalic acid and vanillin and the use of wood and lignin in storage batteries, concrete, etc.

A critical attitude is maintained throughout and the economics of processes considered. In view of the wide field covered, treatment is necessarily brief in certain cases. While this is offset in general by the large number of references cited few references to work later than 1948 appear to be included. It is surprising to find no account of the production of carboxymethyl cellulose from wood. The account of the production of cellulose nitrate rayon might well have been omitted since this process is no longer used. The high compression of water absorbed by cellulose and wood, as stated on page 129, is no longer generally accepted. In spite of such errors and omissions the book is likely to provide much of interest to those engaged upon or interested in the many aspects of chemical utilisation of wood.—W.R.M.

**FENTON'S NOTES ON QUALITATIVE ANALYSIS.** New edition. Edited by B. C. Saunders. Cambridge University Press, London. 1953. Pp. 126. 15s.

There has long been a great need in this country for a good text book on qualitative analysis, the best texts on this subject being produced in America. The author has missed a wonderful opportunity to remedy this need and has done Fenton a grave injustice by allowing this book to reach yet another edition. The reviewer has considerable doubt as to whether the book is even suitable for candidates for the General Certificate of Education at the advanced and scholarship levels, but he is in complete agreement with the author's views that the main purpose of

qualitative analysis is that the student should gain a working knowledge of the ordinary reactions of chemical substances. In this respect the book could be useful but there are many larger texts available in this country which give a more comprehensive selection of chemical reactions.

The solubility products of nickel and cobalt sulphides are quoted (p. 73) as  $1.4 \times 10^{-24}$  and  $3 \times 10^{-26}$  respectively, which would indicate that these sulphides should precipitate in Group II. Why should cadmium sulphide be difficult to precipitate from hydrochloric acid solutions  $> 0.3N$  and lead sulphide cause no trouble when both have the same solubility products? A simple calculation based on the solubility product of cadmium sulphide would show that if 0.2 g. of  $Cd^{++}$  were dissolved in 10 ml. of  $11N$  hydrochloric acid, and hydrogen sulphide were passed through the solution, more than 95 per cent of the  $Cd^{++}$  would be precipitated. Some of the anomalies encountered in the precipitation of sulphides have been described by Belcher (*cf. J.R.I.C.*, 1949, lecture summary) and prospective authors of text books of qualitative analysis could consult this paper with advantage.

If a student were given a simple unknown such as a saturated solution of common salt, he would obtain a precipitate in Group I on addition of hydrochloric acid. The text does not mention this type of reaction or many others of a similar nature, all of which may baffle the beginner in qualitative analysis.

A teacher would have to be bold indeed to recommend the use of potassium cyanide for bringing certain refractory oxides into solution (p. 59), but it is refreshing to note that reference has been made to the solubility of silver halides in sodium thiosulphate solutions.

The reaction of chloroplatinic acid with  $K^{\bullet}$  has rightly been included in the reaction section, but should not have been given as a qualitative test for that element (p.100), as the reaction is not sensitive and the reagent is expensive. The cobaltinitrite test is by far the most sensitive reaction and the reagent is cheap, but in the text it finishes a poor third.

The qualitative tables are adequate but difficult to read because of the uncomfortably small and closely packed print. — A. J. NUTTEN.

THE SCIENCE OF PETROLEUM. Volume V, Part II—Synthetic Products of Petroleum. General Editors, B. T. Brooks and E. A. Dunstan. Oxford University Press, Geoffrey Cumberledge, London. 1953. Pp. 329 + x. £5.

The first four volumes of 'The Science of Petroleum' were published in 1937, and provided a comprehensive treatise of the principles and practice of the production, refining, transport and distribution of petroleum and its many products. Most of the chapters in these volumes covered the literature up to the year 1936. It was the editors' intention to provide additional volumes when necessary to bring up to date particular subjects. Volume V deals with the chemistry, physics and chemical engineering of petroleum and Part I of this volume appeared in 1950, dealing with crude oils. The present book, Part II, continues the account of developments in the chemistry and refining of petroleum from 1936 up to 1946, and is essentially a companion volume to Part I and not an extension of it. The editors state that Part III of Volume V, which they hope to publish in the near future, will bring the subject matter of Volume V up to date.

The book is divided into two main sections, the first dealing with the Synthetic Products and the second with Refinery Processes. Section I contains eight chapters dealing with 'Polymerisation of Hydrocarbons,' 'Catalytic Polymerisation of Olefines,' 'Polymers and Copolymers of Isobutylene,' 'Chemicals for Synthetic Rubbers,' 'Butadiene, Isoprene and Styrene,' 'The Manufacture of Organic Chemicals from the Hydrocarbons of Petroleum and Natural Gas,' 'The Nitro Alkanes,' 'Carbon Black,' and 'Surface Active Agents.'

Section II is divided into five parts with the following chapter headings:

(1) *Distillation*, Fractionating Column Design, The Commercial Separation of Light Hydrocarbons by Fractionation, Extractive and Azeotropic Distillation, Hypersorption Process, Petroleum Refinery Distillation.

(2) *Refinery Processes*, Caustic Methanol Process for Mercaptan Removal, The Use of Copper Salts in the Sweetening of Hydrocarbons, Recent Advances in Solvent Extraction and Dewaxing of Lubricating oils. Alloy Steels in Petroleum Refinery Service. Some Metallurgical Aspects of Refinery Steels, Toughness and Related Engineering

Problems in Pressure Vessels and Low Temperature Equipment.

(3) *Cracking*. Catalysis and Catalytic Processes in the Petroleum Industry, The Evaluation of Catalyst Microstructure and Composition by Physical Methods, The Houdry Fixed-Bed Catalytic Cracking Process, Airlift Thermofor Catalytic Cracking (T.C.C.), Fluid Catalytic Cracking.

(4) *Hydrogenation and Dehydrogenation*. Hydroforming, Catalytic Dehydrogenation of Hydrocarbons.

(5) *Alkylation*. The Chemistry of Sulphuric Acid Alkylation, The Alkylation of Hydrocarbons in the Presence of Hydrogen Fluoride, Aluminium Halide Catalysed Alkylations of Paraffins.

Each chapter is written by authors of the highest standing and presents an authoritative review of the literature on the particular subject up to the end of 1946. In some cases the subject matter represents processes new to the industry since 1937; in others the chapter brings up to date (i.e., up to 1946) subjects reviewed in the earlier volumes. Naturally development in certain subjects has far outstripped that in others and some processes which achieved considerable importance during the period 1937-1946 have since been replaced by new processes or modifications. The remarkable developments in the manufacture of petroleum chemicals has to some extent overshadowed the developments in the same field during the period which this volume reviews. Nevertheless, the chapters on the polymers of isobutene and on the production of butadiene, isoprene, and styrene contain much data of value today, while the chapter on carbon black is an extremely important contribution. The chapter on the nitro alkanes is also of considerable interest, but the commercial application of these compounds has not achieved the importance expected of them at the time of their development. In distillation progress has been somewhat less marked and the chapters in this section constitute a valuable source of reference for design and operating personnel. The processes described in the refinery processes section have all fulfilled their early promise, and have developed into important processes. These chapters thus constitute an important record of the early pilot and commercial plant data upon which current developments have been based.

