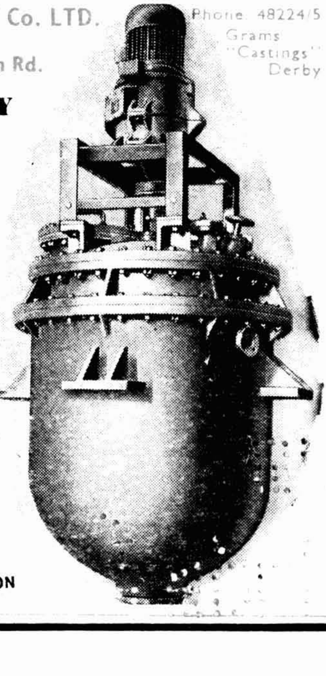
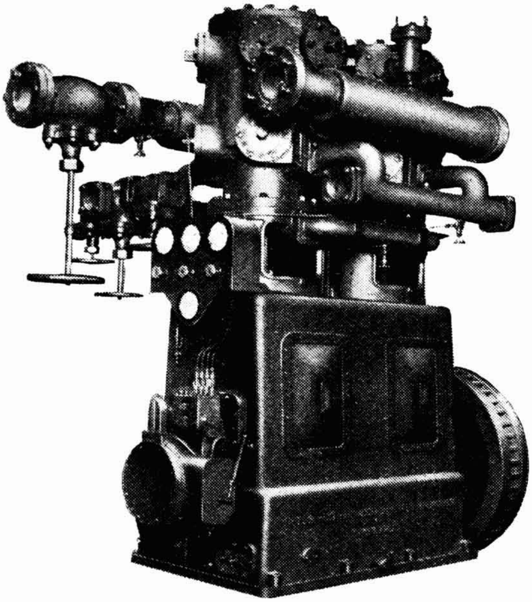
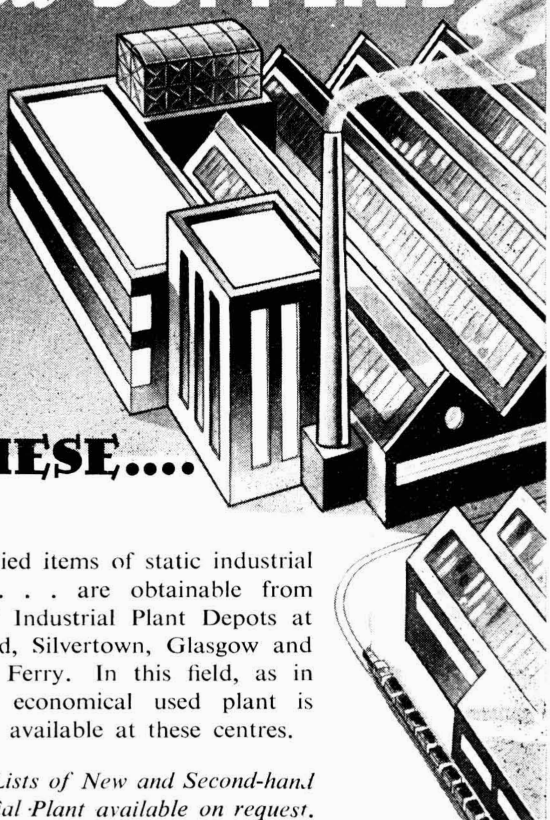
The Chemical Age

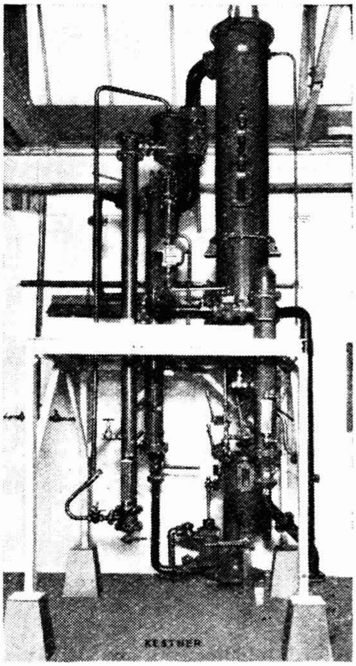
VOL LXVIII 9 MAY 1953 No 1765

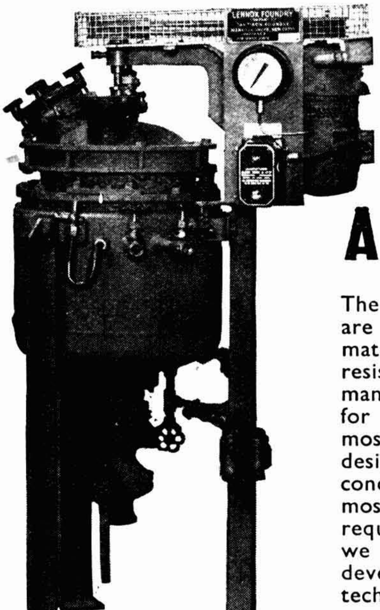


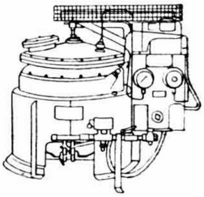


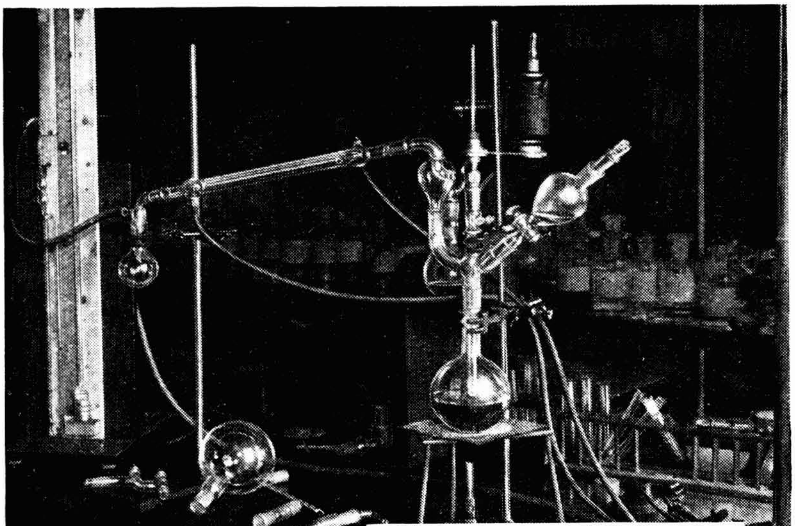


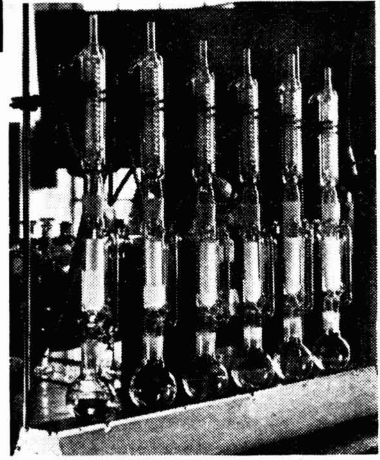
INDEX TO ADVERTISERS IN THIS ISSUE

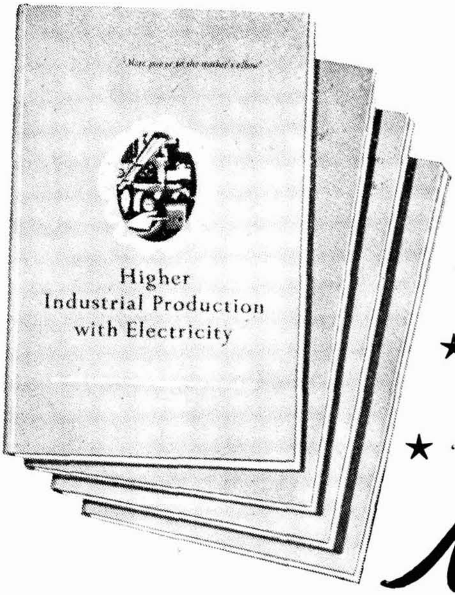

KESTNER


LENNOX FOUNDRY



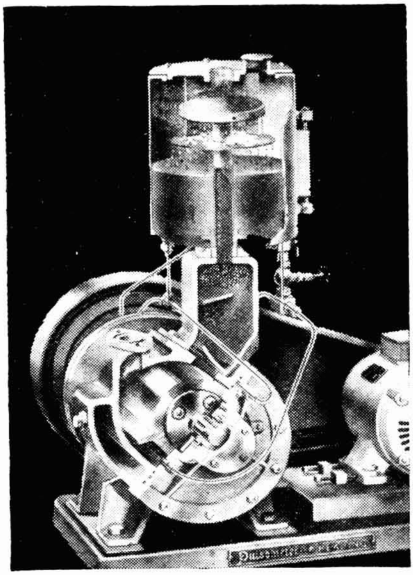





Higher Industrial Production with Electricity


STAVELEY


KARBATE
REGD. TRADE MARK
IMPERVIOUS GRAPHITE
RESISTS PRACTICALLY ALL CORROSIVE CHEMICALS



The
Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4.
Telegrams: ALLANGAS FLEET LONDON · Telephone: CENTRAL 3212 (26 lines)

Volume LXVIII 9 May 1953 Number 1765

Science & the State

A FEW weeks ago Lee A. DuBridge, president of the California Institute of Chemistry, addressed the American Chemical Society on the subject 'Science and Government'. Last week in London Dr. O. H. Wansborough-Jones, Chief Scientist of the Ministry of Supply, delivered the Royal Society of Arts Pope Memorial Lecture in London and chose the theme 'The Scientist's Place in the Services'. Each covered a good deal of common ground: Dr. DuBridge's theme may have been the wider in detail, but in practice today there is no longer a clearly defined boundary between the military and non-military aspects of defence; if Dr. Wansborough-Jones specified 'the Services' in his lecture title, his own Ministry is civilian and his conception of scientific service liberal enough.

There is an old saying that experts should be on tap but never on top. That contempt for specialised knowledge and the trained mind is now hopelessly outdated, but it still expresses the crux of the problems associated with the scientist's function in State and defence service. That is not to say, of course, that scientists should automatically be placed 'at the top'—most of them would vanish at undignified speed were they confronted with the possibility. It does mean, however, that their place is not 'on tap', to be called in as and when non-scientists believe that a problem exists and requires scientific examination. Too often the scientist 'on tap' can only say, as many doctors have had to say, 'Why on earth didn't you come to me earlier?'

Dr. Wansborough-Jones revealed that the position of the scientist in the Services has changed profoundly since the first world war. Then scientists were invited to give the Services what they wanted . . . 'not necessarily the same thing as giving the Services what they needed'. During World War II a pattern of joint discussion developed by natural evolution, leading eventually to 'operational research'. Although there is considerable difference between the outlooks of the military and scientific mind, in the second war 'the real step forward was the integration of the two disciplines, service and scientific, at a high level. Thus were the real problems isolated, studied by the best scientific means available. . . .' Dr. Wansborough-Jones suggests that such progress would never have been possible had not the technical and scientific knowledge 'within the Services themselves been greater than is commonly supposed'. This prospering of co-operation has not only proceeded in peacetime but it is said to have been permanently secured. The fact that defence research is costing more in one year than the total grants to universities in the next five years is sizeable evidence that the Services and service-supply departments are prepared to make the fullest use of scientific knowledge.

A similar revolution in the attitude of the Services took place in America during the second world war. The story of this change in outlook is recounted by Dr. DuBridge in very similar terms to those of Dr. Wansborough-Jones. However, Dr. DuBridge was more prepared to look at the reverse side of the coin, especially with the peacetime continuation of vast expenditure on research for defence. He estimates that at least 80 per cent of State expenditure on research or development is aimed at some goal in military technology; furthermore, that much the larger portion of this 80 per cent is devoted to development rather than to research. This is not so very different from the British account with its one-year research cost equalling five years of State grants to universities. Dr. DuBridge makes two criticisms. First, this preponderance of scientific military effort distorts the total scientific and engineering effort of America. Second and more seriously, that effort is so preoccupied with applied science that basic science is neglected and 'some day, we may no longer have new scientific knowledge which we can apply'.

Dr. Wansborough-Jones did not ask whether Britain in her huge expenditure upon defence research was getting her money's worth. Dr. DuBridge did and outrightly considered that America was not. One of his detailed criticisms was in remarkable contrast with Dr. Wansborough-Jones's picture of the British effort. Much of the American defence research work is carried out under military control, so much so that 'a military establishment will be the third or fourth or fifth choice as a place where a good scientist will wish to work'. Our wartime revolution in science/Services relationships seems to have cut deeper and stayed longer, for Dr. Wansborough-Jones was able to claim that many scientists stayed in defence research establishments here, even though industry offered better pay, because first-class facilities for research are provided. Perhaps this is the old story that those who have less money to spend must make a more effective use of their resources.

On Other Pages

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

Graduates in Harness

IN recent weeks *The Observer* has published a series of realistic articles on the recruitment and utilisation of man-power for industry. One notable conclusion, though it is one that all may not accept, was that industry fails to attract or keep the best brains from universities. Fine students prefer research or academic life even though industry's cash rewards are greater. *The Observer* reported on 26 April that correspondence from readers following these articles had been 'remarkable for their number and similarity'. The theme of graduates' letters was disturbing—on the whole, industry mishandles its recruits from the universities, not entirely excluding the technically qualified graduate who has been taken on for specifically defined duties. University life has been broadening and industry immediately afterwards is narrowing. Petty restrictions and regulations assume the shape of mistrust. The graduate is treated much as the youthful initiate straight from school. 'The evidence is too widespread and convincing to be dismissed lightly.'

No Preferential Treatment

THESE findings are not palatable. Those who made the dive from university into industry 25 years or more ago might well have hoped that things are better now. There is, of course, a genuine problem in industrial organisation that is not similarly encountered elsewhere. Obviously preferential treatment cannot be given to newcomers merely because they have been through a university. The frustration and injustice felt by other workers, who are much more numerous, would be enormous. Given time to learn the facts of industrial life, any graduate likely to be of value to industry would come to appreciate this; but in the first few months of industrial assimilation, it may not be sufficiently understood. Is it not the duty of industry to explain itself more clearly? But letters to *The Observer* refer to 'the works manager's unconcealed contempt' and industry is described as 'a dead-end for independent minds'.

Conflict of Policy

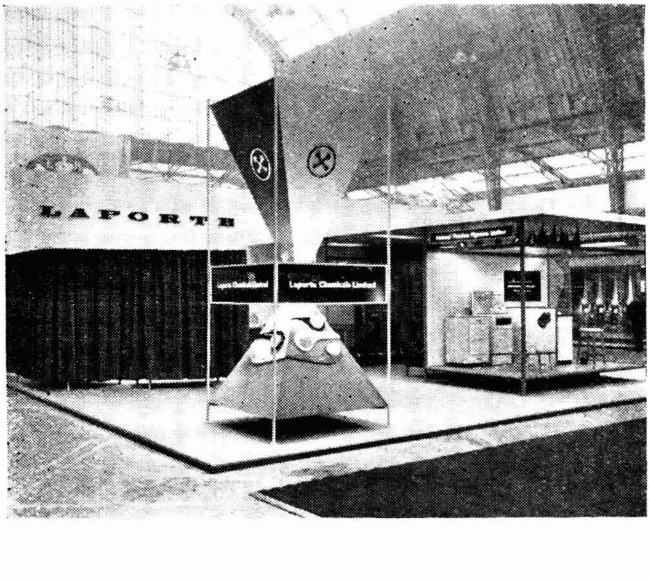
CLEARLY enough there is a conflict of policy. Some progressive firms have built up systems of training to fit the cases of university graduates. Others seem to assume that the university graduate must in any case start the hard way and show he can come up from the bottom. Perhaps the latter method works well enough when it works at all, but the wastage cannot be ignored. Not only do many graduates speedily resign, but others reject industry from the start because experienced friends advise them to seek futures elsewhere. It is very true, of course, that many of industry's managers have risen by their own efforts. They will have a natural distrust of university recruits and will inevitably be slow in passing out responsibilities. Also, many of industry's boards of directors no doubt believe that self-made practical men are the best for key-posts. Yet is there not wastage here? The hard way from the ranks takes a great toll upon highly useful and talented life. The steady rise of thrombosis is not an irrelevant factor. Industry has become so much more complex that the highway from the ranks is as full of casualties as the course of the Grand National. With proper assimilation university graduates should be able to carry their share of responsibility in modern industry with less strain.

British Abstracts

INTEREST in the fate of *British Abstracts*, which flared up last autumn (THE CHEMICAL AGE, **67**, 347, 418, 452, 488, 537) has been somewhat subdued throughout the winter. The subscription renewal forms arrived just before Christmas, and the baleful warnings that they bore, of possible, even probable, cessation, were forgotten in the ensuing festivities. And '*BA*' seems still to be with us, a little thinner, more worried about its future, but alive yet. The great drawback, and one which is shared by the rival *Chemical Abstracts*, is still there, however: too great an interval occurs between the publication of a paper and its appearance in abstract form, and an even greater interval before one can find what one wants in the index. Given the present policy, this is a state of affairs which can never be remedied. Abstracts take a considerable time to write. They are written, not by a whole-time staff, but by working chemists in their spare moments, and the total delay involved in delivery of the journal to the abstracting authority, dispatch to the abstracter, recovery from the abstracter some weeks after the dead-line, editing and setting-up in print, remission of proofs to the abstracter, recovery of proofs (weeks later again), final editing, printing and distribution, can easily total many months.