It is the sections on cracking, etc., which

illustrate so clearly the phenomenal rate of development of the petroleum industry, which makes the task of the editors in maintaining these volumes up to date almost as difficult as that of the editors of 'Beilstein.' Of the processes described, the fixed-bed Houdry process has been replaced by the 'Houdrifiow' process, and the fluid cracking process has developed into the major catalytic cracking process with considerable modification in unit design and catalyst character. Catalytic reforming, which has achieved such remarkable success in recent years, is referred to only in the chapter on Hydroforming—in which the now almost obsolete fixed-bed process only is described. Nevertheless, these chapters constitute a valuable record of a period of intense development and research, in which the basis of modern reactor design was established and the fundamental characteristics of the cracking catalysts were first investigated.

If subsequent volumes can be published with less delay between the writing of the text and publication, so that they constitute an up-to-date record of developments in the industry, the editors will have achieved the original objective and will render a great service to the industry. The possibility of achieving this will to some extent depend upon the response of the public to the volume. This, together with the authoritative nature of the text, should ensure the volume of a ready sale for, despite the high price, it is a volume which no library can afford to be without and which almost every scientist in the industry would wish to possess.—FRANK MORTON.

SEMI-MICRO APPARATUS & TECHNIQUE. By H. Holness. Sir Isaac Pitman & Sons, Ltd., London. 1953. Pp. 19. 2s.

This little book embodies the substance of a lecture delivered by the author before the Science Masters' Association in London last Christmas, and describes the technique normally followed by students who are taking courses in inorganic qualitative analysis at the South-West Essex Technical College. There are a sufficient number of illustrations, mostly of the author's own apparatus, and the book is suitable as a first introduction for those to whom this is an unfamiliar technique, since it continually stresses the simplicity of the methods.—B.I.

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# HOME

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## Detergent Experiments

The first of three large-scale experiments to determine whether detergents are detrimental to sewage purification was recently completed at Wolverhampton, the effects of the main type of soap substitute used in industry being investigated. Mr. J. Hurley, manager of the sewage disposal department, stated: 'I think the experiment has proved that we have nothing to fear from this detergent as the ordinary processes of sewage treatment remove it quite readily from the sewage.' He added, however, that tests of two other main types of soap substitutes had so far indicated that they were not so easily treated.

## Glasgow Productivity Committee

A productivity committee to distribute worthwhile information to industry has been formed in Glasgow. Among those appointed to the committee are: Mr. John Murray (Mirrlees Watson Company, Ltd.), chairman; Mr. James Lambert (I.C.I., Nobel Division), vice-chairman; Mr. M. C. Kirkwood (A. Kirkwood, Ltd., Arden Lime Works, Nitshill) and Mr. J. Logan (Bull's Metal & Marine, Ltd.).

## School of Welding

The need of welding for increased productivity and economy in the major industries of the country was the keynote of the School of Welding recently held at Ashorne Hill, near Leamington Spa, by the British Welding Research Association. The number of students attending was 160.

## Toxic Chemicals in Agriculture

The Working Party under the chairmanship of Professor Zuckerman has completed the second stage of its inquiry, relating to possible risks to consumers arising from the use of toxic chemicals in agriculture and the storage of food. Professor Zuckerman has now been asked to extend the range of his investigation to possible risks to wild life. The Working Party has been reconstituted for this part of the investigation, and includes representatives of the Agricultural Departments, the Fisheries Departments, the Nature Conservancy, the Agricultural Improvement Council, the Agricultural Research Council and the Medical Research Council.

## Long Service Recognised

Long-service awards were presented recently to 44 I.C.I. employees on the Dye-stuffs Division headquarters staff from Hexagon House, Blackley, who have a total of more than 1,000 years' service. Mr. H. C. Depledge, assistant distribution manager, headed the list with 40 years' service. There were 17 employees with 30 years' service and 26 with 20. The presentations were made by Mr. R. A. Bankes, senior director.

## Instrument Technology

The annual general meeting of the Society of Instrument Technology Ltd. will be held at Manson House, Portland Place, London, W.1, on 26 May at 6 p.m. Following the meeting Mr. W. A. Goldstein will present a paper on 'The Instrumentation of Pilot and Experimental Scale Plant.'

## Technical Education

Speaking at the annual luncheon of the Midlands Section of the Plastics Institute last week, the chairman, Mr. D. W. H. Fletcher, said that the Birmingham civic authorities were giving 'great support' to the Institute's plans for technical education and to its efforts to maintain a high standard in its associateship award. Since examinations for the award were begun four years ago entrants had increased in number from seven to 33 last year.

## Potash Mining on North East Coast

In the House of Commons last week Sir L. Plummer asked the Minister of Materials what results have been obtained from the attempts begun in 1949 to mine potash on the North East coast. Sir A. Salter replied that exploratory work had been completed and the firms concerned were considering the mining engineers' reports. It was clear that the economic and technical problems involved required considerable study.

## DDT Best Mothproofer

In an address to the Wool Education Society recently, Mr. John Barritt, of the Wool Industries Research Association, stated that DDT is the most effective mothproofing substance. Wool is made mothproof when only 0.1 per cent of DDT is present, he said.

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# OVERSEAS

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## German Perlon Output

Output of Perlon in Western Germany during 1952 totalled 4,000 tons according to a statement made recently by Dr. Schlack. He added that output would be stepped up this year.

## Rhodesian Mineral Discovery

Pyrochlore, a mineral composed largely of the combined oxides of columbium and tantalum, has been found at Nkumbwa Hill in the Northern Province of Northern Rhodesia. The proportion of the two oxides in the mineral found is 73.46 per cent, almost 10 per cent more than the proportion recorded in other pyrochlore.

## Manganese Deposit

The Minister of French Overseas Territories has approved an arrangement between French mining companies and the United States Steel Company providing for research and mining of the manganese deposit in Gabon. This deposit contains 40-50 per cent manganese and is to be mined by open pit methods. Reserves are estimated at 50,000,000 tons.

## New Pyrites Plant

A \$175,000 sulphur-extracting plant at the Thunder Bay mill of the Abitibi Power and Paper Company has started operation. Abitibi president D. W. Ambridge announced recently. The opening of the mill coincided with his semi-annual inspection visit to the Lakehead area. Mr. Ambridge said the new plant will process iron pyrites from the Noranda district in Quebec to start with, but will later use pyrites from the Port Arthur area.

## Sindri Production

The Sindri fertiliser factory, which started production in March, 1952, is now producing at a rate of 965 tons of ammonium sulphate a day, against a target of 1,000 tons. It is planned to broaden the scope of the project by building a coke oven plant to produce 600 tons of coke a day, and a plant which will use the by-product of chalk sludge to make 600 tons of cement a day. The coke oven gases will be used to make urea.

## Chilean Copper

The Chilean Finance Minister is reported to have confirmed the Government's intention to maintain the present price of copper as long as the current 'stationary situation' in demand persists. The present price is 35½ cents (US) per pound f.o.b. Chilean ports.

## Carnauba Wax Decline

Carnauba wax exports, which represented 4.3 per cent of Brazil's overall exports in 1941, fell to less than 1 per cent in 1952. Figures for January-September show that only 6,311 tons, valued at Cr. \$189,000,000, were exported during this period, against 7,611 tons valued at Cr. \$252,000,000 in the same period of 1951.

## Atomic Power in Australia

Addressing a conference of electrical manufacturers on 4 May, Professor Marcus Oliphant, director of the School of Physics at the Australian National University, urged immediate action in co-operation with Great Britain to establish atomic energy power stations in Australia. He predicted that uranium power stations would eventually be followed by hydrogen power stations.

## Asbestos in Southern Rhodesia

A Canadian company is engaged in developing asbestos mines in the Fort Victoria area of Southern Rhodesia and it is hoped that full production will be reached in about 18 months. The value of the Colony's asbestos production has been increasing rapidly in recent years and in 1952 it reached a figure of £6,652,000, passing the gold production figure for the first time.

## Oil Refining Agreement

An agreement has been signed between the Indian Government and the Caltex Company of New York for the establishment of an oil refinery at Visakhapatnam, with a capacity to refine 500,000 tons of crude oil a year. The refinery will be owned and operated by an Indian company to be formed by Caltex and Indian investors will be able to subscribe up to 25 per cent of the share capital.

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# PERSONAL

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The chairman of Imperial Chemical Industries, MR. JOHN ROGERS, O.B.E., LL.D., has announced his intention of resigning from the board on 30 June. Mr. Rogers has been actively associated with the company and its predecessors for more than 54 years; he was a director of Nobel Industries, one of the four companies which merged in 1926 to form I.C.I., and was immediately appointed to the board of I.C.I. When he succeeded Lord McGowan in December, 1950, it was agreed that this was only to be a short term of office. Mr. Rogers was president of the Society of Chemical Industry 1951-2. The new chairman is to be DR. ALEXANDER FLECK, one of the deputy chairmen, who has been actively connected with the company and its predecessors since 1917. He was appointed to the board in 1944, and was elected a deputy chairman in 1950. He is the third Glaswegian in succession to become chairman.

MR. DOUGLAS D. STOKES, who has held a number of important positions with Monsanto Canada, Ltd., since joining the company in 1948, has now been appointed to fill the newly-created post of general sales manager. Mr. Stokes is well known in Britain as he was with Monsanto Chemicals, Ltd., from 1926 to 1939 and from 1945 to 1949. He was captured at Dunkirk while serving with the British Army and was a prisoner of war until 1945. Prior to his present appointment he was plant manager of the Canadian Company.

All seven retiring members of the Council of the Pharmaceutical Society of Great Britain have been returned to the seven vacancies on the Council. MR. T. HESELTINE, the Society's vice-president headed the poll with 4,988 votes. One of the two women among the 21 candidates, MISS MARY BURR, a Nottingham retail chemist, came third with 3,908 votes.

MR. R. T. FLEMING GUILD and MR. ERIC G. INGHAM, who have been elected directors of Salts (Saltaire), Ltd., have been actively associated with the management of the company for several years.

Among twelve distinguished people on whom the Princess Royal, as Chancellor of Leeds University, conferred honorary degrees last week, was PROFESSOR C. K. INGOLD, F.R.S., D.Sc., Ph.D., A.R.C.S., F.I.C., Professor of Chemistry, University of London, University College, and Director of Chemistry Laboratories. Professor Ingold was awarded the Davy Medal of the Royal Society in 1946 and the Longstaff Medal of the Chemical Society in 1951.

MR. A. D. BONHAM-CARTER and MR. J. F. VAN MOORSEL have been appointed members of the board of Unilever, Ltd., and MR. T. J. TWUNSTRA has been appointed an advisory member of the board of Unilever N.V.

MR. ALLEN STOCK, managing director of the Morgan Crucible Company, has been elected hon. treasurer of the London Chamber of Commerce.

The new committee of the Organic Finishing Group of the Institute of Metal Finishing, elected by ballot, is as follows:—MR. A. A. B. HARVEY (chairman), MR. J. T. N. ADCOCK (hon. secretary), MR. W. E. CATTLEY, MR. J. DIXON, MR. H. J. MASON, MR. S. J. SCOUSE, DR. W. STEIN, MR. R. L. YEATES, with MR. H. SILMAN and DR. S. WERNICK *ex officio*.

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## Obituary

### Sir T. Gavin Jones

The death occurred on 14 May, at the age of 80, of SIR TRACY FRENCH GAVIN JONES, founder and for many years managing director of the Cawnpore Chemical Works. Born in India in 1872, he was educated at Clifton and was then trained as a mechanical and mining engineer. He returned to India in 1896 and in 1898 founded the Cawnpore Engineering Company; he was with the British India Corporation from 1919 to 1924, and in 1928 founded the Cawnpore Chemical Works. He was for long a prominent member of the Chamber of Commerce of Upper India, and was elected president in 1921, 1922, 1934 and 1935.



# Publications & Announcements

A NEW section of the silver anniversary issue of 'Consulting Services, 1953,' published by the Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st Street, New York 17, NY, gives valuable information on rare laboratory equipment owned by members. The first section contains about 200 items of activity with the members specialising or qualifying in the given field indicated by key numbers, which correspond with the scope pages in the second section. The index is arranged alphabetically by members and by geographical location, which should be of value to people overseas seeking the services of a specialised USA consultant. One free copy of this directory is obtainable on application.

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FIRST four titles in a new series of monographs for students sponsored and published by the Institute of Physics are 'Practical Thermometry' and 'Fundamentals of Thermometry,' by J. A. Hall; and 'Soft Magnetic Materials used in Industry' and 'The Magnetic Circuit' by A. E. De Barr. The monographs are intended as general reading for students in Higher National Certificate in Applied Physics courses, or in the first two years of a degree course, and not as text-books to cover any special part of a syllabus. Further volumes are being commissioned in a uniform series, price 5s. each.