Unnecessary Details ?

IN a letter to *Chemistry & Industry* of 11 April, Mr. J. C. Earl asks whether the amount of detail given in an abstract is really essential, and suggests that a 'current index' is of greater importance than the extent of detail. Most chemists know from hard experience that it generally turns out to be necessary to consult the original paper, however comprehensive the abstract, and they soon learn to judge, from the title, the authors, their address, the journal in which they write and the number of pages in the article, whether it is worth consulting at all. Need *Abstracts*, then, publish any more than these few essentials ? That such a venture could be commercially profitable is shown by the success of a similar publication in a rather more limited field—the *Industrial Arts Index* published in America by the H. W. Wilson Co. Only the essentials listed above are given, and the index is cumulative each month. There is surely a possible market for a similar index devoted to chemical subjects. Most monthly journals know several weeks in advance what articles their forthcoming numbers are to contain, and even trade papers might give some prior information, so that the index could appear almost concurrently with the articles listed in it, to everybody's great advantage. A small full-time staff could be employed on the relatively non-technical job of indexing, and another of Mr. Earl's suggestions might be implemented: the provision of photostat copies of unobtainable papers at an economic price. The most attractive part of Messrs. Wilson's venture is one that could well be copied by any abstracting organisation: the rate of subscription is scaled to the size of the library.



The stand of Laporte Chemicals, Ltd., at the British Industries Fair, Olympia, showed the varied applications of hydrogen peroxide, and that of National Titanium Pigments, Ltd., demonstrated the whiteness and opacity of titanium dioxide.

Chemistry in Iron & Steel Research

Wide Range of Studies in 1952

THE Chemistry Department of the British Iron and Steel Research Association has the prime responsibility of studying the scientific bases of industrial operations and applications of new scientific knowledge. Its work plays a prominent rôle in the association's programme and a number of interesting investigations carred out in the department's laboratories as well as in collaboration with other associations and committees are contained in the ninth annual report for 1952, now published.

Research conducted by the Chemistry Department during the 12 months ended 31 December, 1952, is divided into three sections—physical chemistry, refractories and corrosion.

In the physical chemistry section work in the department's laboratories included the continuation of theoretical studies and a report on the activity of ferrous oxide in slags, previously submitted to the Steelmaking Division Panel, and another on the relationship between entropy and molecular structure have been submitted for publication. Further literature surveys on the free energies of formation of nitrides and the activity of manganous oxide in steelmaking slags are nearly complete.

The heats of formation of magnesium and manganese phosphates are being determined by solution calorimetry to check the heat terms in the expressions for free energy changes derived from high temperature equilibrium studies. A calorimeter to determine heat contents is nearing completion.

Free Energy of Formation

Papers on the free energy of formation of calcium and magnesium phosphates have been published. The relative stabilities of the two phosphates indicate why magnesia should play no part in dephosphorising by lime-bearing slags. The free energy of formation of manganese phosphate is being determined and results are being obtained in work designed to show the mutual effect of phosphorus and oxygen dissolved in molten iron on their respective activity coefficients.

In view of the publication in the USA of a report on the solubility of sulphur in solid iron, it is intended to carry out only sufficient experiments to check the published information before studying the solubility of sulphur in solid iron-manganese alloys. Present results are in line with those obtained in the USA.

Vacuum fusion apparatus continues to be used for the determination of gases in solid iron and steel in connection with laboratory experimental work and to assist member firms and other investigators needing such analyses. The gas analysis train has been modified to bring it in line with up-to-date practice.

Effect of Added Elements

Equipment to determine the effect of added elements, including silicon, vanadium, aluminium, titanium and chromium, on the solubility and activity of nitrogen in solid iron is in operation. Preliminary results on iron ore are in line with those previously published.

At the Imperial College, London, work on the interaction of carbon and sulphur when dissolved in liquid iron has resulted in a tentative explanation being advanced of the mutual raising of the activity coefficients of these two elements.

Diffusion rates of carbon and sulphur, alone, or together, and the influence of carbon and sulphur on the viscosity of molten iron are being studied. A technique using radio-carbon has been developed for determining diffusion rates and the equipment for measuring viscosity has been built and calibrated.

In an attempt to discover the part played by excess base in the structure of molten slags, electric conductance measurements have been made on $PbO\text{-}SiO_2$ melts. This system was chosen because it is possible to cover essentially the whole composition range at conveniently low temperature. The energy and entropy of activation associated with the conductance process have been deduced but a full interpretation of the results awaits determination of transport numbers in the system. This work is in hand.

A viscometer has been constructed for the determination of viscosities of slags up to about 2,000°C. A detailed study has been made of the Ca-SiO_2 system. The results indicate that the liquid slags contain neither SiO_2 molecules nor the continuous chain and sheet structures previously postulated but consist of discrete ions, the approximate nature of which has been deduced.

Experiments Now in Hand

The lattice parameters of ferrous oxide-manganous oxide solutions, over the range 0-100 per cent MnO have been measured by X-ray powder diffraction methods. The two oxides form a continuous range of solid solutions in which the lattice parameter is almost a linear function of composition. No evidence has been found of the separation of the solution into two phases. As with ferrous oxide itself, the lattice constant of the solid solution at a fixed rate of iron to manganese is a function of the oxygen potential of the environment. Experiments are now in hand to determine the relation of oxygen potential to the composition of the solid solutions at high temperatures.

Passage of hydrogen from the gaseous state into solid iron involves preliminary surface adsorption which is followed by a slower absorption. A study has been made of the free energies of adsorption of hydrogen, carbon monoxide, nitrogen and oxygen on films of iron. The information so gained should be of value in the work, now in progress, aimed at elucidating the mechanism of absorption and desorption of hydrogen by bulk iron at temperatures up to 1,000°C., even when the surrounding atmosphere or the metal is contaminated by any of the above-mentioned gases.

Other studies included the thermodynamics of chromium and carbon in liquid iron and the movement of sulphur between gases and liquid iron via a steelmaking slag.

Work on the physical chemistry of iron and steel making at the Royal Technical College, Glasgow, is assisted by a grant-in-aid from the association. The following subjects have been studied during the year:

A paper on the reaction between sulphur dioxide and molten iron has been published. Experiments were carried out in which mixtures of sulphur dioxide, oxygen and nitrogen were passed over molten iron and the resultant changes in composition of gas and metal determined. It has recently been found that the presence of 1.6 and 4.0 per cent of carbon in the iron represses the tendency of the metal to pick up sulphur from the sulphur dioxide.

In work on slag constitution it was found that melts from the silica-rich field of the FeO-Na_2O-SiO_2 system produced so much glassy material on cooling that it was decided to investigate the MnO-Na_2O-SiO_2 system. Compositions on the 2 MnO.SiO_2-Na_2O.2SiO_2 joint have been examined and it appears that this is a true binary. The melts, however, show a greater tendency to glass formation than do the melts from the FeO-Na_2O-SiO_2 system.

Difficulty of gas evolution when melting some FeO-CaO-P_2O_5 mixtures in iron containers has been overcome by the use of slip-cast magnesia crucibles. The cause of the evolution of gas, which contains phosphorus, has not, however, been satisfactorily explained. The lime-rich side of the immiscibility loop in the system has been determined and experiments are in progress to ascertain the position of the remainder of the loop. Slag metal equilibria are also being studied.

Work on the effects of phosphate, vanadate, chloride, fluoride and sodium oxide on the surface tension of CaO-SiO_2 slags has yielded some interesting results. The first two additions have been found to be particularly surface active. Attention is at present being concentrated on the influence of phosphate because of its possible practical interest.

Results Indication

Results indicate that phosphate addition to CaO-SiO_2 slags tends to produce a two-liquid system, and this is being correlated with thermal studies. Elucidation of the effects of chloride and fluoride additions is complicated by the rapid loss of these constituents from the molten slag.

Measurements, with a rotating outer cylinder apparatus, of viscosities in the CaO-MnO-SiO_2 and CaO-MgO-SiO_2 systems have shown that, for the same MO: SiO_2 ratio, the magnesium ion resulted in the highest and the manganese ion in the lowest viscosity. The activation energies for diffusion also decrease in the same order, that is $Mg > Ca > Mn$. This order is not in accordance with field strengths of the cations but is the same as that found for increase in surface tension. No anomalous viscosities have been detected in the systems studied.

Investigations on the equilibrium between iron, containing manganese and silicon, and FeO-MnO-SiO_2 slags are continuing. The silicon contents of the metal are higher than those calculated from existing data because of the effect of oxygen on the activity coefficient of silicon. Some results for the activity of MnO in MnO—SiO_2 slags have been published but work is proceeding to cover a range of compositions not adequately covered by the previous research.

The action of molten steel on casting pit refractories has been studied and a paper thereon published. No evidence was found to substantiate the superior resistance of more aluminous refractories. In practice, however, the more aluminous materials contain less iron oxide and this may explain their better performance. The greater attack on refractories caused by manganese steels may be attributed to the greater fluxing power of MnO for alumino-silicate refractories as compared with FeO.

Collaborative work with the British Ceramic Research Association has continued. In this, part of the committee structure has been altered to cover separately the three principal refractory materials used in the steel industry (basic, silica and alumino-silicate).

Special Report Published

An Iron and Steel Institute Special Report has been published and used as the background for a meeting of the West of Scotland Iron and Steel Institute. This meeting concentrated on combustion problems and testing of refractories. Only two melting shops are working all-basic furnaces at present. In one of them, a new type of automatic roof control gear is to be fitted to the second furnace to be constructed with a basic roof. The work on these and other furnaces has shown that it takes a long time to assess the value of bricks, basic or silica, from full-scale open-hearth roof trials.

In consequence, effort is being made to devise a panel testing system in full-scale furnaces. It has been planned in such a way as to permit useful conclusions to be drawn from the minimum number of experiments. Quantitative measurement of wear in the panels is required and ultrasonic echo, surface temperature and thermal resistance methods have been examined. The first is quite unsuitable but the latter two are being studied in the laboratory.

Bursting expansions of chrome-magnesite bricks have been studied in the laboratories of the department and the British Ceramic Research Association. In the former a new miniature test has been developed. Experiments with a number of slags, not containing iron oxide, has shown that without this oxide no bursting expansion occurs and that dilution of iron oxide by basic slag or by dolomite decreases the bursting expansion proportionally.

Measurements Undertaken

Measurements of surface tension and contact angle have been undertaken with a view to ascertaining whether refractory materials could be protected against slag attack by providing a non-wetting surface. Vanadium oxide has been quoted as a suitable non-wetting agent but neither this nor any other material tried reduced the extent of interaction at 1,700°C. An alternative method, that of producing a glaze with suitable viscosity characteristics, was tried. Some commercial mixtures, based on zircon, were tested with promising results in short-time laboratory experiments but they showed signs of being not very durable.

Glazing experiments indicate that dolomite powder forms a protective layer on chrome-magnesite and it is hoped, after preliminary small-scale tests, to try the effect of feeding such dust into or near a furnace flame so that, as is known from flow model work, it will distribute itself over the open-hearth roof.

Work on special refractories, particularly for application in checkers in all-basic furnaces, has included works trials of 55 per cent and 73 per cent alumina bricks and a detailed study of mullite and associated compounds. This placed special emphasis on the effect of other oxides on the properties of such refractories. It is indicated that a good yield of mullite on firing may be obtained at the cost of refractoriness.

In testing open-hearth refractories a small slag dust test-rig for silica bricks at temperatures up to 1,700°C. has been developed. Considerable preliminary work has been necessary on cold models and on methods of introducing the slag dust into the gas stream intended to bring it to the brick face. Insufficient results are available for any conclusions to be drawn at present.

Further experimental work has indicated that corrosion by slag of single crystals of corundum occurs by cationic attack at the surface but that the controlling step in the corrosion process is normally the diffusion of alumina or aluminate away from the surface. Any process which moves the slag over the refractory surface and thus reduces the thickness of the diffusion layer will increase the rate of corrosion.

The corrosives of the ions $Fe^{\bullet\bullet}$, $Mn^{\bullet\bullet}$, $Ca^{\bullet\bullet}$, $Sr^{\bullet\bullet}$, $Ba^{\bullet\bullet}$, $Li^{\bullet}$, $Na^{\bullet}$, and $K^{\bullet}$ have been examined in binary silicate melts. The first two were most corrosive followed closely by $Ca^{\bullet\bullet}$. The larger ions are less corrosive.

Corrosion Committee's Sixth Report

Arrangements are being made by the Corrosion Committee to publish its sixth report which will cover the period from 1938 to 1952. The second report of the Methods of Testing (Corrosion) Sub-Committee was published in July, and a symposium held in October when this and three reports on phosphate coatings were discussed.

A report of the results of tests on protective metallic coatings for steel will shortly be published. It has been found that the life of a sprayed aluminium coating ($\frac{3}{4}$ oz./sq. ft.) is at least 10 years in Sheffield and longer in other, less corrosive atmospheres. A coating of 3 oz./sq. ft. of zinc will protect steel for six years when immersed in the sea.

The Joint Technical Panel studying paints for structural steelwork has decided to limit its tests to priming and not to conduct tests on finishing paints.

The Atmospheric Corrosion Sub-Committee has exposed sets of specimens inside factories and dwelling-houses during an investigation into indoor corrosion. They are to be left for 12 months in the first instance and the results of these preliminary tests should become available early in 1953.

Conclusions drawn from the routine tests on reference specimens of ingot iron and of zinc exposed to the atmosphere have been included in a report to be published shortly. This report will include the results of a series of tests on the relation between atmospheric corrosion and atmospheric pollution undertaken in collaboration with the Fuel Research Station. Specimens of copper-steel and of zinc were exposed at sixteen sites in this country where routine observations of sulphur pollution are made using lead peroxide candles. An almost perfect correlation was observed between the corrosion of both metals and the pollution of the atmosphere.

Results of tests on the Sutton Coldfield television mast show that there is no pronounced effect due to the height of the specimen above the ground, and tests at Delhi indicate that the slight corrosion of the iron pillar there is primarily due to the very mild corrosiveness of the atmosphere and not to any peculiar properties of the iron itself.

A research into the corrosion of nodular cast iron has begun. All the atmospheric corrosion tests in this country have started and specimens have been sent to the Tropical Testing Establishment for exposure in Nigeria. One set has been buried in the soil at Benfleet. Further specimens will be tested under immersed conditions in a rotor aparatus using both fresh and salt water.

A further series of soil corrosion tests on pipes protected with bitumens and tars commenced. In this research some pipes have been hot-dipped, while it is planned to spray others. The latter method presents some practical difficulties but if successful should allow pipes to be coated *in situ.*

Investigation into the fundamental causes of corrosion have continued at Cambridge University.

Setting properties of the acetate type of cementiferous paint have been studied and the difficulties mainly overcome; there are indications that mixed acetate-phosphate paints will prove superior to the paints in either medium alone.

Films Indistinguishable

It has been found that the film formed on iron by the anodic discharge of hydroxyl ions is composed of material having the cubic structure of either magnetite or γ-ferric oxide; consequently it is indistinguishable from the air-formed film. This film may be produced when freshly abraded iron is immersed in decinormal sodium hydroxide solution containing dissolved oxygen, or in decinormal solutions of the sodium salts of weak acids, such as phosphoric, boric or carbonic acids, which are readily hydrolised.

Experiments to find a 'safe' inhibitor against corrosion in water have continued. Even in the presence of chlorides the combined action of calcium compounds and of condensed phosphates has produced a more marked slowing-down in the corrosion rate than results from the addition of either inhibitor alone.

Arising out of the work on rust-resisting stainless steel the most important fact is that there is a rectilinear relation between the amount of oxygen added to dilute sulphuric acid in which the steel is immersed and the reciprocal of the time needed for passivity. This indicates that the growth of the protective film follows a logarithmic law. Analogous work carried out using potassium dichromate in place of oxygen gives similar but less regular results.

The results of tests to determine the mechanism of the attack of specimens at the water-line confirm Schikorr's theory in a modified form. It has been found that replenishment of inhibitor in the meniscus zone is slower than elsewhere, although, if a film or film-forming substance is present, the amount of inhibitor needed for film-repair is equally great. This explains the preferential attack at the waterline.

Some of the factors that may influence the corrosion resistance of wrought iron have been investigated. The existence has been proved of quickly corroding zones, relatively resistant zones and very resistant zones. Micro-analytical methods are being used to determine the composition of each of the zones. The longevity of old wrought iron may be connected with low probability of corrosion although the absence of acidity in the atmosphere in earlier times may have been an important factor. The presence of a continuous surface scale will greatly assist in protecting the underlying iron.

Conserving Acid

Much attention has been given during the year by the coatings committee to conserving acid in sulphuric acid pickling and its recovery from waste liquor. It has been concluded that the best method of recovering unused acid from waste liquor is to evaporate the liquor to high acid strength, by either submerged combustion or a heat exchanger, whereupon ferrous sulphate separates out as a monohydrate.

The method appropriate for a particular work depends on the fuels available and the use to which the ferrous sulphate is put. In this respect the size of crystal is important. It has been found that the submerged combustion method forms crystal aggregates, whereas the heat exchanger method yields very small single crystals. Laboratory experiments are being carried out to determine the optimum conditions for producing large single crystals of ferrous sulphate monohydrate.

Influence of bath composition on the rate of pickling is being studied and it is hoped to establish, among other things, the optimum concentrations of acid and ferrous sulphate for any desired pickling speed. Results indicate that an increase of 10 per cent in the acid strength may permit an increase of 50 per cent in the pickling rate.

Location of Plant Changed

Location of the pilot plant for regenerating sulphuric acid from ferrous sulphate by the autoxidation process has been changed from the Llanelly Old Castle Works of The Steel Company of Wales, Limited, to their King's Dock Works, Swansea. Simon-Carves, Limited, are constructing the plant and it is hoped that erection will be completed during the summer of 1953.

Several chemicals have been tried in the search for a material which, when applied to the surface of steel prior to heat treatment, will form a film to prevent oxidation. The best results have been obtained with ammonium borate. Experiments have shown that when a specimen of steel previously heated to 150°C. is coated by spraying with a concentrated ammonium borate solution and heated to 850°C. in an oxidising atmosphere, the loss in weight through oxidation of iron is reduced by 97 per cent.

During heating the ammonium borate decomposes, evolves ammonia and produces a film of boric oxide on the surface of the steel. After heat treatment, the boric oxide is easily removed in hot water to form boric acid which can be converted to ammonium borate by the addition of ammonia.

The protective efficiency of the boric film is being tested in some typical furnace atmospheres. In burnt town gas it has been found to be as effective as in air: its behaviour in more sulphurous atmospheres is being studied.

A similar method has been used for spraying clay on surfaces to be heated to 1,000°C.: the steel is again preheated to 150°C. Heating steel treated in this way in an oxidising atmosphere produces very little oxide and on cooling the clay parts from the steel leaving a smooth surface covered with only a thin superficial film of iron oxide.

Special attention is being paid to the electrochemical behaviour of tinplate in service as a food container, particularly the effects of discontinuities in the tin coating and the character of the food packed. The Isotope Division of the Atomic Energy Research Establishment at Harwell has tested for the association a possible method of assessing the area of steel exposed at pores in tinplate.

A tinplate specimen is immersed in a solution of radioactive cobalt salt. As cobalt is below iron, but above tin, in the electrochemical series, deposition of cobalt by chemical displacement occurs only on the iron exposed at the pores in the coating.

The possibility of depositing alloy coatings by electrodeposition has been studied and some success has been achieved in depositing alloys of iron and zinc. The coating is hard, strongly adherent and for low zinc contents is very bright. The surface of the steel base needs no special preliminary action such as 'buffing,' because of the 'smoothing' action of the deposit. Increasing the zinc content of these alloys improves their corrosion resistance, generally with diminishing brightness. A provisional patent application has been filed for the co-depositing iron and zinc methods.

During the past eight years an extensive research programme has been evolved.

More than 400 research projects are now in hand, the majority of which are supervised by the 65 panels and research committees. Some are fundamental and long-term problems, while others are capable of earlier solution.

Outstandingly important are those that have a direct bearing on the success of the industry's second development plan and in the immediate future the rapid application of research results to the industry and the follow through from the laboratory stage to the works trials will continue to take an increasingly important place.

Two attractive BIF stands : that of Messrs. Hickson & Welch at Olympia, and of Royal Doulton, at Castle Bromwich

Montan Wax

Developments Over the Last Fifty Years

SHORTLY after the commencement of this century, a new wax was introduced to this country from Germany, under the name of mountain or mineral wax, soon referred to as 'montan' wax. This natural product was then being obtained from Thuringian lignite, one of the series of wax-containing coals, many deposits of which occur in various parts of the world including Australia, New Zealand, Czechoslovakia, Russia, and America, although the main source for many years was Central Germany.

Chemically, montan wax can be regarded as forming a link between the true waxes, on the one hand, and the solid hydrocarbons such as paraffin and ozokerite, on the other. The constitution of montan wax varies a good deal depending on geographical occurrence, but it has been stated[1] that typical figures are 55 per cent to 60 per cent of esters of wax acids, 15 per cent to 20 per cent free wax acids, with up to 5 per cent free alcohols. There is always an appreciable resin content, although German montan wax is low in this respect, and largely due to this the German-produced wax established itself almost from its inception, and the production of montan wax very soon became an important industry.

Owing to the increasing demand for synthetic waxes and the relative ease with which montan wax could be utilised in the production of such modified products, the pre-war 'I.G.' waxes were developed and subsequently produced in large quantities, and these synthetic waxes formed an important export item until the commencement of the last war, when both this country and America were forced to seek other sources for these waxes.

The German Process

In the German process, montan wax is extracted by means of solvents from brown coal, after suitable granulation and drying. The crude wax so obtained can be further refined by vacuum distillation using steam, and producing the so-called 'double refined' montan. The German brown coal has an average wax content of 10 per cent to 15 per cent, and the crude wax obtained by solvent extraction of the coal contains from 15 per cent to 20 per cent resin, which is largely removed by a second solvent extraction.

The more important process of extraction commences with removal of resin by solvent treatment, the de-resinified wax being then oxidised with chromic acid. The product of this reaction may then be esterified with aliphatic glycols, etc., to give a wide range of versatile waxes. This is the usual German practice, and was developed during the 1920's in the Ludwigshafen-Oppau Works of I.G., being later transferred to Gersthofen, where the industry expanded considerably. It is favoured in Germany, because it gives higher yields and produces harder waxes.

Possibilities of Production in the U.S.

The United States Bureau of Mines, in an endeavour to utilise the natural American deposits of lignite, carried out an investigation into the possibilities of producing montan wax in the United States. By solvent extraction methods, yields from California and Arkansas lignite were comparable to those obtained from German coal, but the American wax contained a much larger amount of resin. However, during the last war, investigations were intensified and the American Dyewood Co., producing sodium humate from lignite deposits near Malvern, Arkansas, commenced extracting montan wax as a by-product. The wax obtained, however, still had a very high resin content, and when the demand for sodium humate ceased, the plant was shut down.

Meanwhile, in this country, investigations had been going on into the possibilities of obtaining an indigenous wax to replace imported montan. This work, carried out at the Fuel Research Station at the request of the Non-Ferrous Mineral Development Control of the Ministry of Supply, was extended to include a survey of many of the lignite deposits in Great Britain. As a result,[2] it was found that the nature and amount of wax obtained from lignite and peat depended upon the type of solvent used for the extraction. The crude wax consisted of a true ester wax with a proportion of asphaltic and resinous material which increased with increase in the yield of crude wax. It was further discovered that benzene extraction of lignite from the Bovey Tracey Basin in Devonshire yielded a wax similar in properties to German montan wax.

A partial survey was also made of the wax contents of peat deposits in England and Scotland, and it was noticed that the wax content of peat was apparently determined by the nature of the vegetation from which the peat was derived; thus sphagnum peat had a low wax content, whereas peat derived from cottongrass was relatively rich in wax. Some independent work which was carried out using Irish peat, showed that a wax with a relatively high melting point, could be obtained.[3] This wax has been given the name Mona wax, and is stated to contain approximately 50 per cent of complex bitumen material, 35 per cent peat esters, with 15 per cent resin. By suitable processing, waxes can be produced varying in colour from dark brown to white.

Further Complications

The production and supply of Continental montan wax was further complicated at the end of the war by the political situation, since most of the best lignite deposits were located in Eastern Germany and Czechoslovakia. Czech montan is now available under the name of 'Bohemia' brand wax and is described as of dark brown colour, giving a conchoidal fracture on splitting. The melting point determined by the ASTM method is 80-81°C., acid value varying between 22 to 35, with a saponification value of from 65 to 78. The resin content is from 35 per cent to 42 per cent.

A few years after the war, the German production of the former 'I.G. Waxes' recommenced, and these have once again become established industrially, under the name of Gersthofen waxes. Chemically, the Gersthofen waxes consist of esters of high molecular wax acids with certain alcohols, and because of their similar chemical structure, possess basic properties which resemble those of the natural waxes.

BIO Examination

As a result of the British Intelligence Objectives examination of the German montan industry,[4] a very considerable amount of information is now available. It was found that the only useful lignite in Germany for the production of montan, which contained 15 per cent of wax, was at Halle Riebeck. The Gersthofen plant,[5] though specially built for the manufacture of synthetic waxes, had no special features, and was of a type common in the manufacture of organic chemicals. The lay-out comprised a mill for grinding the raw wax, oxidation kettles, smaller kettles for washing the crude oxidised wax, vacuum kettles for drying, and kettles for esterification and other modifying processes.

The code numbers of the Gersthofen waxes are practically parallel with the former I.G. waxes, and at present ten different types are available. Light colour, lustre, hardness, capacity for binding oils and emulsifiability have been increased.

The most recent development in this field has, however, come from America. American Lignite Products Co., of Ione, California, have now commenced large scale production of a high quality American montan wax, which is claimed to be equal or superior to the best German montan.[6] Operations were commenced in 1946, and actual production started in the middle of 1948. It was found that Californian lignite yields a good quality wax, one ton of lignite (25 per cent moisture) giving 280 lb. of finished crude. Little detailed information is yet available, but it is reported that the American crude montan has a higher acid value and saponification value, and is higher in true wax esters, than any of the best grades of imported wax. Development work is still continuing on bleaching and refining processes for the crude, and it has been discovered that the chromic acid treatment, a feature of the German process, destroys a large percentage of the wax esters.

Decolorisation Process

As a result of this work, American Lignite Products feel that they are on the threshold of one of the most important wax developments in recent years, as they have now perfected a new process of decolorisation, which does not use chromic or other acids, and therefore results in no loss of wax esters or other damage. Two types are being produced, a modified montan, which is deresinified but dark in colour, with a high melting-point around 87°-88°C., and a light coloured montan, with excellent oil retention and flow properties, with a melting-point around 81°C.

The following table gives a comparison of some of the properties of the montan waxes which have been discussed.

Source	m.p. °C.	Acid value	Sap. value	Resin content per cent
German	82–87	28–35	65–75	14
Czecho-Slovak	79–85	30–40	65–75	35–42
American				
No. 1950	82–85	—	—	—
No. 1644	82–88	—	—	—
English peat wax	63–68	50	119	—
Devon lignite wax	73–83	30	75	40

The uses for crude montan wax are somewhat restricted, on account of its natural dark colour, but this in no way detracts from its use, with excellent results in such products as shoe polishes, stick wax, last wax, carbon papers, printing inks, and other similar commodities. The modified montan, where the colour has been reduced, and very light waxes result, is capable of even greater versatility, and these grades can replace expensive carnauba wax in a variety of products. Both the crude and the various modified waxes exhibit excellent binding properties with oils and solvents, although polishes made with montan waxes require rather longer to set up. For this reason, it is possible to fill such products at much lower temperatures than would otherwise be possible; in fact, montan wax appears to exhibit a web-like structure when admixed with solvents, and soft gel-pastes are easily obtained which exhibit no graininess.

Montan shows good compatibility with other waxes, and the de-resinified grades have excellent properties in this respect, while the high acidity of the wax is often useful for solubilising nigrosine dyes, thereby reducing the need to add fatty acids as dye solvents. Emulsions can be prepared with either the crude or modified grades with relative ease, and once again the range of application is very large.

REFERENCES

[1] C. J. Marsel, *Soap and Sanitary Chemicals*, **29**, 1, 120 (1953).

[2] C. M. Cawley and J. G. King, *Fuel Research Technical Paper No.* 52, HMSO (1946).

[3] Anon. *Chemurgic Digest*, **10**, 11, 15 (1951).

[4] '*BIOS* Final Report *No.* 13', HMSO.

[5] '*BIOS* Final Report *No.* 419', HMSO.

[6] Anon. *Soap and Sanitary Chemicals*, **29**, 2, 137 (1953).

Glaxo Laboratories

The directors of Glaxo Laboratories Ltd. announce an interim dividend of 5 per cent on the £1,592,700 Ordinary stock (compared with 10 per cent last year on £796,350 stock) on account of the year ending 30 June, 1953, payable less tax on 16 June, 1953.

I.C.I. Board Changes

Research Executives Retire

As briefly mentioned last week **Sir Wallace Akers** and **Mr. W. F. Lutyens** retired from the board of Imperial Chemical Industries, Ltd., on 30 April. Sir Wallace's place as Research Director will be taken by **Dr. R. Holroyd**. Mr. Lutyens will be succeeded as development director by **Mr. C. R. Prichard.**

Sir Wallace Akers was with Brunner, Mond & Co., Ltd. from 1911 to 1924. In 1928 he joined I.C.I. Technical Department in London and in 1931 was appointed chairman of the delegate board of I.C.I. (Fertiliser & Synthetic Products), Ltd. In 1939 he was appointed an I.C.I. executive manager and was appointed to the I.C.I. board in 1951 as the director responsible for research. During the last war Sir Wallace Akers was Director of Atomic Energy for the Ministry of Supply. He was knighted in 1946.

Mr. W. F. Lutyens joined Brunner, Mond & Co., Ltd., in 1913. He was appointed chairman of the delegate board of I.C.I. (Alkali), Ltd., in 1931. In 1939 he was appointed an I.C.I. executive manager and was appointed to the board of I.C.I. in 1941 as the director in charge of development.

Mr. Lutyens was I.C.I. Development Director from 1941 to 1948 when he was made responsible for the Heavy Chemicals Group. In 1951 he again took charge of development and was also made responsible for the 'Terylene' Council.

Dr. Ronald Holroyd was educated at Sheffield University, where he did research in fuel technology and pure chemistry. During his service with I.C.I. he has been continuously connected with hydrogenation and oil research. He was appointed joint managing director of Billingham Division in 1951 and to the I.C.I. board in 1952.

Mr. C. R. Prichard was educated at Winchester and Trinity College, Oxford. He joined Brunner, Mond & Co. in 1926, and served with this company and I.C.I.'s Alkali Division—its successor—from this date until 1950, except for a period of war service with the RAF. In 1945 he became joint managing director of the Division, and five years later was made chairman of the Salt Division. He was appointed to the I.C.I. board in November, 1952.

Discoloration in Polymers

Recent Applications of Non-Staining Antioxidants

THE discoloration by light of rubber and other plastic products having white fillers is an undesirable feature which, in the case of polymeric synthetic fibres, may even become objectionable. The discoloration of elastic yarn is important because the staining effect may show through the fibre. The light coloured materials of all-weather furniture usually made of PVC and GR-N alloys become discoloured in daylight if not adequately stabilised by suitable antioxidants, and other compositions having white fillers such as white walled tyres and textile rollers, also present undesirable features if stained by light.

The desirable features of an antioxidant in tyre manufacture are good antiflexing characteristics coupled with an ability to prevent discoloration, since the flexing of a product causes molecular agitation and consequent susceptibility to photo-oxidation—urea, thiourea and their substituted derivatives act as ultraviolet light absorbents and find considerable use in applications for resisting discoloration. In this respect waxes also afford protection against light, and wax-like materials made from complex alcohols, ketones, amines or their condensation products have been the subject of modern patents (B.P. 650,610).

Metal Chelates

Some modern techniques involve the use of metal chelates, and the autoxidation of rubber by Cu has been inhibited by the introduction of such complexes as the copper phthalocyanines. The stability of polyethylene compositions to light is again improved by utilising the Cu, Co or Ni chelates of the Schiff's bases of ethylene diamine and salicyl aldehyde (B.P. 677,733). The solubility of antioxidants in water is undesirable since during laundering processes they may be extracted from the fibre; the general insolubility of chelate structures in aqeous media renders them suitable in such applications. Thus 2-hydroxy-benzophenone, utilised as an antioxidant in films and filaments consisting of polymeric vinylidene chlorides, has now been replaced by such chelate structures as the Ca salt of 2 - hydroxy - 5 - chloro - benzophenone. (B.P. 680,409).

Polyalkylated Phenols

The 2,4,6-trialkyl phenols are often utilised as non-staining antioxidants, particularly in compositions comprising synthetic elastomers such as the acrylo-nitrile copolymers and poly-*iso*-butylenes. It is conceded that the efficacy of such antioxidants is related to the nature of the 4-alkyl substituent, upon which depends the formation of the intermediate benzyl radicals essential to the chain termination reactions. Such groups as the tertiary alkyl radicals occupying the 4-position therefore support structures having poor antioxidative characteristics. Improved non-staining properties have been obtained by the use of the more complex homologues as 2,2′-methylene-*bis*-(4,6-dialkylphenol). As in the previous case, the nature of the substituent in the 4-position is of importance, the antiageing characteristics decreasing from Me to *iso*-Pr. The length of the methylene linkage also contributes to the same effect. Certain polyalkylated phenols which cause the stiffening up of GR-N vulcanisates may now be replaced by 2,4-dimethyl-6-octylphenol (U.S.P. 2,605,251).