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EVERYONE interested in smoke abatement and the problems of air pollution will find the 1953 Year Book of the National Smoke Abatement Society an essential source of reference and up-to-date information. In addition to information about the Society, it gives factual notes on such matters as the law relating to smoke, the measurement of pollution and the work of various Government departments. There are also extracts on smoke abatement policy from the Simon and Ridley reports, a summary of the facts about the December fog, a handy directory of organisations, a bibliography of recent papers and reports, and a list of over 50 available publications on the subject. The Year Book can be obtained from the Society at Chandos House, Buckingham Gate, London, S.W.1 (1s. 2d. post paid).

THE first issue of a new journal devoted specifically to the science and application of photography has now been issued by the Royal Photographic Society of Great Britain. After the last war it was decided to divide the society's journal into two sections, A: General and pictorial; B, Scientific and technical. Paper control was, however, then in force and there was no question of starting a new journal. Control has now passed, and 1953, throughout which the society is celebrating its centenary, was chosen as an appropriate time to fulfil this delayed ambition. Entitled *The Journal of Photographic Science* (Section B of The Photographic Journal), the new publication will appear every two months on the first day of February, April, June, August, October and December. No. 1 contains three articles. The first is a report of the Seventh Renwick Memorial Lecture presented at Birmingham by Dr. W. F. Berg (Fellow) on 'Photographic Sensitivity and Chemical Sensitisation of Emulsions.' The other articles are 'Direct Observation of Solid Surfaces at High Resolution by Reflection Electron Microscopy,' by J. W. Menter (Research Laboratory for the Physics and Chemistry of Surfaces, Department of Physical Chemistry, University of Cambridge), and 'Fast Multiple Frame Photography,' by J. S. Courtney-Pratt, of the same laboratory and department of Cambridge University. Subscriptions and inquiries for the new journal should be sent to the publications manager, The Royal Photographic Society, 16 Princes Gate, London, S.W.7.

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'VACUUM,' Volume II, Number 2, for April 1952, has just been published. Contents include papers on 'A Bakable Evaporation Apparatus and Throughput Gauge' by Professor J. D. Strong, 'Vacuum Fusion Technique as Applied to the Analysis of Gases in Metals' by R. A. Yeaton, 'Leak Detection Practice with Particular Reference to the Hydrogen Palladium Method' by N. Ochert and W. Steckelmacher, and 'A Cylindrical Magnetron Ionisation Gauge' by A. H. Beck; correspondence and book reviews; and the regular classified abstracts.

THERE are many instances in industry where acid liquors should be heated electrically, such as pickling liquors and those used in metal plating processes. To avoid contamination of the solution as a result of attack on the heater envelope, it is essential that the sheath enclosing the electric heating unit should be acid-proof, in addition to being a good insulator and unaffected by extreme thermal shock. These properties are claimed for Vitreosil pure fused silica electric immersion heaters, which are described and illustrated in a leaflet obtainable from the manufacturers, The Thermal Syndicate Ltd., Wallsend, Northumberland.

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THE completion of 150 years of work and service by the engineering house founded by a distinguished engineer, Bryan Donkin, F.R.S., is marked by the publication of an extremely well produced book by the Bryan Donkin Company Ltd., Chesterfield. Donkin was contemporary with many famous British engineers, and although he made striking contributions to the craft his modesty and avoidance of personal publicity resulted in his work not being as widely known as it deserves to be. He built and perfected the first practical paper-making machine in the world; he invented the steel pen nib; and was the first to be successful in preserving food and fruit by canning. His pioneer work in making the mercury tachometer and the early revolution counter was followed by developments in water wheels and other aids to increased production. The extensive contributions to the efficient operation of the gas industry by the company he founded are well known.

\* \* \*

VOLUME 5, No. 4, of 'Chemische Industrie' (Dusseldorf) is devoted to German chemical trade-marks and trade-names. There are a number of articles on the use of trade-marks—and the problems involved—in such varied industries as dyestuffs, textiles, personal hygiene articles, plant protection products, timber and polishes, as well as general chemicals, and surveys of German international trade-mark legislation. There follows a comprehensive directory of proprietary names and marks in all branches of the German chemical industry and apparatus manufacture, an article on the Trade Mark Association, and surveys of international developments and patents.

THE control of humidity is of great importance in such establishments as tobacco warehouses, egg stores, textile factories and conditioning rooms, and to maintain control measurement of the humidity is essential. The fourth in the National Physical Laboratory's series of notes on applied science deals with this problem. 'Measurement of Humidity' is written for the non-specialist and contains no difficult technical details; it describes all types of hygrometers likely to be needed for both approximate and accurate determinations, and explains the principles on which they work. There are a number of diagrams and instructions on the calibration of the instruments. The booklet is published by HMSO for DSIR, price 1s.

\* \* \*

A NEW catalogue of isotopes, both radioactive and stable, produced by Oak Ridge National Laboratory, Oak Ridge, Tennessee, replaces a previous edition published by the Atomic Energy Commission in March 1951. Oak Ridge National Laboratory, which is operated for the AEC by Union Carbide and Carbon Corporation, is a prominent producer and distributor of radioisotopes and stable isotopes for use in medicine, agriculture, industry and science. More than 100 radioactive and 175 stable isotopes are listed in the new catalogue. Prices range from as low as \$5.00 per curie for radioactive cobalt (in large quantities) to \$5.00 a microcurie for radioactive chlorine. The catalogue—at \$1.00 per copy—or information about ORNL-produced radioisotopes, may be obtained by writing to Carbide and Carbon Chemicals Company, Oak Ridge National Laboratory, Radioisotopes Sales Department, Post Office Box P, Oak Ridge, Tennessee.

\* \* \*

THE detailed rules for the carriage of dangerous goods and explosives in ships, which are set out in Appendix A to the 'Report of the Departmental Committee on the Carriage of Dangerous Goods and Explosives in Ships, 1951,' need to be kept up to date in the light of current experience and to provide for the packing and stowage of new substances. Amendments Nos. 1, 2 and 3 were published on 7 May and can be obtained from H.M. Stationery Office, price 2d., 6d. and 4d. respectively. Further amendments will be published by HMSO from time to time.

# 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.)

THAWPIT, LTD., London, W., chemical manufacturers. (M., 23/5/53.) 13 April, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; charged on site at Hill Bottom Road, High Wycombe. £2,190. 30 November, 1952.

### Increases of Capital

The following increases of capital have been announced: ANCORITE LTD., from £100 to £10,000; COLGATE-PALMOLIVE-PEET, LTD., from £500,000 to £1,000,000; A. BOAKE, ROBERTS & COMPANY (MANUFACTURING), LTD., from £100 to £900,000.

## New Registrations

### Western Proofing Compounds Ltd.

Private company. (518,989.) Capital £100. Merchants and manufacturers of chemical preservatives, dressings, emulsions, compounds and allied products; merchants, blenders and distillers of oils, tar, pitch and bituminous products, etc. Directors: E. A. O'Neill and Mrs. I. Davies. Reg. office: 126 Paget Street, Cardiff.