Such complex nonanes as 1,1-*bis*-(2′-hydroxy-3′5′-dialkylphenyl) nonane possess excellent non-staining properties, and mixes containing these antioxidants after exposure to ultra-violet light for 24 hours, only afford a pale cream stain. The highly objectionable pink discoloration of such diamines as di-β-naphthyl-*p*-phenylene diamine in the presence of light is obviated by the introduction of 2,5-di-*tert*-butyl hydroquinone. The good ageing characteristics of rubber vulcanisates are often attributed to the accelerators present. It is not surprising to note therefore that in some of the modern non-staining antioxidants, such as 2-(dialkylthiazyl)-1,4-dihydroxybenzene, accelerator fragments are substantially present in their structures.

Symposium on Effluent Disposal

Part II—The Industrial Problem

The Graduates' and Students' Section of the Institution of Chemical Engineers held a symposium on effluent disposal in London on 17 April. In our issue of 2 May we published a report of the morning's proceedings and following is a report of the afternoon session which was concerned with 'The Industrial Problem':—

THE afternoon session was presided over by J. T. Calvert, M.A., M.I.C.E., F.R.I.C., of John Taylor & Sons. He first introduced C. Lea, B.Sc. (Imperial Chemical Industries Ltd.), who spoke on 'The Chemical Industry.' After a brief survey of the legislation on sewage disposal and river boards, leading up to the Rivers (Prevention of Pollution) Act, 1951, Mr. Lea estimated that the arrears in expenditure on effluent disposal must now total some £250,000,000, since it had been officially estimated in 1949 that the figure was £72,000,000. He pointed out that any drainage scheme for an industrial site would therefore involve heavy expenditure not only for the factory owner but for the local authority as well. Three classes of effluent must be disposed of from an industrial site: domestic sewage, trade effluent and surface water, and the third was generally forgotten until too late. The first essential, therefore, when planning or re-planning a site, was complete renewal of the drainage system.

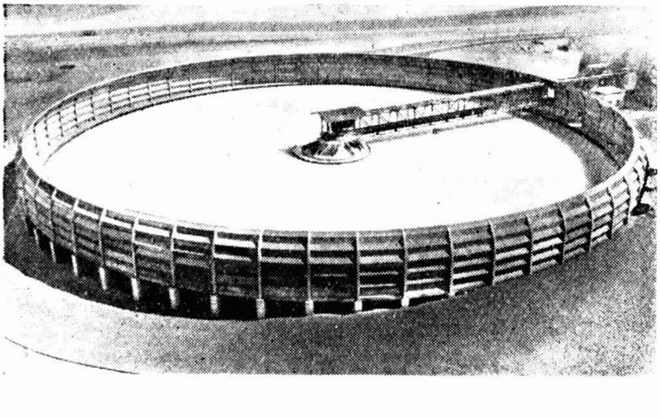
The speaker was not sure that effluent might not possibly be made too clean; how *pure* a water, for instance, would fish tolerate? Pretreatment before passing to the public works was not always either necessary or desirable, and in view of the lack of knowledge about suitable standards, and the manufacturer's probable inability to conform to the conditions that might be imposed by the river boards, he felt that the whole question of standards was premature.

R. F. Stewart, M.C., A.R.T.C., A.R.I.C., M.I.Chem.E., and C. J. Smith, M.Sc., A.R.I.C., (Dorr-Oliver Co., Ltd.), spoke next on 'Plant and Equipment.' Mr. Stewart introduced the subject with a short summary of his thirty years' experience in waste disposal, and divided disposal problems into two classes: those which were relatively straightforward, such as effluent from blast furnaces, pickle liquors, paper-mill waste and beet sugar transport water, and the highly complex effluents from chemical works and coal-gas plants, which might contain as many as twenty different components.

The various types of equipment manufactured by the Dorr-Oliver Co., were described by Mr. Smith. He stressed the advantages of some separation of wastes; for instance, it was worthwhile to keep paper-mill back-washer water separate from the sludges, since the valuable fibre in the former could then be recovered. When it had been decided which of the effluents could be sent direct to the public works, and which must be pretreated, it was better to plan for treatment at a single site. The typical purification plant could be considered in four principal parts.

Blending

The cost of the blending tank might be a



A Dorr-Oliver thickener at the Palliser Works of the Steetley Magnesite Co. This is 240 feet in diameter and the largest in Great Britain

considerable part of the total, since its capacity should be as large as possible. When the rate of input varied periodically, the ideal was to have a tank of a capacity equal to the total input over this period, so that a nearly continuous process could be worked. The tank should be fitted with mixers, or preferably with a recirculating pump. The perfect layout involved draining into the blending tank by gravity, pumping to the top of the treatment plant, and then subsequent working by gravity.

Sedimentation

There was considerable discussion still as to whether a circular or a rectangular tank was preferable for a 'thickener.' On the whole the speaker preferred the circular pattern, since the sludge was removed in a thicker form, and there was less carry-over with the clear liquor. He showed photographs of installations up to 250 ft. in diameter; the rotating rakes which swept the sludge down to the centre as it settled out made about one revolution in twenty minutes, and a 2-3 h.p. motor was quite sufficient for a thickener of 100 ft. in diameter.

Flocculation

Aggregation of particles was achieved by slow mixing, so that small bodies in suspension were brought into contact with one another. If the flocculator were put in before the sedimentation tank, however, there was a possibility that the flocs would be broken up again as the liquid flowed over the weirs into the tank. The flocculator had therefore been combined with the circular pattern of thickener to give a 'clariflocculator.' A centre compartment was fitted to extend from the surface of the liquid to within a foot of the bottom of the tank, and within this compartment was a combination of fixed and moving baffles. These served as the flocculator, the flocs from which settled to the bottom of the tank and became the feed to the thickener.

Filtration

The speaker showed some photographs and diagrams of rotary vacuum filters, which made one revolution in from 1-5 minutes. Presses were still used in some plants but were not so convenient.

Under the title 'Some Specific Problems,' the chairman introduced three short contributions. The first was by H. J. Blythe, B.Sc. (AERE, Harwell), who spoke on the disposal of radioactive effluents. He confined himself to a consideration of liquid effluents, and of the three main sources of these—hospitals, research establishments, and production plants. That from the first could be ignored, since it contained only a low concentration of short-life $\alpha\beta$-radioactivity. The effluent from Harwell and similar establishments was typical of the long-life radioactivity waste from the other two sources. Each building in the establishment was provided with a number of delay tanks, for two classes of waste: that of medium activity and that of low activity. The latter was delayed merely as a precaution, in case any mistake had been made in disposal. The tanks were of 500-1,000 gallon capacity, of mild steel construction lined with polythene or rubber, and contained within another tank of brick lined with bitumen; there was no bottom outlet to these tanks. After analysis the waste was pumped via a system which contained altogether more than 6½ miles of pipeline, to two 300,000-gallon tanks. If the radioactivity of the liquid in these tanks was within the limits imposed by the British Medical Council it was passed for disposal; otherwise chemical treatment was necessary.

Chemical Treatment Complex

Since any of the ninety-eight known elements might be in solution, the problem of chemical treatment was considerable. Alum floc had been found unsuccessful, but tannic acid proved very useful. It readily precipitated the rare elements thus giving a large surface area of precipate for the adsorption of others. Calcium tannate had been found a good adsorbent, but it was too light, and a poor remover of the β-radiation. At first a 'weighter,' such as bentonite, had been tried, but success had now been achieved by precipitation of calcium phosphate with calcium tannate *in situ*. The liquids were brought to 100 ppm PO_4, 10 ppm tannic ion, and taken to *p*H 10.5 with lime.

Other possible methods of treatment included ion exchange and evaporation, but, apart from questions of economy, there were other factors which made these methods unsuitable. The volume of effluent handled would make the size of ion-exchange columns prohibitive, and in the case of concentration, the presence of ammonium nitrate and innumerable catalysing ions in solution would render the risk of explosion too great.

Radioactive sludge was run into an 'active lagoon' or put into concrete-lined steel drums and dumped far out at sea.

J. J. Priestley, M.Sc. (W. R. Holmes Ltd.), spoke next, on gas-works liquors. He said that the gas industry produced about 6,250,000 gallons of effluent a day; the newer plants disposed of a more toxic liquor than the older plants, and they were, moreover, generally larger, and sited further from the communities they served, so that the balance between effluent and domestic sewage was upset.

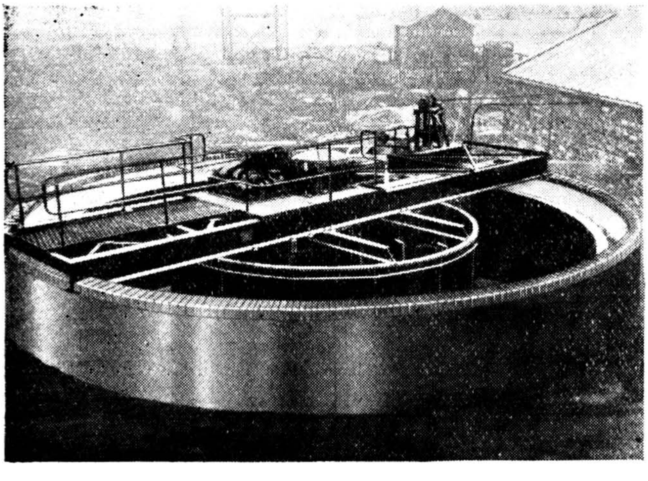
The great bulk of the liquor was produced as a result of carbonisation or during the subseqent removal of ammonia and hydrogen sulphides and had an oxygen absorption value of 10,000-17,000 ppm. Except at Tingley, near Leeds, no gas works in Great Britain could produce a completely purified effluent, and improvement was the most that could be hoped for. Little was known about the effect of gas-liquor constituents on ordinary sewage processes: ammonia, thiocyanate, and some organic substances such as the carboxylic and humic acids were found, however, to be particularly antagonistic to biological oxidation.

Nor more than 0.3 per cent of the dry-weather flow could be accepted by public sewage works from gas plants, or 0.4 per cent if the liquor were ammonia-free. Dephenolation, by such solvents as benzole, methyl alcohol or methyl *iso*-butyl ketone, was found to render the effluent more acceptable; since phenols are relatively easily oxidised, removal of the more intractable constituents should be of even greater value. Electrostatic detarring resulted in some increase of monohydric phenols, but the higher acids were correspondingly decreased. Another worthwhile precaution was the separate storage of tar and liquor.

The first full-scale plant had been installed at Tingley. This gave complete disposal, producing saleable commodities and clean water. It had been found essential to erect it in the particular circumstances, but the cost had been extremely high.

The final speaker was F. F. Ross, M.A., F.R.I.C., M.Inst.F. (British Electricity Authority) who defended the Authority's methods of waste heat disposal. He pointed out that to run all BEA cooling towers at once would require the total output of 76 small power-stations. As it was, the cooling water put through the condensers during the past year had been equivalent to 200 gallons per day per head of population.

It was the opinion of the speaker that the use of river water for cooling resulted in a decrease of pollution, an opinion which he then proceeded to defend. He first put the case against his argument: that an increase in the temperature of the water resulted in an increased rate of bacterial oxygen consumption, that this would result in the bottom sludge becoming anærobic, and that the sludge would rise to the surface in the warm water. In reply to these points, the speaker maintained that all mud is anærobic from a very little distance below the surface, that gas formed in the sludge will always bring it to the surface, and that since the warm effluent is exposed to air over a wide surface, the oxygen uptake would be increased with rise in temperature. He himself knew many good fishing stretches where the temperature quite often was over 90°.



A Dorr-Oliver 'clarifloccu-lator' treating pickling effluent at the Blythe Bridge works of Simplex Electric Co., Ltd.

In opening the ensuing discussion the chairman remarked that, in his experience, the manufacturer quite often found that effluent purification was a paying proposition: he instanced a brewery which had until recently been throwing used yeast into the river, but which now found it to be a profitable by-product.

The discussion which followed was very brief. In reply to a question on the smallest size of gas works which could profitably install a complete purification plant, Mr. Priestley said that it was very doubtful whether it was profitable at all, and certainly not for a works with a capacity of less than 3,000,000 cu. ft. Major Spicer, with reference to Mr. Lea's talk, wondered how it was possible for a River Board to give consent to new discharges unless they had standards of purity; and he expressed disagreement with the arguments of Mr. Ross, asking what waters, what fish were found when the temperature was over 90°.

Summing up the symposium, Professor D. M. Newitt, D.Sc., Ph.D., F.R.S., M.I.Chem.E. (Chairman, Water Pollution Research Committee, DSIR), said that he had been in two minds whether to come up from Hampshire at all, since it was one of those dull April days when the brown olive was on the water and the trout rose in the late afternoon. However, he thought that his day had been well spent, nevertheless. He wondered what could and what could not be done by legislation: it was easy to pass, but difficult to enforce. He welcomed the widest co-operation, and it was the duty of Government institutions to help all they could. He felt sure that the Water Pollution Laboratory was very much alive to the problems of industry, and that Dr. Southgate and his staff would willingly place their experience at industry's disposal.

Pigments & Bleaches

National Titanium Exhibits at the BIF

A SUBSIDIARY of Laporte Chemicals, National Titanium Pigments, Limited, exhibited for the first time at this year's British Industries Fair. Approximately half of the Laporte stand was given over to a display of products utilising the whiteness and opaque properties of titanium dioxide.

The pigment display was of particular interest to the trade at this time because NTP's new titanium oxide factory, the Battery Works at Stallingborough, Lincolnshire, will be shortly coming on stream.

The design of the new factory embodies more than 25 years' experience in the manufacture of titanium pigments, since NTP made the first titanium oxide in this country in 1927. Employing Empire-produced ilmenite, and sulphuric acid manufactured on the same site as its raw materials, the new factory is expected to be able to satisfy immediate demand for titanium oxide. The reasonable expectation of continuity of supplies will be a source of satisfaction to actual and potential users of this important pigment.

The display illustrated a few of the applications of titanium oxide which are already well established. Technical staff on the stand advised their many visitors on many ways in which titanium oxide can be used to improve products in widely varied industries, including paint, plastics, rubber, textiles, paper, ink, leather, glass, vitreous enamel, linoleum and cosmetics.

New applications were also stressed on the Laporte side of the stand. New uses for hydrogen peroxide as a chemical reagent and oxidant as well as a bleaching agent were illustrated. Hydrogen peroxide remains the company's chief product and Laporte are the largest producers of hydrogen peroxide in the British Commonwealth.

The company has developed an interest in many products related to hydrogen peroxide, including oxygen carriers such as sodium perborate, sodium percarbonate, persalts and organic peroxygen compounds. Another group of products which have a link with both the bleaching and the pigment sides of the company's interests are barium products including barium carbonate, chloride and sulphate. The company also has an interest in detergents and sterilising products, in which field details of interesting new developments were released at the Fair.

MR. J. DIXON SMITH, chief accountant at the Billingham works of Imperial Chemical Industries, Ltd., and also a director of the firm, has retired after 33 years' service. He became a director seven years ago. His successor as chief accountant is MR. B. NEASHAM, assistant chief accountant, who in turn will be succeeded by MR. C. M. JENNINGS, of the treasurer's department at I.C.I. headquarters.

Beet Sugar Refining in the U.S.A.

Plants & Processes Reviewed

BEET sugar refining is largely a chemical process and like many others the industry is dependent on the chemical engineer whose work is primarily concerned with the design, construction and operation of equipment and plant which assists the industrial application of the physical and chemical changes of material through the theories of unit operation and applied chemical kinetics.

Much interesting information is contained in the 'Case Study Data on Productivity and Factory Performance . . . . Beet Sugar Refining' (Bureau of Labour Statistics Report No. 6), prepared for the Productivity and Technical Assistance Division of the Mutual Security Agency and distributed in Great Britain by the British Institute of Management, 8 Hill Street, London, W.1 (price, 5s.).

The case studies, based on reports submitted by six selected plants, are not meant to be a substitute for the visits of industry teams or to give novel technical information, but are designed to provide managements with a series of yardsticks by which they can compare their performance with that of U.S. plants.

Particular thanks are due to the men who contributed their time and gave of their technical experience. Through them have been made available data and information on man-hours, output, factory operations, production methods, managerial practices, and machinery which represent the results of many years of research and observation.

Sections of the Report

After an opening chapter which deals generally with the beet sugar refining process, plant characteristics and man-hour requirements, the second section of the report gives technical details of value to the plant superintendent or the production engineer, and the final chapter discusses labour policies and relationships in the industry, together with some labour adjustments to technological changes.

The first refinery described, plant 'E,' is situated in an area where high temperatures did not allow long storage of the beets, so that both speed and co-ordination of beet slicing following receipt of beets and oversize equipment at critical points are necessary.

A maximum of 4,000 tons of beets a day are delivered by railroad cars and trucks, weighed, tested and pumped by two 5,000 gallon-per-minute pumps through flumes to the next process. About 60 per cent of the flume water is recirculated.

After washing and trash removal, the beets pass over a magnetic pulley which removes tramp iron, and are fed to four Ogden slicers. The battery operator co-ordinates the speed of the slicers to the requirements of the diffuser. These slicers are each driven by a 50 h.p. gear-reduction motor and can be varied in speed from 60 to 120 r.p.m.

Automatic Controls

A Merrick Weightometer automatic recording scale weighs the cossettes entering the diffuser and simultaneously regulates the amount and flow of water and its temperature (140°F.) to the diffuser.

The diffuser is a Silver 21-cell continuous type, one of 16 in use in the industry. The unit is installed in two banks, nine cells over 12 cells, through which perforated steel shelves move, driven by 10 three-horsepower direct current motors. The unit is operated by only one man, a saving of about 168 man-hours per 24 hours over conventional batch-type units.

About 98 per cent of the sugar present in the beets is extracted in a cycle time of about 80 minutes, at a uniform automatically controlled temperature (70°C.).

Although most refineries use either the Silver continuous diffusion system as described for this plant or the Roberts batch-type system, another type used is the Oliver-Morton continuous diffusion process. This system consists of a line of 24 to 28 tanks set at a slight incline through which water flows by gravity and cossettes are moved in the opposite direction by means of a scroll and lifter paddles.

In using this method the loss of sugar was reported to have been reduced from 3.10 to 1.86 lb. per cwt. In addition, about 15 lb. fewer of juice, with a higher sugar content, is drawn off with resulting savings in fuel required for evaporation.

Diffusion juice is pumped to heaters where its outflowing temperature is automatically controlled at 85-90°C. Tubes from these heaters are arranged so that they may be withdrawn singly to remove scale. Closed heaters are replacing open injection heaters because a closed heater prevents the condensate from diluting the sugar liquor and will operate on a lower pressure vapour.

Heated juice then enters the continuous carbonation systems through a 14 foot-diameter Benning carbonator where the *p*H is automatically controlled.

Cost & Space Saved

A Benning carbonator replaces the first and second tanks in the conventional Dorr carbonisation system, with saving in equipment cost and space occupied. There is, however, a disadvantage in a single unit requiring the refinery beet end to be shut down if the carbonator becomes so scaled as to require cleaning.

The glass-calomel electrode units develop a small voltage, determined by the *p*H and temperature of the solution, which is automatically and continuously recorded by a controlling potentiometer. The control unit regulates the addition of kiln gas or liming reagent. The gassed limed juice, under a pressure of 7 lb. p.s.i., is clarified in a 28-foot Dorr thickener and heated by a third vapour to an automatically controlled temperature of 85°C.

After the second carbonation in which the *p*H controller regulates the amount of gas introduced, the juice is filtered and pumped to the sulphur tower. The amount of sulphur dioxide gas introduced is automatically controlled by a *p*H instrument. The thin juice from sulphitation is pumped to a boiler where temperature (98°C.) and juice level are automatically controlled, and to heaters (148°C.).

Continuous carbonation systems are now widely used and offer large savings in labour and maintenance over the older batch-type methods. In 1920 no known continuous systems were in use in the U.S.A.; in 1947 more than 66 per cent of the refineries had continuous first carbonation and more than 94 per cent had continuous second carbonation.

Because of transportation costs if the refinery is located at a distance from the supplier, sulphuring by the addition of liquid sulphur dioxide is seldom used, although the method eliminates many of the difficulties arising from the use of the sulphur stove.

The Swenson, five-effect long-tube evaporators using automatic pressure controls are so designed that the vapours provide heat for numerous other operations. The flow of juice to the first effect is automatically controlled and constant juice levels are automatically maintained in all effects.

Thick-juice effluent from the fifth effect is blended with centrifugal wash-syrup and high-raw melted sugar and is filtered in seven plate and frame filters (840 sq. ft. each), using a refined diatomaceous filter aid (Johns-Manville High Flow Super Cell).

Next the high-quality liquor goes to a storage tank (1,620 cu. ft. capacity), also with automatic temperature control, from which it is drawn by vacuum to the two white pans (1,300 cu. ft. each).

Automatic pressure controls govern the calandria-type Stearns-Rogers vacuum pans and vapours are drawn off with automatically operated water-jet condensers. Calandria-type pans can operate on much lower steam pressure than coil pans. There is no successful type of automatic vacuum pan controller for beet massecuites which can cover all variables, although it is used in cane sugar refining. The massecuite from a strike flows to a mixer (1,300 cu. ft. capacity) and then to six centrifugals.

The centrifugals are 40 in. in diameter, 30 in. deep, and run at 1,600 r.p.m., with individual motors and fluid clutch, completely automatic except for filling and discharging. In the companies surveyed in this report, two to three centrifugals are operated by one man who, in some cases, only pushes a button to load and start the cycle. The sugar is then conveyed (510 lb. per minute) by scroll and elevator to the wet sugar bin (30,000 lb. capacity) and then to a Rotolouvre granulator.

Purified Air Used

Air, which is purified by ionisation through a 13,000 volt, direct current grid Precipitron, enters the dryer at an automatically controlled temperature. In this type of dryer the air is forced through the sugar instead of the sugar being moved through the air, with a claimed increase in lustre preservation.

The sugar is then elevated at a rate of 505 lb. per minute, screened, automatically weighed by 100 lb. lots and dumped into one of four cylindrical bulk bins each 50 ft. in diameter, 106 ft. high and holding 10,000,000 lb.

Air dried by a calcium chloride dehumidifier, is circulated in the bins to maintain a low relative humidity.

Plant 'A' was the smallest refinery included in the report with a slicing capacity under 2,000 tons per 24 hours. The plant is under control of a parent company which performs such functions as administration, sales and purchasing in addition to research, standardisation of chemical analysis, and production control.

Research at the plant is directed towards reduction of lime usage, better waste disposal, less scaling, and by-product development. Improvements have been made in methods of trash, mud, and rock handling to overcome problems created by mechanical harvesting. Pulp press water is not used in diffusion, nor is an anti-foaming agent. Both activated carbon and filter aid are added before thick-juice filtration. The plant has 11 centrifugals which are loaded and discharged manually by four men while all parts of the cycle are automatically controlled.

The newest plant in the report was Plant 'B,' which is of medium size and has more equipment of later design than the other refineries. This includes Silver chain-type continuous diffuser, automatic *p*H and evaporator controls, automatic carbonation end-point control, and automatic (except discharge) centrifugals.

Research at the plant includes methods of disposal of pulp press water, which is being used in diffusion, and laboratory-scale study of the ion exchange process. Beets are stored, as at most of the other plants, in piles over metal ducts with openings through which blowers force air for ventilation of the pile. No antifoaming agent is necessary because of high purity beets.

Carbonation Juice Filtered

First carbonation juice is filtered on rotary vacuum filters, which require about ½ hour for cleaning every eight hours. Only three of the four filters are used at one time. The cloths of the plate and frame presses at second carbonation require about two hours for cleaning every 24 hours. As in most plants, waste water goes to a pond and is later discharged into rivers. Waste lime cake is also pumped to a small pond.

Beets are generally received by truck, stored in unventilated sheds, and carried to the factory by open flumes. Some 85 per cent of the flume water is recirculated, whereas between 50 to 60 per cent is recirculated at Plants 'A,' 'E' and 'F.' Plants 'B' and 'D' reported none.

About 75 per cent of the sugar content of the molasses from regular refinery operations is recovered at this plant by the Steffens process. The waste from this process is concentrated and sold for the recovery of monosodium glutamate. Almost half the sugar produced during the campaign is stored in bulk for packaging between campaigns.

Costs Limits Improvements

Erected in the middle of the 1920's, Plant 'D,' has adopted many of the automatic controls more recently developed. The cost of major equipment replacements has prevented this refinery (and others erected before 1940) from installing certain improved methods such as continuous diffusion. As at most of the other refineries the best piles are ventilated and the warehouse is air conditioned.

Plant 'F' is the largest described in the report. Although much of its equipment is 40 years old, it has an up-to-date continuous diffusion system and also continuous carbonation. This older equipment, particularly filters and presses, accounts for much of the higher man-hour requirements of this plant.

Lime cake, which is a waste-product at other plants, is processed at Plant 'F,' for the recovery of lime. During the 1951 campaign almost 5,000 tons of lime were recovered, reducing the requirements of coke by almost 600 tons. The pulp from diffusion is pressed and dried at this plant. Water from pressing, which is also a waste product at all other plants except Plant 'B,' is clarified and used in the Steffens operation to dilute molasses. Approximately 2.1 additional tons of sugar is recovered from every 1,000 tons of pressed pulp water sent to the Steffens process.

The ion exchange process of juice purification has been tried or proposed for treating diffusion juice, second carbonation juice, green syrups, molasses, and Steffen filtrate. At present three beet sugar refineries are equipped to use this process on second carbonation juice. In the process the juice flows through beds of resins or exchangers which remove practically all of the salts and many of the organic impurities from the juice before it is boiled.

Advantages claimed for this process over conventional methods include increased yields of granulated sugar, with reported extractions up to 93 per cent; higher purity; better colour removal; lower ash content: crystallisation of two or three 'strikes' of white sugar instead of one; elimination of evaporator and pan boil-outs; fewer processing problems; production of edible molasses; and improved by-products.

Costs a Disadvantage

Disadvantages which have limited the wider adoption of the process are the high initial cost of new equipment, the high costs of the resins and regenerating chemicals, and costs of transportation for the materials. The equipment of the surveyed plant includes four pairs of tanks with heads designed for a working pressure of 60 lb. p.s.i. The tanks, pipes, and valves are rubber-lined for protection against acid. The process is controlled by the push-button operation of switches which open or close the valves.

Although European beet sugar refineries do not try to recover additional sugar from beet molasses because of its values as a source of alcohol, yeast, and stock feed, this practice, called the Steffen process, is fairly common in the U.S.A. It consists of adding powdered dry lime (CaO) to the cold (about 12°C) and diluted (about 6 per cent sucrose) molasses syrup under agitation. The lime combines with the sugar to form tricalcium saccharate which precipitates and is filtered. The filtrate is heated and the precipitate removed by settling and filtration. The final filtrate serves as a raw material for the recovery of by-products.

The two filter cakes are dispersed in about 10 per cent refinery sweetwater, heated and added into the factory carbonation with the diffusion juice, replacing the milk of lime used in conventional refineries. The heated saccharate then decomposes to sugar and calcium hydroxide, which serves as the purifying agent for the diffusion juice. In plants where the Steffen process is used the total recovery of sugar is almost 90 per cent.

In one refinery in the U.S.A. the Steffen discard-molasses is subjected to the barium saccharate process and rotary kilns are used for barium regeneration. The world's principal source of raffinose is crystallised directly from the final molasses in this plant.

Although it comprises only 4 per cent of the total volume of refinery waste the Steffen filtrate is responsible for almost half the biochemical oxygen demand, and as such creates a serious problem of disposal. Some refineries have installed equipment which carbonates and concentrates the filtrate, which is then sold to manufacturers of amino acid products.

Several plants recover monosodium glutamate by alkaline hydrolysis of the concentrated Steffen filtrate. After hydrolysis of the filtrate with a 50 per cent solution of caustic soda, the liquid is partially acidified with hydrochloric acid and again concentrated.

This mixture of hydrochloric and glutamic acids creates a difficult problem of metal corrosion which requires the use of stainless steel or rubber-lined equipment. The concentration results in the crystallisation of inorganic salts which are removed by centrifugal action. The filtrate is further acidified and the solution crystallised, the latter requiring five to eight days; the crystals are separated by high-speed centrifugals.

By processing the filtrate, betaine may be obtained. The crude glutamic acid is then purified, concentrated and centrifuged, producing pure (almost 100 per cent) monosodium glutamate.

Control of production of granulated and liquid sugar, pulp, molasses, process-materials and by-products is of considerable importance to the industry. Data indicating the performance of the various operations are recorded by foremen, chemist samplers or operators.

These reports show both operating characteristics of the equipment and chemical or analytical results of tests on the material in process. A major control item is also the listing of delays and their causes.

Numerous chemical tests and analyses of all phases of operations are being conducted continually for both control and improvement of operations.

Owing to the lease on their present premises having expired, W. T. Bruce & Co., Ltd., have now moved their head office to 16 Wood Street, Kingston-on-Thames, Surrey. The telephone number is now Kingston 4237.

Non-Ferrous Metals

Statement on Research Association's Progress

IN the course of a statement presented at the 33rd annual general meeting of the British Non-Ferrous Metals Association, on 22 April, Lieut.-Col. the Hon. R. M. Preston, chairman of council, said most of the research programme had been concerned with the improvement of materials and processes used by different sections of the membership, but there was also in hand some more fundamental and longer range work of less direct immediate application.

An example in this group, he continued, was examination of the properties of titanium alloys for the Ministry of Supply. Much had been said about the future of titanium as an industrial metal, and, if it was advisable to take a little salt with some of the statements, there was no doubt that it would be foolish to discredit this material unduly on account of its present high cost and the other disadvantages which it certainly possessed.

Thirty-two main researches had been included in the Research Department's programme during the past year; six had been terminated or suspended, and eleven new researches had been started in 1953.

Of the completed researches, Lieut.-Col. Preston referred especially to the successful conclusion of the investigation of the causes and prevention of stretcher strain markings in certain aluminium alloys when used for sheet pressing. A basic study of the mechanism causing these unsightly markings led to practical recommendations for their avoidance and, during the past year, the effectiveness of the remedial measures had been confirmed by works trials carried out by several members.

The Electroplating Field

Some particularly interesting work had also been done during the year in the electroplating field. Work designed to examine properties of alternatives to nickel as a protective undercoating in chromium plating had not only demonstrated the relative efficiency of a variety of such alternatives, but had also brought to light some very interesting information about standard nickel-plated finishes which was being followed up.

Referring to research and development work in which members were directly co-operating, Lieut.-Col. Preston said the experimental trials of refractory linings for Ajax-Wyatt melting furnaces for copper and high-copper alloys in members' works were progressing satisfactorily. The Liaison Department, in conjunction with the Research Department, had been visiting members who were making use in their foundries of the association's work on insulating sleeves for feeder heads and of the nitrogen degassing technique for bronze.

Analytical Research

One field of activity which was of interest to nearly all members was that of analysis and here co-operation in research was extensive and fruitful for the analysis of major constituents in copper alloys and for aluminium and lead alloys; a start had been made on a new research on physico-chemical methods of analysis which would be carried out on the co-operative basis.

In the analytical sphere suitable progress was being made with study of the copper alloys, using the direct recording spectrographic equipment installed last year, and there seemed every prospect that the Quantometer would fulfil its promise in copper and copper-alloy analysis.

The drive for higher productivity which had been much discussed of late fell closely in line with the work of the association, particularly that of the Liaison Department. Nearly all their efforts, directed for example towards better and sounder castings, new and improved materials, more rapid methods of analysis and so on, aimed ultimately at economies in time or material.

A more detailed review of the progress made in the association's research work during the past year is given in the annual report, which also gives a list of researches and another of the confidential reports available to members.

Proposing the toast of "The British Non-Ferrous Metals Research Association" at the luncheon following the annual meeting, Brigadier A. R. W. Low, Parliamentary Secretary to the Ministry of Supply, said that in the field of research and technical information, together with the liaison of industry which went with it, a little more effort today might lead to so much more reward in the future. He knew that much research went on inside industrial firms, but the work done by an association like the British Non-Ferrous Metals Association was most valuable because its successes went to such a wide variety of firms.

The Association's effort depended on the moneybags. In the end those who put up the money for research activities would put up more or less in accordance with their estimate of the value and efficiency of the association's work. They would first want to know that the association did not waste money and he noted with envy their success in making a real saving last year.

Brigadier Low went on to say that he was a wholehearted and completely convinced protagonist (though very amateur) in favour of the expenditure of money and effort on the best application of the best science to industry—for peaceful commercial purposes just as for defence purposes.

They would grow richer in the next 50 years, not because of the material resources of this country or even of the Commonwealth, but because of the fullest use of the brains of their men and the scientific knowledge that had been built up.

Lack of Fuel Technologists

Institute's Endeavour to Meet Demand

THE need for employing a far greater number of technologists if Britain was to make the most efficient use of her fuel was emphasised by Dr. G. E. Foxwell, the president, at the annual luncheon of the Institute of Fuel held in London on 23 April, and attended by some 600 members and guests.

Proposing the toast of 'The Institute of Fuel,' the Rt. Hon. Geoffrey Lloyd, M.P., Minister of Fuel and Power, said that although young the institute was one of the leading institutions of Britain. Recognition of its status had been marked by the granting of a Royal Charter a few years ago, and lately by the acceptance of honorary membership by H.R.H. the Duke of Edinburgh.

Britain today, declared the Minister, had to face competition in the economic field from other states which had a far greater fuel potential. It would require the skill of all her industrial scientists to meet the challenge in the next few years.

Responding to the toast, the president, Dr. G. E. Foxwell, paid a tribute to the work of the Ministry of Fuel and Power, particularly its technical branch, and outlined some of the developments of particular significance that it was promoting. In all fields of fuel utilisation the institute stood behind the Ministry. It was independent of any industry or corporation, but it served all.

One of its major objectives was to ensure that there was thoughout the country a sufficient number of adequately trained and experienced fuel technologists.

Fuel technologists might be of two categories: (1) The specialist devoting his whole energies to the profession; and (2) the engineer, chemist, chemical engineer, electrical engineer, and so forth, engaged mainly in his major profession, but having in addition knowledge and experience of fuel technology to a standard adequate for corporate membership of this institute.