### H. A. Mumford Ltd.

Private company. (518,761.) Capital £5,000. Manufacturers of and dealers in chemicals, gases, drugs, medicines, plaster of Paris, gypsum, plasters, disinfectants, fertilisers, etc. Subscribers: K. A. Wyndham-Kaye, C. Hoile. First directors are not named. Reg. office: Essex House, Essex Street, W.C.2.

### Penian Jones Chemist Ltd.

Private company. (519,028.) Capital £5,000. Manufacturing, wholesale, retail, consulting, research, analytical and dispensing chemists and druggists, etc. Directors: P. L. Jones, Mrs. S. M. Jones. Reg. office: 239 Farnham Road, Slough, Bucks.

### Gordon & Boyle Ltd.

Private company. (519,309.) Capital £1,000. Wholesale or retail consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: K. R. Boyle, Mrs. A. Boyle, C. J. Hoyle. Reg. office: 96/98 Holdenhurst Road, Bournemouth.

### De Vere Pharmaceuticals Ltd.

Private company. (519,211.) Capital £1,000. Manufacturers of and dealers in all kinds of pharmaceutical, toilet and chemical products, etc. Directors: D. M. Ambrose, G. J. Ambrose, E. S. Ambrose, H. S. De Wolfe, B. S. Spiers and S. Spiers. Reg. office: 21 Soho Square, W.1.

### C. Calvert (Chemists) Ltd.

Private company. (518,888.) Capital £3,000. Manufacturing, pharmaceutical, photographic and general chemists, etc. Directors: E. A. Calvert, M. Compton and E. D. Bisatt. Reg. office: 11 Manor Park Parade, Lee, S.E.13.

### Morris-Adams Ltd.

Private company. (519,645.) Capital £5,000. Manufacturers of and wholesale or retail dealers in chemical liquids. Subscribers: R. Morris-Adams, F. W. Palmer. First directors are not named. Reg. office: 36a Waterloo Street, Birmingham.

### Caltiu Ltd.

Private company. (519,458.) Capital £100. Manufacturers of and dealers in chemicals, etc. Subscribers: J. A. Taylor, M. S. Barber. First directors to be appointed by the subscribers. Reg. office: 6 Broad Street Place, E.C.2.

### Shaftesbury Chemical Co. Ltd.

Private company. (519,545.) Capital £100. Manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Subscribers: A. Grossman, and A. Grossman. Albert Grossman is the first director. Reg. office: 73 Piccadilly Mansions, 17 Shaftesbury Avenue, W.1.

## Market Reports

LONDON.—The demand for industrial chemicals during the past week on home and export account has been quietly steady, and the volume of new business has been reasonably good. Contract delivery specifications for the main consuming industries are keeping well up to schedule, but movements have not been outstanding. The general run of the potash and soda chemicals are in steady request and there has been an active interest in hydrogen peroxide, arsenic and formaldehyde. There has also been a good call for the solvents. In the market for coal tar products the home demand for creosote oil, cresylic acid and carbolic acid has been fairly steady, but export buying continues to be influenced by competitive conditions.

MANCHESTER.—The past week has seen a fair volume of new inquiry about for heavy chemicals on the Manchester market. The textile and allied trades in Lancashire and the West Riding have been reasonably prominent both as regards replacement buying and contract deliveries, while the export movement in the soda compounds and other leading lines has continued on a fair scale. For the most part prices have been steady. Fertiliser manufacturers are maintaining steady deliveries of the compounds and of sulphate of ammonia, but otherwise business is showing a seasonal tapering off. Among the tar products creosote oil and the light distillates are in steady request.

GLASGOW.—Although trading in the earlier part of the week for the usual run of general industrial chemicals was very slow, business has come away nicely in the last day or so and orders for forward delivery will ensure a steady output for the best part of next week. Business as a whole is inclined to be quiet but not unduly so. The export market remains steady with little change either way.

### Unemployment in Chemical Industry

Thirteen per cent of the industrial labour force in the chemical industry were discharged as redundant during 1952, and the number of unemployed in the industry, registered in January last, was more than 7,000, according to a statement made in Parliament by Mr. T. Driberg (Maldon).

### Ad Valorem Duty on H<sub>2</sub>SO<sub>4</sub>

The Board of Trade have announced that they have under consideration an application to restore the 10 per cent general *ad valorem* duty, under the Import Duties Act of 1932, on sulphuric acid:oleum which was removed on 24 May, 1951. Any representations which interested parties may desire to make in regard to this application should be addressed to the Board of Trade, Industries and Manufactures Department, Division 1, Horse Guards Avenue, Whitehall, London, S.W.1, not later than 5 June, 1953.

### NORTON & RIDING (YORKSHIRE) LTD.

*Chemical Plumbers & Leadburners*

On Ministry of Supply List  
Contractors to N.C.B.

LEAD-LINED TANKS, COILS and VATS  
SULPHURIC ACID PLANT  
HOMOGENEOUS LEAD LINING  
LEAD WORK FOR DYEWORKS and  
EXPLOSIVES

SATURATORS and BENZOLE WASHERS

<i>Reg. Office</i>	<i>Works</i>
66 Westfield Road, Heaton, BRADFORD.	New Works Road Low Moor, BRADFORD
Tel. : 42765 & 44868	

### CHARCOAL!

### CHARCOAL!

### CHARCOAL!

If interested we are manufacturers of  
WOOD STICK CHARCOAL

SEND YOUR ENQUIRIES TO:—

**BOYS & BODEN, LIMITED,**  
CHARCOAL MANUFACTURERS,  
WELSHPOOL

For Optimum Hardness and Strength

NITRIDED  
**NITRALLOY**  
STEEL

For all parts subject to frictional  
wear, fatigue or corrosion fatigue.

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# PERMUTIT

## ION EXCHANGE MATERIALS

Ion Exchange today performs many tasks in industry, and Permutit manufactures a wide range of these materials. Their application in roles distinct from water treatment has resulted in the development of numerous new industrial processes giving improved results and lower running costs. Some of the materials now available, with their characteristics, are shown below.

- |                     |   |                        |   |
|---------------------|---|------------------------|---|
| <b>ZEO-KARB</b>     | A sulphonated coal product containing both strong and weak acid groups. | <b>DE-ACIDITE E</b>    | A medium basicity high capacity anion exchange material.  |
| <b>ZEO-KARB 215</b> | A nuclear sulphonic acid resin containing also hydroxyl groups.         | <b>DE-ACIDITE FF</b>   | A very high basicity anion exchange material in bead form suitable for absorption of very weak acids.               |
| <b>ZEO-KARB 216</b> | A resin containing weak acid groups of the carboxyl type.               | <b>BIO-DEMINROLIT</b>  | A mixed cation and anion exchange resin of high stability for demineralisation in a single column.                  |
| <b>ZEO-KARB 315</b> | A sulphonic acid resin particularly stable up to 100°C.                 | <b>DECOLORITE</b>      | A resin of high porosity for removing colour from solutions.  |
| <b>ZEO-KARB 225</b> | A unifunctional, high capacity sulphonic resin in bead form.            | <b>RESIN MEMBRANES</b> | For special purposes, many of these materials can be supplied as membranes in the form of rods, discs and thimbles. |

With forty years' experience in the manufacture and operation of Ion Exchange materials, the Permutit organisation is continually developing new materials, and new methods of using them. Its Research Laboratory is ready always to co-operate in the solution of your problems.

## THE PERMUTIT COMPANY LIMITED

Dept. V.A. 150, Permutit House, Gunnersbury Ave., London, W.4. Tel.: CHIswick 6431

# 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.*

### AMENDED

**EXPERIMENTAL OFFICERS AND ASSISTANT EXPERIMENTAL OFFICERS** in various Government Departments. The Civil Service Commissioners invite applications for pensionable posts. Applications may be accepted up to December 31st, 1953, but an earlier closing date may be announced either for the competition as a whole or in one or more subjects. Interviews will generally be held shortly after the receipt of the completed application form.

The posts are divided between the following main groups and subjects:—(a) Mathematical and Physical Sciences; (b) Chemistry and Metallurgy; (c) Biological Sciences; (d) Engineering subjects; and (e) Miscellaneous (including e.g., Geology, Library and Technical Information Services).

**AGE LIMITS.** For Experimental Officers, at least 26 and under 31 on December 31st, 1953; for Assistant Experimental Officers at least 18 and under 28 on December 31st, 1953. Extension for regular service in H.M. Forces.

Candidates must have at least one of a number of specified qualifications. Examples are Higher School Certificate, General Certificate of Education, Scottish Leaving Certificate, Scottish Universities Preliminary Examination, Northern Ireland Senior Certificate (all in appropriate subjects and at appropriate levels), Higher National Certificate, University degree. Candidates taking their examinations in 1953 may be admitted. Candidates without such qualifications may be admitted exceptionally on evidence of suitable experience. In general a higher standard of qualification will be looked for in the older candidates than in the younger ones.

Inclusive London salary scales:—

Experimental Officer £681-£838 (men).

Assistant Experimental Officer £274-£607 (men).

Starting pay according to age up to 26. At 18, £274; at 26, £495 (men). Somewhat lower in provinces and for women.

Further particulars and application forms from **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S94-95/53. Completed application forms should be returned as soon as possible.

21283/176/EH/a.

**ASSISTANT ENGINEERS** required by **CHEMICAL ENGINEERING FIRM** in London. Qualifications required are: age up to 30; B.Sc., or equivalent; good knowledge of Physics and Heat Transfer essential; good Mathematics; understanding of Chemistry desirable; understanding of general office procedure and technical sales an advantage. These positions offer excellent opportunities to men having these qualifications, coupled with a keen business outlook. Write, stating age, qualifications, salary required, to **BOX No. C.A. 3221, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

## SITUATIONS VACANT

**SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES.** The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1953. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1953, may eventually be announced. The Scientific posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields of fundamental and applied science; in Biology the number of vacancies is small. The patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and Patent posts taking their degrees in 1953 may be admitted to compete before the result of their degree examination is known.

**Age Limits:** Senior Scientific Officers, between 26 and 31; for Scientific Officers and Patent classes, between 21 and 28 during 1953 (up to 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London Salary Scales: Senior Scientific Officers (men) £812-£1,022; (women) £681-£917; Scientific Officers (men) £440-£707; (women) £440-£576; Patent Examiner and Patent Officer Classes (men) £440-£655; (women) £440-£576. Somewhat lower rates in the provinces.

Further particulars from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S.53/53 for Senior Scientific Officers and S.52/53, S.128/53 for the other posts.  
20094/150/LMS.

**RADIOCHEMICAL CENTRE, AMERSHAM, BUCKS.** Ministry of Supply requires **BIOCHEMIST** with mature and varied experience in isolation of pure substances from biological materials, to develop and apply biological methods to synthesis of compounds labelled with Carbon 14 and other radioactive isotopes. Quails: 1st or 2nd Class Honours Degree in Biochemistry, Biology or Chemistry, or equivalent. Post will be graded Principal Scientific Officer or Senior S.O., according to age, qualifications, etc. Ref. F180/53A. **CHEMISTS**, with good all-round laboratory experience in Inorganic, Organic or Analytical Chemistry, for duties concerned with synthesis of compounds labelled with radioactive isotopes by chemical and biological methods; extraction of radioactive isotopes from irradiated materials at high levels of activity; production of radioactive appliances for medical and industrial use; associated analytical problems. Posts graded according to age, qualifications, etc., in Scientific Officer class (requiring 1st or 2nd Class Honours Degree in Chemistry, or equivalent). Ref. F181/53A, or Experimental Officer class (requiring Higher School Certificate (Science), or equivalent—H.N.C. or degree may be an advantage). Ref. F182/53A. Salaries: Principal S.O. (min. age 31), £1,033-£1,377; Senior S.O. (min. age 26), £781-£980; S.O., £417-£675; Senior E.O. (min. age 35), £803-£1,033; E.O. (min. age 26), £597-£754; Assistant E.O., £264-£555. Women somewhat less. All posts unestablished. F.S.S.U. benefits may be available for S.O. class. Application forms from **M.L.N.S., TECHNICAL AND SCIENTIFIC REGISTER (K), 26, KING STREET, LONDON, S.W.1**, quoting appropriate reference number.

## FOR SALE

**MORTON, SON AND WARD LIMITED**  
offer  
**MIXERS**

- TROUGH MIXER** by **CHALMERS**, 3 cwt., s.s. tilting trough, motorised.
- 2 TROUGH MIXERS** by **GARDNER**, 3 cwt., s.s. lined troughs, one motorised, one fast and loose pulley.
- MORWARD 'U' shaped TROUGH MIXERS** made to requirements up to 3 tons.
- One 350 g. homogeneous lead lined **JACKETED PAN** with lead lined anchor type stirring gear. Arranged fast and loose pulley drive.
- 1 CHANGE PAN MIXING UNIT** with s.s. agitators. Fast and loose pulley.

**HYDRO EXTRACTORS**

- 72 in., 60 in., 48 in. and 36 in. by **BROADBENT**, 48 in. and 42 in. by **WATSON LAIDLAW** and 42 in. by **MANLOVE ALLIOTT**. All electric 400/3/50, with starters.

**LEAD LINED VESSELS**

- Two 100 g. and one 75 g., totally enclosed, cylindrical. As new.

**PUMPS**

- A large selection of **MONO** and other pumps in stock, 2 in. to 6 in.—new and secondhand.