To this end the institute had, within these last two years or so, overhauled its educational policy. It had brought the practice of admission to membership into line with that policy. Its qualifying standard was as high as that of any qualifying body in the country. Moreover, the practice of fuel technology could not advance unless it walked with science, and the institute was therefore greatly expanding its *Journal* to permit the inclusion of scientific papers on the subject.

Unless the institute succeeded in creating an adequate body of fuel technologists, the Minister's fuel policy when it emerged would be still-born. If the institute succeeded, the task would be accomplished. Men could devise all the policies in the world but they would fail if the individual effort and knowledge were not behind them.

Higher Ratio Needed

There was a tendency in some quarters to think that there were too many people who were not manual workers. This was particularly urged against the nationalised industries. As so often happened, the truth was the exact opposite. The visit of productivity teams to America had shown that Britain needed to employ not fewer, but many more technologists in relation to manual workers. It was imperative that this country should secure the efficient use of its fuel, and it was only through technology that it could do so.

Progress of Monsanto Chemicals

Chairman's Review of the Past Year

THE effect of the emphatic shift during the year from a seller's to a buyer's market, as a result of economic changes within industry both at home and abroad, is commented upon in a statement by Mr. Edward A. O'Neal, Jr., chairman of Monsanto Chemicals, Ltd.

The statement, which has been issued in connection with the annual meeting of the company, to be held in London on 27 May, says that as a result of the changes the company's programme was promptly revised.

The results for the year ended 31 December, 1952, fell short of original estimates in respect of turnover and net profit—£293,718—was well below that of 1951—£919,033.

Profit margins, states Mr. O'Neil, suffered because of lower selling prices forced by intensive competition, especially in export markets, as well as from irregular operations during the second and third quarters, and continued increases in raw material and labour costs. Nevertheless, the total value of goods sold was well maintained at just 3 per cent below the 1951 level, and the tonnage of goods showed an increase of approximately 10 per cent. Especially gratifying was an increase of goods exported from 33 per cent of total sales in 1951 to 39 per cent in 1952.

Mid-Year Sales Decline

High levels of operation were attained during the first and fourth quarters, but full utilisation of productive capacity was not possible owing to the mid-year decline in buying on the part of several major customer industries, notably textiles, plastic moulding, metals, lubricating oils, detergents and rubber. Curtailment of output, both at Newport and Ruabon factories, became necessary to correct inventory build-up, and resumption of fuller operations was not possible until sales demand improved during the last few months of the year.

Turning to significant developments, Mr. O'Neal recalls that the first £1,500,000 of a total of £3,500,000 5 per cent Unsecured Loan Stock 1982 was issued in August 1952. The additional funds so made available were reflected in the increase in total assets at 31 December, 1952, to the record level of £12,925,629.

Part of the new moneys had been employed in new plant and equipment at Newport, Ruabon and Fulmer, and for increased working capital for raw material and finished goods inventories. A sum of £478,426 was used in taking up the company's proportionate share of a rights issue of additional ordinary capital by Monsanto Chemicals (Australia) Ltd.

Biological Effluent Plant

Important new facilities commissioned during the year at the Ruabon factory included the final stages of the biological effluent purification plant, which had been deemed the latest in technology in the field and was proving satisfactory in every way.

Also commissioned in 1952 at Ruabon were a fifth unit for the production of phthalic anhydride; increased capacity for the production of synthetic phenol, aspirin, phenacetin and other related pharmaceuticals, additional warehouses; and the first stage of a major pilot plant unit for supplementing the company's research and development effort with facilities for interim production of promising new projects. A major project for the production of Syton, a product used in the treatment of textiles, was completed and successfully put into commercial-scale operation.

At the Newport factory the extensive construction programme started in 1947 was completed and numerous improvements were made. A new unit for the production of organic silicates was completed, also a unit for the production of Stymer, a promising new product with important uses in the textile industry.

The new research laboratories at Fulmer Hall, Buckinghamshire, had been fully equipped and staffed. The year also saw the completion of further facilities for research to discover new applications for plastics, adhesives, rubber chemicals, fungicides and agricultural and textile chemicals.

A final ordinary dividend at the rate of 11⅔ per cent (less tax) is recommended by the directors, bringing the total for the year to 18⅓ per cent.

The Chemist's Bookshelf

TEXTBOOK OF QUANTITATIVE INORGANIC ANALYSIS: I. M. Kolthoff and E. B. Sandell. 3rd Edition. New York: The Macmillan Company. London: Macmillan and Co., Ltd. 1952. Pp. xv + 759. 30s.

There is no need to introduce or to recommend this book to chemists, since it is now, deservedly, quite as firmly established as one of the standard textbooks in Great Britain as it is in America. Prospective purchasers will therefore really only be concerned to know the extent of the alterations and additions in this new edition.

The whole book has been completely reset. A larger format (page size $9\frac{1}{4}$ by 6 in.) and a new style of type, in three sizes, give a more open and more pleasant appearance to the page.

Chapter IV, dealing with the law of mass action, is extended to include a short discussion of acids and bases in terms of the Brönsted theory. Chapter VI, on quantitative separations, has been extensively rewritten, and in particular the treatment of organic precipitants has been thoroughly revised. Additions have been made to such important topics as separation by solvent extraction and adsorption. There has been some re-writing of the statistical part of Chapter XV on errors.

Little that is significant has been added to the sections dealing with standard gravimetric and volumetric procedures, the most extensive additions being those dealing with newer indicators in oxidation-reduction titrations, and alternative procedures for chloride by Volhard's method and for oxalate by permanganate titration.

The remaining additions of any material extent have been in the section dealing with physicochemical methods, and the chapter on analysis by physical methods, which incorporates the material in Chapter XLII of the older edition, has been considerably extended and revised in some of its sections.

Occasional modifications have been made in the procedures for the analysis of complex materials.

It is perhaps a little disappointing that little attempt has been made to include a few of the more notable techniques or reagents which have been developed over the past ten years. Thus methods based on precipitation in homogeneous solution have considerable significance but are hardly referred to; and none of the many uses of ethylenediaminetetra-acetic acid receive any mention. One could list half a dozen topics of this nature which are probably now well enough established to receive more than passing mention, at least in the theoretical section, if not in actual practical exercises.

However, in spite of this decided lack of new matter, the book remains an eminently sound introduction to the fundamental ideas and operations of analytical chemistry. It will continue to stand high on the list of recommended textbooks.—C.L.W.

A LABORATORY MANUAL OF PHYSIOLOGICAL CHEMISTRY. By D. Wright Wilson. 7th ed. 1952. Bailliere, Tindall & Cox, London. Pp. 294. 24s.

That most laboratories jealously indulge the whim of devising their own practical courses, many prepare cyclostyled manuscripts specially for this purpose, and some even arrive at the ultimate folly of embodying their courses in book form, are observations from experience that cannot be denied. Independence, it would seem, is the alpha and omega in this matter. And this is not surprising when we consider the differences of space, of equipment, of time and especially of tradition which first tend to fashion and then to distinguish the teaching of one laboratory from that of another. No wonder that most practical manuals are doomed to a very local success, with elsewhere a neglect, we must suppose wholly unmerited. The elementary biochemical courses for medical, dental and veterinary students offer no exception to this rule, and in the face of such conservatism it might seem useless to claim for any published practical syllabus a more universal appeal. Yet Professor Wright Wilson's book surely deserves this claim, and for reasons that are not too difficult to discover.

First, and most important of all, the book is honest: it never fails to remember that somewhere or other on the student's shelves there is another book dealing with the subject in its theoretical aspects. This means both a saving of space and a more refreshing text, in which one does not have to hunt for experimental methods, written in small type, at the end of long, irrelevant, theoretical discussions. There are discussions in this book, but they are just the ones the student needs in the laboratory: the use of the photoelectric absorptiometer for instance—which is well treated—or the consideration of the actual reaction involved in a titration. Beyond this Dr. Wright Wilson refuses to go, and his book accordingly maintains its form and specific usefulness.

A second point on which the book may be commended is its balance, both in its detailed aspects, where no concession is made to exotic modifications of simple tests (though the xanthoproteic test is perhaps too mercilessly reduced), and in its larger design. Two-thirds of the total space is given to 'Body Tissues and Fluids,' and here the large section on the quantitative analysis of blood is admirably set out, and in fact is felt as the very backbone of the course. It is undoubtedly this satisfying sense of structure and relatedness, imposed on the series of heterogeneous experiments which normally form the course of practical physiological chemistry, that will be this book's main claim to the student's attention.

The 'lecturer-in-charge' may profit in other ways, not least in the stimulus the book gives towards the introduction of modern biochemical techniques into an elementary course. Paper chromatography, the Warburg apparatus and even the Geiger counter all make their brief bow in its pages, while the author's suggestions for dietary experiments and the elementary management of an animal colony will be recognised as having the highest importance by all teachers whose task it is to present practical courses of this type.—F.N.M.

MASSANALYSE. By G. Jander and **K. F.** Jahr. Sixth edition, 1953. Vol. I, pp. 140. Vol. II, pp 139. Walter de Gruyter and Co., Berlin. Each volume DM. 2.40.

The sub-title of this little two-volume work is 'Theory and Practice of Classical and Electrometric Titration Methods.' When the first edition appeared, 1935, the work was up to date, and formed an impressive introduction to titrimetric analysis. Close comparison of the sixth with the first edition fails to show any major alteration. The only differences that can be found are the correction of a few misprints and three minor additions, each of less than a page in extent, and none of them introducing any outstanding recent procedures. It is a pity that the authors have not fulfilled the early promise of the book by including some of the many advances that have been made in titrimetric procedures in the past 20 years, so that the book does not now make the same impression of freshness.

The selection of methods contained in the book covers quite a wide range, and students in this country could use it both as an alternative account of standard methods and as a training in German translation. The language is straightforward and simple. However, in using it they should bear in mind the failure of the authors to include any method more recent than 1935, and should therefore not regard it as the last word on analytical chemistry.

The volumes are paper-bound, and in the truest sense of the word are pocket-size, the page size being 6 in. x 4 in.—C.L.W.

REVISION TESTS IN ORGANIC CHEMISTRY. By W. E. Morris. Methuen, London. 1953. Pp. 54. 2s. 9d.

Although 26 tests, each comprising 10 questions, seems hardly sufficient, students will find that the author has selected his problems from a wide range, and this little pocket book should be useful for the last-minute 'refresher.' The book's great value is that it also includes the answers, which seem on inspection to be generally reliable. The author hopes that it will be used by those studying for the General Certificate of Education (Advanced and Scholarship papers), 1st M.B. and Inter B.Sc. examinations, and even by first-year university students.—B.I.

· PERSONAL ·

Mr. H. Middleton, M.Sc., F.R.I.C., senior lecturer in organic chemistry at the Technical College, Bradford, is shortly to retire. In recognition of his 42 years' teaching at the Technical College, a presentation is to be made to him at the end of term. It is thought that many of his old students may wish to make contributions, and these should be sent to Dr. W. R. Moore, senior lecturer in physical chemistry.

Mr. R. D. Hamer, vice-president and director of Aluminium Laboratories, Limited, has been elected president of the Aluminium Development Association for the coming year. After early schooling in England, Mr. Hamer attended a university in Canada, graduating with the degree of B.Sc., followed by two years post-graduate studies in Berlin. He travelled extensively in Europe and finally joined the Aluminium Company of Canada, Limited, as a chemical engineer. He took an active part in the war-time construction of the expanding aluminium industry in Canada, and in 1945 joined Aluminium Laboratories, Limited, the technical management company of the Aluminium Limited Group, of which Northern Aluminium Company, Limited, Aluminium Union Limited and Stand Limited are members, and became a vice-president and a director in 1950.

The new vice-president of the Association is **Mr. H. G. Herrington**. **Mr. G. W. Lacey** was re-elected chairman of the executive committee of the Association.

At the annual general meeting of the British Laboratory Ware Association, Ltd., held on 15 April, **Mr. J. S. Towers**, of J. W. Towers & Co., Ltd., was re-elected chairman for the ensuing year. The following members of the council were also re-elected: *Vice-chairman*: T. A. **Dryden** (T. Dryden, Ltd.); *treasurer*: N. **McKinnon Wood** (Griffin & Tatlock, Ltd.); *members*: J. E. C. **Bailey**, C.B.E. [Baird & Tatlock (London), Ltd.]; F. N. **Branson** (Reynolds & Branson, Ltd.) V. J. **Martin** (Brady & Martin, Ltd.); W. H. **Nicolson** [W. B. Nicolson (Scientific Instruments), Ltd.]; C. **Preston** (J. Preston, Ltd.); A. W. **Rundle** (A. Gallenkamp & Co., Ltd.); N. **Trepte** (W. & J. George & Becker, Ltd.); W. H. **Adams** (secretary, BLWA). On the technical committee D. **Allan** (Townson & Mercer, Ltd.) was re-elected convener and the other members were: S. J. **Davies** (A. Gallenkamp & Co., Ltd.); C. A. **Merry** (Griffin & Tatlock, Ltd.); A. **Cowling Smith** (W. & J. George & Becker, Ltd.); S. J. **Kennedy** [Baird & Tatlock (London), Ltd.].

Mr. J. P. Digby, director of Ceimici Teo, industrial alcohol manufacturers, has been appointed by the Irish Government to the Electricity Supply Board, the official electricity authority, for the next four years.

Mr. R. W. Rutherford, who joined Ashmore, Benson Pease & Co., Ltd., and its parent organisation, the Power-Gas Corporation, Stockton-on-Tees, in 1917, has been appointed deputy managing director of the concerns. Mr. Rutherford was formerly the firm's representative in Japan and in 1938 was appointed technical sales manager. In 1944 he was appointed a director of Ashmore, Benson and four years later was elected to the board of the Power-Gas Corporation. He is also a director of Rose, Downs & Thompson, Ltd., Hull, an associate firm of the Stockton companies.

The three new members among the eleven elected to the Council of the Textile Institute are **Mr. John Boyd**, textile technologist of Courtaulds, Ltd., Use-Development Organisation, Manchester; **Mr. C. H. Crabtree**, chairman and managing director of Charles Crabtree, Ltd., Tormorden, and **Mr. W. A. Dutton**, assistant director of Research of the Hosiery & Allied Trades Research Association. Retiring members re-elected are **Mr. C. H. Edwards**, head of the Department of Textiles, Nottingham College; **Mr. J. C. H. Hurd**, head of Leicester School of Textiles; **Mr. G. Leasby**, director of the British Nylon Spinners, Ltd.; **Mr. R. G. Oversby**, of Bradford College; **Mr. E. J. D. Poole**, Wool Industries Research Association, Leeds; **Professor J. B. Speakman**, of Leeds University, and **Dr. F. C. Wood**, of Tootals, Limited, Manchester.

• HOME •

Varley Pumps

The controlling interest in Varley Pumps & Engineering, Ltd., Brentford, Middlesex, has been acquired by Food Machinery & Chemical Corp., San Jose, California. The company will manufacture FMC's 'Peerless' pumps, agricultural sprayers, and food processing machinery.

Coronation Dress

Tins of Pears Baby Powder now appear in a new coronation dress. The tin has a wrapper illustrating the coach and escort against a royal purple background adorned with coloured bunting. The price is the same as for the standard pack.

Wrong Impression

It has been drawn to our notice that in the report of the annual dinner of the British Chemical Plant Manufacturers' Association which appeared in our issue of 25 April, the impression was given that Sir Harold Hartley referred to an annual exhibition of chemical plant. This reference was, in fact, to the chemical plant section of the Engineering, Marine and Welding Exhibition which will be held at Olympia from 3-17 September. There is no annual exhibition of chemical plant.

The Number of Scientists

In reply to a question by Mr. F. Lee in the House of Commons on 28 April, the Chancellor of the Exchequer announced that the number of scientists and technologists coming from the universities and technical colleges of Great Britain with degrees, Higher National Certificates and Higher National Diplomas, or their equivalent, in the academic year 1951-52 was estimated to be one in about 2,600 of the population. The Government was doing its best to improve facilities.

Gas from Crude Petroleum

Because of shortage of gas-making coal West Midland Gas Board is to build an experimental plant at Stafford to extract gas from crude petroleum for domestic use. It is expected that the plant will take about 12 months to complete and that an extra 1,000,000 cu. ft. of gas a day will be produced to boost the town's supply.

Fertilisers: U.S.A. Grant

In reply to a question in the House of Commons, the Minister of Agriculture, Sir Thomas Dugdale, said the grant made by the United States Mutual Security Agency to meet the cost of demonstrating the use of fertilisers to British farmers amounted to £41,000. He added that he was satisfied that the demonstrations would make a very valuable contribution to the Government's policy of stimulating greater agricultural production.

Additional Publicity

A few of the exhibitors in the chemical section of the British Industries Fair at Olympia may receive some unexpected additional publicity. On Tuesday afternoon some scenes for a new British film were 'shot' alongside the stand of the Association of British Chemical Manufacturers and in front of that of Laporte Chemicals Ltd. The star of the film ('Three Steps to the Gallows') was the American film actor Scott Brady and the scenes showed him being pursued by a gunman through the BIF crowds. Among the stands nearby (and probably within camera range) were those of W. J. Bush & Co. Ltd., Brotherton & Co. Ltd., and Hickson & Welch Ltd.