**ENQUIRIES INVITED.**

**MORTON, SON AND WARD LIMITED,**  
**WALK MILL,**  
**DOBCROSS, NR. OLDHAM,**  
**LANCS.**  
Phone : Saddleworth 437.

**CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating ; also lumps ground and granulated ; established 1830 ; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELEPHONE 3285 EAST.**

**DELAFILA, THE INERT FILLER.** Used in the manufacture of Fertilisers. Insecticides, Paints, Plastics and Insulating and Sealing Compounds. Prompt supplies in a wide range of fineness grades. **THE DELABOLE SLATE CO., LTD., DELABOLE, CORNWALL.**

**600****LANCASHIRE BOILERS**

- L LANCASHIRE BOILER** by **DANIEL ADAMSON**. Makers' No. 9955. 30 ft. long by 8 ft. diam. Dish ended. Evap. 9,000 lb. steam/hr. at 160 lb. sq. in. w.p. Fitted Niagara mechanical stoker, Green's economiser available.
- LANCASHIRE BOILER** by **DANIEL ADAMSON**. Makers' No. 9959. 30 ft. long by 8 ft. diam. Flat ended. Evap. 9,000 lb. steam/hr. at 180 lb. sq. in. w.p. Fitted Niagara mechanical stoker.
- TWO LANCASHIRE BOILERS** by **DANIEL ADAMSON**. Makers' No. 9703 and 10081. 30 ft. long by 8 ft. 6 in. diam. Evap. 11,140 lb. steam/hr. at 120 lb. sq. in. w.p. Fitted Niagara mechanical stokers.

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

**SET** of Four Galvanised **WATER COOLING TANKS** for sale. Heavy gauge riveted construction. Each 69 in. high by 36 in. diam. ; 250 gal. capacity. **F. J. EDWARDS, LTD., 359, EUSTON ROAD, LONDON.**

## FOR SALE

**3 JACKETED INCORPORATORS**, double 'Z' arms, double geared, power-driven tipping motion, with counterbalancing weights.

- 1—Baker Perkins MIXER** as above, not steam jacketed, single geared, complete with 25 h.p. A.C. motor.
- 3—Baker Perkins and Werner Jacketed MIXERS** screw tipping pattern, friction pulley drive, single geared, with double-fin type agitators.
- 4—Gardner RAPID SIFTER MIXERS and MIXERS** only, various sizes, one with brass fitted interior and glass-lined end plates.

**27—Various POWDER DRESSING or SIFTING MACHINES**, totally enclosed with barrels from 80 in. long by 22 in. diam. to 120 in. long by 30 in. diam., belt driven with collecting worm in hopper bottoms.

**1—Simon Horizontal Tubular DRIER**, 12 ft. long, 100 lb. steam pressure, size 3B, requiring 12 b.h.p.

**4—Recessed Plate FILTER PRESSES**, 30 in. square, 70 plates in each, centre fed.

**6—Johnson FILTER PRESSES**, 24 in. square, side feed and enclosed delivery, fitted 29 plates and 30 frames.

**1—Johnson FILTER PRESS**, 36 in. square, plate and frame type, double inlet and enclosed delivery ports.

**Johnson Oil FILTER PRESS**, Premier type plates 2 ft. 8 in. by 2 ft. 8 in., of which there are 45, with angle lever closing gear.

**1—Johnson FILTER PRESS**, 42 C.I. plates, 32 in. square, centre feed.

**Steam-heated FILTER PRESS**, Premier type, 32 in. square, with 30 recessed plates.

**Wood FILTER PRESS**, fitted 69 ribbed plates, 2 ft. 8 in. square, with top centre feed and bottom enclosed delivery channel.

**1—24 in. HYDRO EXTRACTOR**, self balancing, swan-neck type, self emptying bottom.

**Heavy Cake CRUSHING MILL**, 2-pair high, by Nicholson, for cake up to 3 in. thick, rolls 30 in. long, top with coarse teeth 9 in. diam., bottom with finer teeth 12 in. diam.

**5 Sets A.A. CRUSHING ROLLS** for linseed, cotton seed, etc., 48 in. long, belt driven, with feed hopper side frames, baseplate and striking gear.

**Bennett Copper-built EVAPORATOR**, 4 ft. diam. by 4 ft. 6 in. high, steam-jacketed bottom, mounted on legs, with swan-neck vapour pipe and separate vertical belt-driven vacuum pump.

**Douglas ROTARY PUMP** for oil, soap, etc., belt driven.

**6 Various Horizontal Duplex STEAM PUMPS**, Worthington and Tangye pattern, 1 in. to 2½ in. suction and delivery.

**"U"-shaped Horizontal MIXER**, 8 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven, end outlet, square horizontal centre shaft with cast radial type mixing arms, last used for lineoleum paste.

**1—"U"-shaped MIXER**, as above, but 7 ft. long.

**4—5-roll REFINERS**, fitted chilled iron, water-cooled rolls, 40 in. long, 16 in. diam., belt and gear driven, with clutch drive suitable for motor, by Baker Perkins, Ltd.

**No. 2HS Hammamac HAMMER MILL**, No. 1 size, Standard Miracle Mill, No. 2 size Standard Miracle Mill and a No. 3 Super Miracle Mill, with fans, piping and cyclones.

**7 ft. Torrance Positive-driven EDGE RUNNER**, 2 Vertical Paint Pug Mills, 2-bar Disc Paint Grinding Mills, and 2 Horizontal 40-gallon capacity Cox Pug Mills for paint.

**1—No. 1A Water-cooled CIRCULATOR MILL.**

**RICHARD SIZER, LTD**  
**ENGINEERS,**  
**HULL.**

Telephone 31743

## FOR SALE

**ROTATING PAN MIXER** by ARTOFEX. Two PANS, 47 in. diam. by 22 in. deep; 2-sack capacity. Human arm type blades. Fast and loose pulley drive. £100 ex-works.

One Ditto by T. COLLINS, BRISTOL. Two PANS, 47 in. diam. by 24 in. deep; 2-sack capacity, with automatic feed. Chain drive to 5 h.p. motor. £85 ex-works.

**THOMPSON & SON (MILLWALL), LIMITED,**  
CUBA STREET, LONDON, E.14.  
TEL. EAST 1844.

**STAINLESS STEEL SHEETS**, large range of sizes and gauges from 20 swg. to  $\frac{3}{8}$  in. thick at less than makers' prices. List from **HENRY SIMON (E.W.) LTD.,** CHEADLE HEATH, STOCKPORT (Mr. J. BARNES).

### STORAGE TANKS FOR SALE

#### HORIZONTAL CYLINDRICAL

- 12,000 gallon
- 3,000 gallon
- 2,500 gallon
- 2,000 gallon
- 1,500 gallon—3 compartment.
- 1,250 gallon
- 1,000 gallon
- 500 gallon

#### RECTANGULAR ENCLOSED

- 1,300 gallon
- NEW 100-1,000 gallons black or galvanised

#### OVAL LORRY MOUNTING

- 3,000 gallon—6 compartment
- 1,200 gallon
- 1,200 gallon—aluminium, 3 compartment
- 750 gallon
- 500 gallon—galvanised

#### RECTANGULAR OPEN TOP

- 12,000 gallon—sectional steel
- 3,350 gallon
- 750 gallon—sectional C.I.

#### VERTICAL CYLINDRICAL

- 250 gallon—new T.V.O. storage

#### LISTS WITH FULL DETAILS FROM:—

**WILLIAM R. SELWOOD LTD.,**  
CHANDLER'S FORD, Hants.  
Phone 2275.

**ZIMMER RECIPROCATING CONVEYORS.** Open or Closed TROUGHS for fine or coarse chemicals, etc. CONVEYS, SIEVES AND GRADES. Silent running; little or no maintenance; low priced; quick deliveries. "Z" EQUIPMENT CO., POYLE ESTATE, COLNBROOK, BUCKS. (Phone 279.)

**30 CWT. CHAIN BLOCKS,** 10 ft.-12 ft. lift, ex-Government surplus. £15 per set.

**5 CAST-IRON JACKETED PANS,** 36 in. diam. by 27 in. deep,  $1\frac{1}{2}$  in. bottom outlet. £20 each.

**1 MILD STEEL WELDED OPEN-TOP TANK,** 60 in. by 27 in. by 42 in. by  $\frac{3}{8}$  in. plate. £25.  
**THOMPSON & SON (MILLWALL), LTD.,**  
CUBA STREET, MILLWALL, E.14.  
TEL. EAST 1844.

## WORKING NOTICE

THE Proprietors of British Patent No. 633342 relating to "MANUFACTURE OF DRY STARCH PREPARATIONS SOLUBLE IN COLD WATER," are desirous of entering into negotiations with firms in this country for the purpose of exploiting the above invention, either by sale of the patent rights or by granting of Licences to manufacture on a royalty basis. Enquiries should be addressed to **ABEL & IMRAY, QUALITY COURT, CHANCERY LANE, LONDON, W.C.2.**

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**CRUSHING, GRINDING, MIXING and DRYING** for the trade.

**THE CRACK PULVERISING MILLS LTD**  
Plantation House,  
Mincing Lane,  
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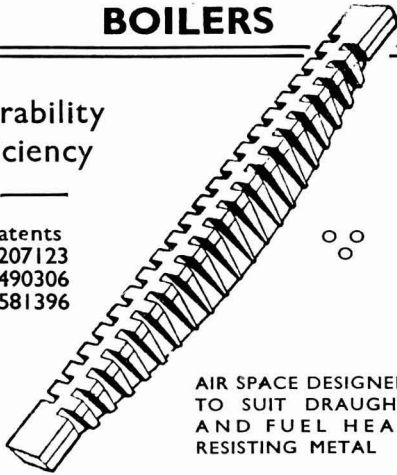
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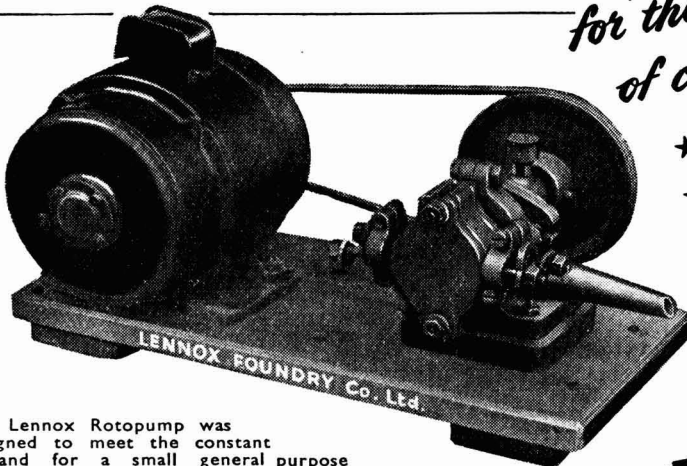
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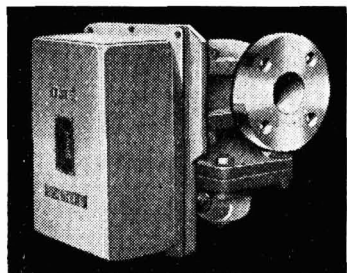
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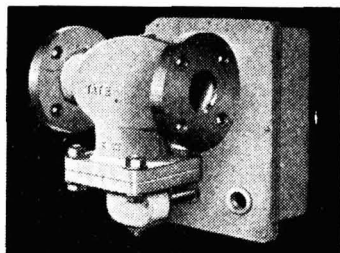
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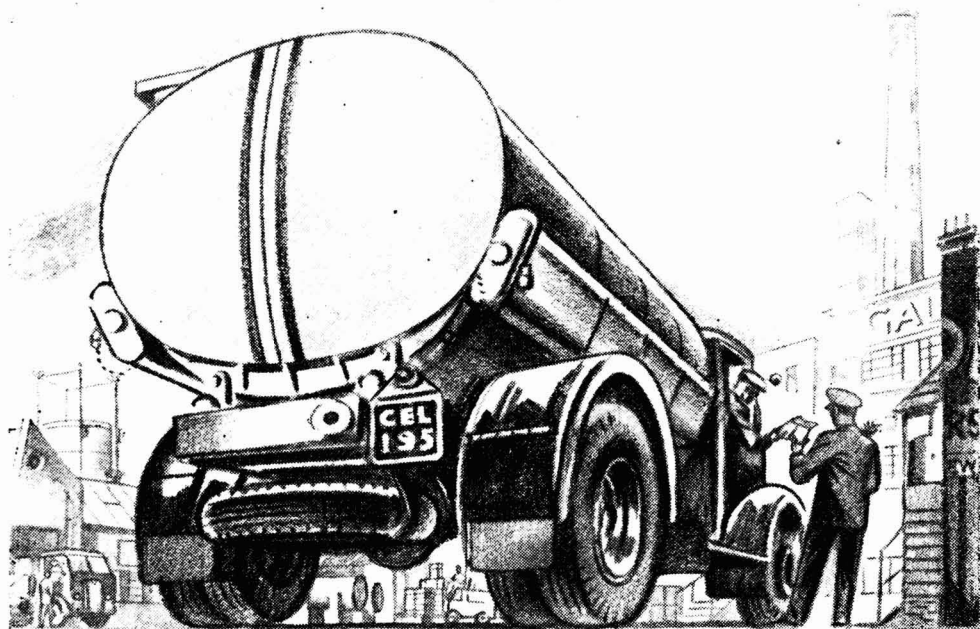


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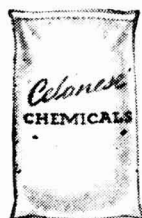
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