Recruiting Lecture

The scope of chemical engineering as a career was outlined by Prof. A. W. Scott, B.Sc., Ph.D., A.R.T.C., M.I.Mech.E., of the Royal Technical College, at the 8th of the series of career talks sponsored by the Glasgow Education Department. Purpose of the series is to give school-leaving pupils a summary of possible careers, with a view to encouraging recruitment to the most suitable industry.

Atomic Power Station

Work on the world's first atomic power station—at Calder Hall, Sellafield, Cumberland—will begin shortly, according to an announcement by the Minister of Supply, Mr. Duncan Sandys. It is stated that the station will 'almost certainly' be an improved type of natural uranium reactor enclosed in a pressure shell. The heat produced will be transferred by a gas under pressure through a heat exchanger to a conventional electric power generator.

· OVERSEAS ·

American Chemical Wages

Chemical wages in the U.S. were ahead of the nation's all-manufacturing average throughout 1952, reports *Chemical Week*. The biggest rise was for soap, glycerin and detergent workers, and the next largest for synthetic rubber employees. Chemical workers averaged 25 per cent more weekly pay in 1952 than in 1948, but the rise in the cost of living brought this down to an overall rise of 15 per cent in purchasing power.

Latest German Dyestuffs

Two of the successor companies to I.G. Farbenindustrie have recen ly introduced three new dyes. Farbwerke AG, Hoechst are producing Remalanbrillant-blau B, which is claimed to surpass all the known acid blue dyes. BASF, Ludwigshafen, are marketing Basolanchromrot, a uniform red for after-chromiumising, and Lurantin light turquoise blue FBL, a substantive dye which will withstand bleaching.

Japanese Titanium

An agreement has been signed between Nippon Titanium Co. Inc. (Tokio) and R. S. Aries & Associates (New York) for the production of several grades of titanium pigments in Japan. It is anticipated that 150 tons per month will be in production by late 1953.

Mexican Sulphur Production

It is expected that sulphur production in Mexico this year will exceed 50,000 metric tons. Production will soon be started in the State of Vera Cruz by the U.S.A.-owned Mexican Gulf Sulphur Company, with an anticipated output of 40,000 metric tons a year. Moreover, deposits of about 800,000 tons on the Island of Socorro will be worked for the first time this year. Production at existing mines in the State of San Luis Potosi has been scheduled to be increased from recent annual averages of 10,000 tons to 35,000 tons this year.

Japanese Trade Policy

Long-range plans formulated by the Japanese Government to bolster the country's declining export trade include the raising of exports of chemicals and reducing production costs on heavy chemical products.

Trinidad Expansion

It is reported that Trinidad Leaseholds, Limited, are to form a subsidiary company to produce industrial chemicals locally. Work on installation of plant and equipment valued at $1,500,000 is progressing at Pointe-a-Pierre. Towards the end of this year production is expected to begin on a range of chemicals, including sulphur and sulphuric acid and chemicals used in the paints and plastic industries.

Potash in Western Germany

No further expansion of the potash industry in Western Germany seems possible according to a report made recently in Hanover by Mr. G. Schmelz of the Potash Sales Organisation. By the end of the harvest year (30 April, 1953) the 18 companies would have produced 1,300,000 tons of pure potash, Mr. Schmelz estimated. Of this total some 770,000 tons were destined for domestic use and 420,000 tons were being exported. The taking into storage of over 100,000 tons showed that supply had now caught up with demand.

Chilean Nitrate Problems

A report from Santiago states that the Government has abandoned its proposal to take over and operate the nitrate plants on account of the owners. The decision was made following a meeting between lawyers of the Chilean Ministry of Finance and the Comptroller's office at which it was decided that it would be illegal for the Government to insist on application of the decree law. It seems that the new deal for the industry requested by the producers from the Government is inevitable, and a less onerous proposal is expected to be submitted to the Senate by the Finance Minister.

Methionine Development

Dow Chemical Inter-American, Limited, announces the commercial availability of N-acetyl-*dl*-methionine, a water soluble methionine derivative. According to Dr. R. H. Boundy, Dow research director, the water solubility of N-acetyl-*dl*-methionine lends itself to more convenient dosage forms and helps to open the way to further research on methionine's lipotropic action, its protein sparing action and its possible relationship with cholesterol metabolism.

New British Standards

Benzole, Naphtha & Toluole

REVISED standards for benzole and allied products have been issued by the British Standards Institution, to bring them into line with current commercial practice. 'Standard Specifications for Benzole and Allied Products' and 'Standard Methods for Testing Tar and its Products' (1950 editions) have been used as basis for the specifications and methods of test.

The main features of these revisions are (a) the inclusion of specifications for products of lower specific gravities than those previously standardised, (b) the deletion of Industrial Benzole, (c) the inclusion of a new grade of Pure Benzole, namely Benzole—Synthesis Grade, of a quality similar to Benzole — Nitration Grade but with much lower carbon disulphide and thiophen contents, (d) the deletion of 95's Toluole, which has been found to be no longer necessary, (e) the deletion of the corrosive-sulphur clause from the specifications for Pure Benzole and Coal-Tar Solvent-naphtha (96/160). For those products for which it has been considered necessary to limit the corrosive sulphur, an improved copper-strip test, capable of numerical interpretation, has been introduced.

Titles of Standards

The titles of the standards are as follows: 'Benzoles' (Pure Benzole, Benzole—Nitration, Benzole—Synthesis, 90's Benzole, Low-gravity 90's Benzole, Motor Benzole, Low-Gravity Benzole), (B.S.135: 1953); 'Coal-tar Naphthas' (Coal-tar Solvent-naphtha (96/160), Low-gravity Coal-tar Solvent-naphtha (96/160), Coal-tar Solvent-naphtha (90/160), Low-gravity Coal-tar Solvent-naphtha (90/160), Coal-tar Heavy-naphtha (90/190), Low-gravity Coal-tar Heavy-naphtha (90/190), Coal-tar Heavy-naphtha (90/190) (Unrectified), Coal-tar Heavy-naphtha (90/200). (Unrectified)). (B.S.479: 1953); and 'Toluoles' (Pure Toluole, Low-gravity Pure Toluole, Toluole—Nitration Grade, Low-gravity Toluole—Nitration Grade, 90's Toluole, Low-gravity 90's Toluole). (B.S.805: 1953).

Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1. Price 7/6 for B.S.135 and 6/- for B.S.479 and B.S.805.

Market Reports

LONDON.—There have been no outstanding movements in the industrial chemicals market during the past week, most sections reporting a steady demand on home account, with delivery specifications against contracts covering good quantities. Export inquiry has been about the average for recent weeks.

Prices generally are well held, but a lower quotation is now ruling for copper sulphate at £84 2s. 6d. per ton, and zinc oxide is £3 per ton lower. Activity in the coal tar products has been only moderate and movements are mostly against existing contracts.

MANCHESTER.—With an odd exception prices on the Manchester market for heavy chemical products during the past week have been maintained at recent levels. The demand for a wide range of textile chemicals from users in the Lancashire and West Riding areas has been on fairly steady lines and a fair flow of new inquiries from these and other leading industrial outlets has been reported. The shipping movement in the soda and other compounds has also been reasonably satisfactory. In the fertiliser market the seasonal demand has passed its peak, although producers are still making good deliveries.

GLASGOW.—There has been a slight easing in demand for general chemicals, but on the whole business has been satisfactory. There have been some slight price increases due to the recent advance in the cost of fuel, but these should not upset trade to any extent.

Bakelite Ltd.

In connection with the issue of £1,000,000 5 per cent debenture stock 1968/77 on behalf of Bakelite Ltd., Morgan Grenfell & Co. Ltd. announced this week that the allotment letters would be posted today (9 May) and dealings on the Stock Exchange would begin on 11 May. The average allotment on the application from the public was 5 per cent of the amount applied for, with more favourable treatment for the smaller applications, including a minimum allotment of £50. The allotment to shareholders is similar, the average percentage being 20 and the minimum allotment £100.

Publications & Announcements

SAFETY rules and regulations for handling, storing and shipping of ethyl acetate are described in detail in a new safety data sheet, SD-51, published by the Manufacturing Chemists' Association, Inc., 246 Woodward Building, Washington 5, D.C. (25 cents). The data sheet points out that while ethyl acetate is classified as a 'flammable liquid,' and its vapours, when mixed with air, are likely to produce explosions when ignited, the material can be handled with safety if employees are properly educated and are familiar with its hazards. The publication also includes regulations regarding loading and unloading and first aid procedures to be followed in case of exposure to excessive vapours or excessive contact with skin.

* * *

ADVANCE copies of some of the papers presented at its conference held at Harrogate from 22-25 April, together with biographical notes on some of its contributors, are contained in the spring issue of the *Bulletin of Institute of Metal Finishing* (Vol. III, No. 1). Other features refer to the importance of the new Organic Finishing Group and to the inaugural meeting of the Scottish branch in Glasgow on 21 January.

* * *

AT home and abroad, 16,000 men and women are employed by the British Oxygen Company Group in the service of industry, medicine and science. A map showing how widely scattered are their activities throughout the world—overseas works of the BOC total 116—is one of the coloured features of a well-produced brochure issued by the company with the title 'All in the Day's Work.' The attractively illustrated text describes in detail how the BOC group of companies are in action in the three important fields mentioned. The Chemicals Division is the most recent BOC enterprise. Its interests lie in chemicals produced by the group. Among those engaging the attention of the division are cyanamide, dicyandiamide, melamine, vinylpyrrolidone and polyvinylacetate. The main outlet for di-cyandiamide is the production of melamine, but it is also used in the preparation of pharmaceutical chemicals, including sulpha drugs and anti-malarials.

THE description 'fluorescent grade' has been applied to various inorganic chemicals from time to time to indicate that the chemical concerned is particularly suitable for the manufacture of fluorescent materials. The demand for fluorescent powders of all types, and particularly for those used in fluorescent lamps and cathode ray tubes, has now reached considerable proportions. Quantity production of high-grade fluorescent materials involves rigid control of the purity of the chemicals used. For this reason the Chemicals Division of Thorn Electrical Industries, Ltd., Great Cambridge Road, Enfield, Middlesex, developed its own special processes for the manufacture of 'fluorescent grade' chemicals, the present range of which is given in a folder just issued by the company with the title 'Fine Chemicals for Industry.'

* * *

WOOLGREASE has its origin in the sebaceous glands of sheep's skin which excrete this material as a protective coating for skin and wool. To remove this grease the wool shorn from the sheep is washed several times with warm water and soap. The resultant liquor is treated by either chemical or mechanical process to recover the wool fat, having in the meantime removed by special process any dirt and extraneous matter which may have been picked up in the wool. The wool fat recovered in this way is the basic material dealt with in a leaflet issued by Croda Limited, Croda House, Snaith, Goole, Yorkshire. Another leaflet from the same company is concerned with wool grease fatty acids, which are obtained when the soap stock or 'foots' from the manufacture of lanolin are acidified.

* * *

THE 1953 catalogue of Gurr's biological stains and reagents has been entirely reset, and now gives cross-references and an indication of the nature of each dry stain. A number of interesting additions have been made to the list, including alkannin, erioglaucine, pontacyl carmine 2B, pontacyl violet 6R and quinizarin. The latest number of 'Gurr's Commentary,' No. 11, contains abstracts on an aldehyde-fuchsin stain for elastic tissue, an evaluation of the Wright and supravital methods, etc.


How much
DISTILLED WATER
can YOU
AFFORD ?

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.)

LEDA CHEMICALS, LTD., London, E.C. (M., 9/5/53.) 1 April, assignment securing to Midland Bank, Ltd., all moneys due or to become due to the bank; charged on certain contract moneys. £7,299. 31 December, 1951.

STARLON, LTD., London, E.C. (M., 9/5/53.) 1 April, £1,400 further charge (supplemental to a charge dated 13 May, 1952), to Broome Rubber Plantations, Ltd.; charged on land and building, at Jubilee Close, Kingsbury, and a general charge. £3,600. 15 December, 1951.

Satisfactions

GENERAL CHEMICAL & PHARMACEUTICAL CO., LTD., Sudbury (Middx.). (M., 9/5/53.) Satisfaction, 2 April, of mortgages registered 1 May, 1930, and mortgage and charge both registered 26 February, 1942.

W. R. PRIOR & CO., LTD., London, W., scientific instrument makers. (M., 9/5/53.) Satisfaction, 7 April, of debenture registered 15 November, 1948.

New Registrations

Bath Fertilisers Ltd.

Private company. (518,643.) Capital £1,500. Seed crushers, manufacturers of and dealers in chemicals, gases, and disinfectants, linseed cotton and other cakes, artificial manures and fertilisers, etc. Directors: Frederick Iszard and Mrs. Hilda M. Iszard. Reg. office: 19 Monmouth Place, Bath, Somerset.

Swedish Astra A.B. (London) Ltd.

Private company. (519,037.) Capital £10,000. Manufacturing, wholesale and retail and analytical chemists, smelters and refiners of ores, assayers, distillers, drysalters, oil and colour men, etc. Subscribers: H. A. Southwell and H. Slatford. First directors are to be appointed by the subscribers. Solicitors: Reynolds Gorst & Porter, 7 Arundel Street, W.C.2.

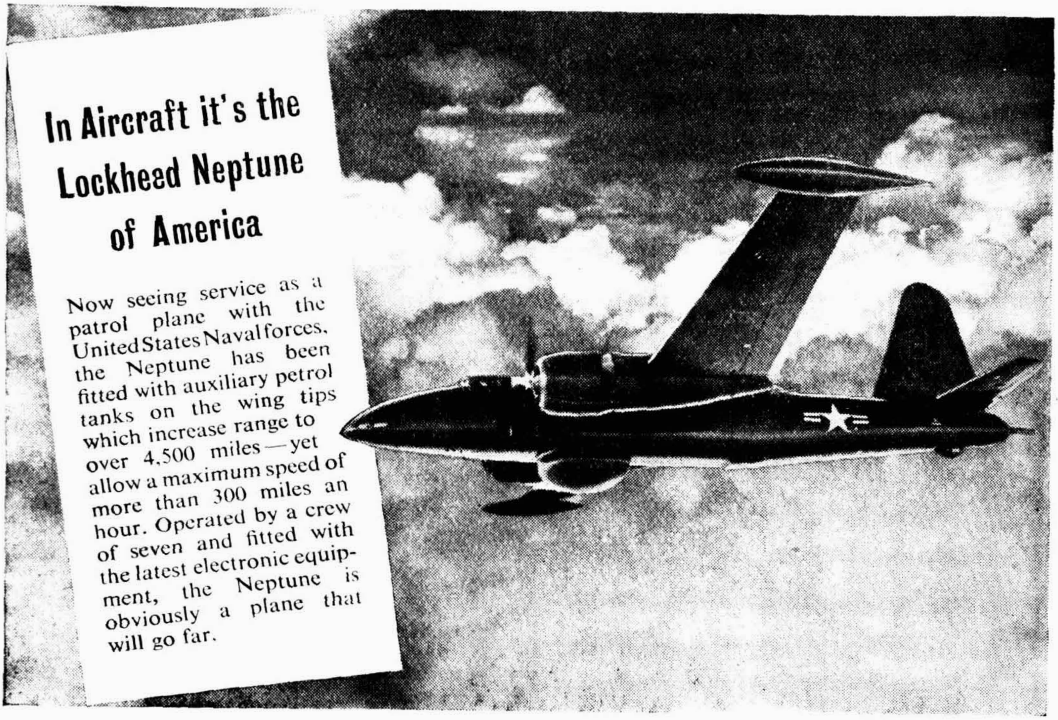
Company News

Imperial Chemical Industries Ltd.

The increased dividend of 13 per cent paid in 1951, is to be maintained by Imperial Chemical Industries, Ltd., on the larger capital now ranking for payment in 1952. Consolidated turnover of the group increased from £262,800,000 in 1951 to a record high figure of £276,300,000 last year. Although the net income for 1952, after tax, is down by £6,883,592 to £13,498,956 the distributable profits, mainly due to the much smaller provisions needed for stock replacement are well maintained even after allocating another £5,000,000 for obsolescence and £2,000,000 to revenue reserve. The 26th annual general meeting of the company will be held at the Wigmore Hall, Wigmore Street, London, W.1, at 11.30 a.m. on Thursday, 18 June.

Reichhold Chemicals Ltd.

No dividend on ordinary shares in respect of 1952 is to be paid by Reichhold Chemicals, Ltd., as the first results following the public placing of part of the share capital of the company fall far short of the estimated profits. Further deterioration in the synthetic resin industry affected the turnover of the Beck Koller and Beadel companies which mainly accounted for the inability to reach the profits forecast. Owing to unexpected technical problems the development of new products has been much slower than was anticipated. As a result of the prolonged recession in the synthetic resin industry no substantial profit from this trade is expected in the first half of the present year. Good prospects are, however, expected from new developments in the low pressure lamination, foundry and casting resin fields, but these will inevitably take time to become fully effective. Arrangements have been made to prepare half-yearly accounts as at 30 June, 1953, and it is proposed to publish half-yearly results about the end of September.



Law & Company News

continued from page 724]

Bofors (Gt. Britain) Co. Ltd.

Bank of England and Board of Trade approval has been given to the formation of a new company to be registered under the title of Bofors (Gt. Britain) Co. Ltd., with a nominal capital of £20,000, of which Bofors of Sweden were founded in 1646 and Guest Industrials Ltd. 10 per cent. AB. Bofors of Sweden was founded in 1646 and are of course internationally known as manufacturers of high grade steels, armaments, explosives and chemicals. The company was acquired in the late 19th century by Dr. Alfred Nobel, the inventor of explosives and the founder of the Nobel Prizes. Guest Industrials Ltd. are a fully owned subsidiary of Harris & Dixon, Ltd., whose chairman is Viscount Wimborne.

The purpose of the new company is to manufacture and to licence for manufacture in this country a wide range of industrial chemicals and pharmaceuticals, processes for which have been developed in the research laboratories of AB. Bofors and to sell the chemical products of AB. Bofors Department Nobelkrut and to buy raw materials, equipment, etc., on behalf of AB. Bofors.

The chairman of the new company will be Mr. Sverre Sohlman, one of Sweden's leading industrialists, director of AB. Bofors. The managing director will be Mr. D. E. Flaherty, a director of Guest Industrials.

Change of Name

General Metallurgical & Chemical, Ltd., to Gemec, Ltd., on 30 March, 1953.

Increases of Capital

The following increases of capital have been announced: Villa Laboratories, Ltd., from £4,000 to £15,000; Laporte Chemicals, Ltd., from £100 to £1,500,000; Esperanza Copper & Sulphur Company, Ltd., from £500,000 to £800,000; Patent Phosphates & Merchandise, Ltd., from £2,000 to £7,400; Starch Products, Ltd., from £185,000 to £249,800.

Manganese Ore From India

Exports of manganese ore from India during 1952 totalled 688,950 tons according to recently published statistics. The total for the previous year was 605,131 tons.

Next Week's Events

TUESDAY 12 MAY

Royal Institute of Chemistry

London: Highgate Golf Club, N.6, 1 p.m. Annual golf meeting 7.30 p.m. Golf dinner.

Incorporated Plant Engineers

Manchester: Engineers' Club, Albert Square, 7.15 p.m. Film by British Ropes, Ltd.

WEDNESDAY 13 MAY

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Annual general meeting of the Corrosion Group. Chairman's address by Dr. W. H. J. Vernon.

Royal Society of Arts

London: John Adam Street, Adelphi, W.C.2, 2.30 p.m. Trueman Wood Lecture. Sir Richard Southwall (joint general secretary, British Association for the Advancement of Science): 'Training for Science and Technology.' E. Munro Runtz, chairman of the council of the society in the chair.

THURSDAY 14 MAY

Institute of Metal Finishing

Manchester: Engineers' Club, Albert Square, 7.30 p.m. H. Ashton: 'Metal Finishing of Non-Metallic Materials.'

FRIDAY 15 MAY

Oil & Colour Chemists' Association

Manchester: Grand Hotel, 6.30 p.m. Professor C. E. H. Bawn: 'Autoxidative Reactions: their Chemistry, Mechanism and Catalysis by Metal Salts.'

CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

THE TRAINING OF TECHNICAL TEACHERS

APPLICATIONS are invited from men of about 25 years of age and over, for admission to a **ONE-YEAR COURSE OF TRAINING** as full-time **TEACHERS OF ENGINEERING AND ALLIED SUBJECTS** in Technical Colleges and similar institutions.

Applicants should have a University Degree or be an Associate Member of a Professional Institution, or possess qualifications of the order of Higher National Certificate or Full Technological Certificate of the City and Guilds of London Institute in the various branches of engineering, together with suitable experience in industry.

The course will begin in September, 1953. Students pay no fees and will be eligible for maintenance grants. The grants are assessed according to the financial responsibility of the individual and include allowances for wife and children.

Further particulars and application forms may be obtained by sending a stamped-addressed foolscap envelope to :—

THE DIRECTOR, (S/3/40),
BOLTON TRAINING COLLEGE,
MANCHESTER ROAD,
BOLTON, LANCS.

THE DIRECTOR, (S/3/40),
HUDDERSFIELD TRAINING COLLEGE,
QUEEN STREET SOUTH,
HUDDERSFIELD, YORKS.

THE PRINCIPAL,
GARNETT COLLEGE,
(TRAINING COLLEGE FOR TECHNICAL TEACHERS),
83, NEW KENT ROAD,
LONDON, S.E.1. (464)

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.

EDITORIAL ASSISTANT required by well-known technical journal with offices in West End of London. The appointment offers excellent opportunities to a young man or woman, preferably but not necessarily a graduate (chemistry, physics, engineering or fuel technology) seeking experience in technical journalism. Salary according to qualifications and experience but not less than £450 per annum. Applications, stating age, education, experience and salary required, to **BOX 435, 18 DEVONSHIRE STREET, PORTLAND PLACE, LONDON, W.1.**

OLD-ESTABLISHED Fine **CHEMICAL MANUFACTURERS, N.W. LONDON,** require—

A. **CHEMIST** experienced in modern methods of inorganic and organic analysis.

B. **WORKING PLANT/PROCESS CHEMIST.**

Permanent pensionable positions for right applicants, who should hold degree or equivalent. Particulars age, education, experience and salary, to **BOX C.A. No. 3218, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FOR SALE

MORTON, SON AND WARD LIMITED
offer

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, and complete with starting equipment.

JACKETED PANS

100g., 150g. and 200g. New **JACKETED PANS,** all welded on three legs—with or without mixing gear.

One 350g. Totally Enclosed **HOMOGENEOUS LEAD-LINED JACKETED PAN,** arranged with lead covered agitator driven through bevel gears from fast and loose pulley.

MIXERS

" MORWARD " " U "-SHAPED POWDER MIXERS made to requirements up to 3 tons capacity.

3-cwt. Second-hand **MIXERS** by **CHALMERS** and **GARDNER,** in stock ; stainless steel lined troughs.

LEAD-LINED VESSELS

Two 100g. and one 75g. Totally Enclosed Cylindrical Lead-lined Vessels. As new.

STAINLESS STEEL TANKS

Two Stainless Steel Tanks, Open-top Rectangular, 10 ft. by 5 ft. by 4 ft. deep, and one 8 ft. by 5 ft. by 3 ft. deep, 10's gauge. Second-hand, in good condition.

One **CHRISTY** and **NORRIS DISINTEGRATOR,** Size 00, arranged with automatic feed and motorised.

PUMPS

A large selection of **MONO** and other **PUMPS** in stock, 2 in. to 6 in., new and second-hand.

INQUIRIES INVITED

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

STORAGE
USE BOILER TANKS
FOR CHEMICALS

WE specialise in 30 ft. by 8 ft. diam. TANKS (each 9,000 galls).

Ready for use.

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

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.**

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.

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

1—Johnson **FILTER PRESS,** 36 n. 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. quare, 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

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.

600

PROCESS PLANT

WATER-COOLED **BALL MILL** by Houchen, approx. 5 ft. diam. by 6 ft. Capacity 500 gal. Internally lined ribbed cast-iron plates.

SIFTER MIXER by Porteous, 62 in. by 27 in. by 32 in. deep. Scroll-type agitator. Brush sifter. Driven through gearing by " V "-rope drive from 6 h.p. S/R. Brook motor, 415/3/50.

200-gal. Vertical S.J. Mild Steel **AUTOCLAVE** by Fraser. Dagenham. Internal dimensions 42 in. diam. by 52 in. deep. Paddle-type agitators overdriven through bevel gears. Bottom and side of vessel jacketed, save for top 9 in. Fitted removable cover. Jacket pressure 330 lb./sq. in.

Seven **FILTER PRESSES,** plate and frame type, each with 51 frames forming cakes 29 in. sq. by 2 in. Individual plate discharge. Plates have ribbed surfaces.

Three-throw **HOMOGENISER** by Rannie, stainless steel rams and cyl. block. Reputed capacity 110 g.p.h.

NEW ⅓ h.p. **STIRRER UNIT** with totally enclosed 400/440/3/50 or flameproof motors, 1,500 r.p.m., or 420 r.p.m., with stainless steel shafts and marine-type propellers.

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

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.**

GRAVITY Roller Conveyor several lengths, Rolls. 2½ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel. . East 1844.)

FOR SALE

NISSEN-TYPE HUTS for sale. All prices reduced. Prompt despatch of 16 ft., 24 ft. and 30 ft. wide huts. Also **ROMNEY HUTS** 35 ft. wide, and **BLISTER HANGARS** 86 ft. 6 in. and 91 ft. wide. All completely reconditioned. These buildings are in various lengths and comprise steel framework with corrugated iron, corrugated aluminium or corrugated asbestos sheeting. Full details from **J. THORN & SONS, LTD., DEPT.** 154, **BRAMPTON ROAD, BEXLEYHEATH, KENT.** Tel.: Bexleyheath 305.

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, 1½ in. bottom outlet. £20 each.
1 MILD STEEL WELDED OPEN-TOP TANK, 60 in. by 27 in. by 42 in. by ⅝ in. plate. £25.
THOMPSON & SON (MILLWALL), LTD.,
CUBA STREET, MILLWALL, E.14.
TEL. EAST 1844.

SERVICING

CRUSHING, GRINDING, MIXING and DRYING for the trade.
THE CRACK PULVERISING MILLS LTD
Plantation House,
Mincing Lane,
London, E.C.3.

PULVERISING of every description of chemical and other materials for the trade with improved mills, wharfage and storage facilities. **THOS. HILL-JONES LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH, LONDON." TELEPHONE: 3285 EAST.**

WET AND DRY GRINDING Micronising, Grading and Mixing of Minerals and Chemicals for all trades. **Also suppliers of ground zircon, sillimanite, fused silica, precision casting materials** and a wide range of ground **minerals.**
W. PODMORE & SONS, LTD.,
SHELTON, STOKE-ON-TRENT
Phones STOKE-ON-TRENT 2814 & 5475

WORKING NOTICE

THE Proprietors of Patent No. 599,683, for **"IMPROVEMENTS RELATING TO THE MANUFACTURE AND UTILIZATION OF COLD-SETTING POLYHYDRIC PHENOLIC ALDEHYDE ADHESIVES,"** desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to **HASELTINE LAKE & CO., 28, SOUTHAMPTON BUILDINGS, CHANCERY LANE, LONDON, W.C.2.**

AUCTIONEERS, VALUERS, Etc.

EDWARD RUSHTON, SON AND KENYON (Established 1855).

Auctioneers, Valuers and Fire Loss Assessors of
CHEMICAL WORKS, PLANT AND
MACHINERY
York House, 12 York Street, Manchester.

Telephone 1937 (2 lines) Central Manchester.

WANTED TO PURCHASE

SMALL CHEMICAL FACTORY

PREFERABLY WITH STAFF AND MANAGEMENT FOR CONTINUING EXISTING PRODUCTION AND WITH POSSIBILITY OF EXPANSION.

SMALL FACTORY NOT IN PRODUCTION MIGHT BE CONSIDERED.

APPLY BOX NO. C.A. 3220.
THE CHEMICAL AGE, 154, FLEET STRRET,
LONDON, E.C.4.

CRESOLS, PHENOL
HIGH BOILING TAR ACIDS
CRESYLIC CREOSOTE
NAPHTHALINE, PYRIDINE

MIRVALE CHEMICAL CO. LIMITED
MIRFIELD, YORKS. Phone Mirfield 2157

THIS

Fluidrive

CENTRIFUGAL

features: **ECONOMY**
EFFICIENCY
ADAPTABILITY

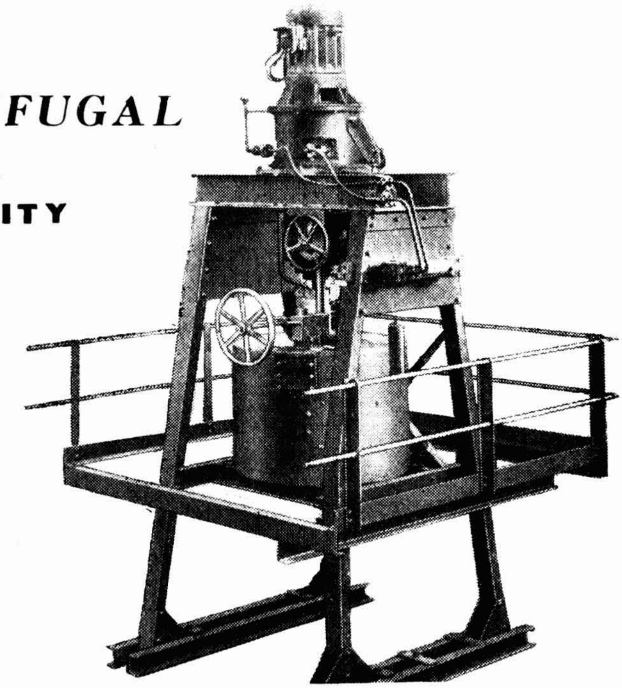
A "Vulcan-Sinclair" scoop tube controlled type hydraulic coupling is interposed between electric motor and centrifugal spindle, giving these advantages:

Continuous-running constant speed motor has low current consumption; there is no current rush when starting, and no wear on switch contacts.

Basket speed is infinitely variable; loading and unloading speeds can be easily controlled; acceleration is smooth.

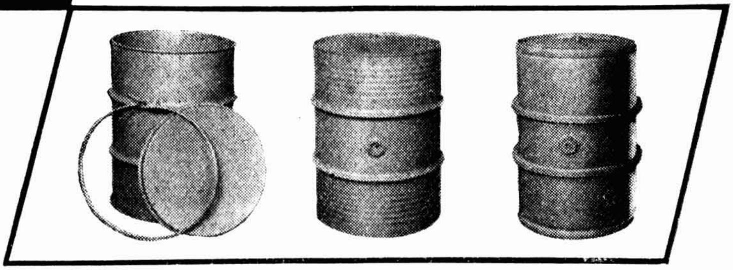
One handwheel controls acceleration, speed variation and braking.

A Mechanical Unloader with single wheel control can be fitted if desired. This Centrifugal can also be supplied with water motor, gear or belt drive.



POTT, CASSELS & WILLIAMSON · MOTHERWELL

"BRABY" REGD STEEL DRUMS



Our Liverpool Factory is equipped with modern plant for the production of Steel Drums of many types. These can be supplied with the exteriors painted, and several types can be galvanized, tin or lacquer lined. Certain Drums can be decorated in colour to display users' names and trademarks.

FREDERICK BRABY & COMPANY LTD.
HAVELOCK WORKS, AINTREE, LIVERPOOL, 10. *Tel. AINTREE 1721. LONDON: FITZROY WORKS, 352-364, EUSTON ROAD, N.W.1. TEL. EUSTON 3456. EXPORT: 110, CANNON STREET, LONDON, E.C.4. TEL.: MANSION HOUSE 6034. ALSO AT GLASGOW, BRISTOL, BELFAST AND PLYMOUTH.*

CHARCOAL!
CHARCOAL!
CHARCOAL!

If interested we are manufacturers of
WOOD STICK CHARCOAL

SEND YOUR ENQUIRIES TO :—
BOYS & BODEN, LIMITED,
CHARCOAL MANUFACTURERS,
WELSHPOOL

Decolorising **CARBON**

ALL GRADES
FOR
ALL TRADES

HIGHEST EFFICIENCY
LOWEST PRICES

Granular Carbon for Solvent Recovery.
Regeneration of Spent Carbon.

Write for samples and quotations.
FARNELL CARBONS LIMITED
CONDUIT ROAD, PLUMSTEAD, LONDON, S.E.18
Telephone: Woolwich 1158 (2 lines).
Telegrams: Scofar, Wol, London.

JOHN KILNER & SONS (1927) LTD
ESTABLISHED 1867
Calder Vale Glass Works, Wakefield, Yorks.
'PHONE : WAKEFIELD 2042 'GRAMS : GLASS, WAKEFIELD

SPECIALISTS IN
Carboys · Demijohns
Winchesters

THE WORLD'S GREATEST BOOKSHOP
FOYLES
★ FOR BOOKS ★

All new Books available on day of publication. Secondhand and rare Books on every subject. Stock of over three million volumes

Subscriptions taken for British, American and Continental Magazines

119-125 CHARING CROSS RD., LONDON, W.C.2
Gerrard 5660 (16 lines) ★ *Open 9-6 (inc. Sat.)*
Nearest Station : Tottenham Court Road

INTERMEDIATE PRODUCTS
ANILINE DYES
FAST BASES FOR ICE COLOURS

Benzol, Nitrobenzol, Binitrobenzol, Toluol, Ortho & Para Nitrotoluol, Binitrotoluol (All Grades)
Para Nitro Ortho Toluidine, Meta Nitro Para Toluidine
ORTHO TOLUIDINE PARA TOLUIDINE

Extensive Range of Oil Colours, Acid Colours, Basic Colours, Direct Colours, Pigment Colours,
Azoic Colours for Wool, also Colours suitable for all Trades
META TOLUYLENE DIAMINE META PHENYLENE DIAMINE

JOHN W. LEITCH & CO., LTD.

MILNSBRIDGE CHEMICAL WORKS
HUDDERSFIELD

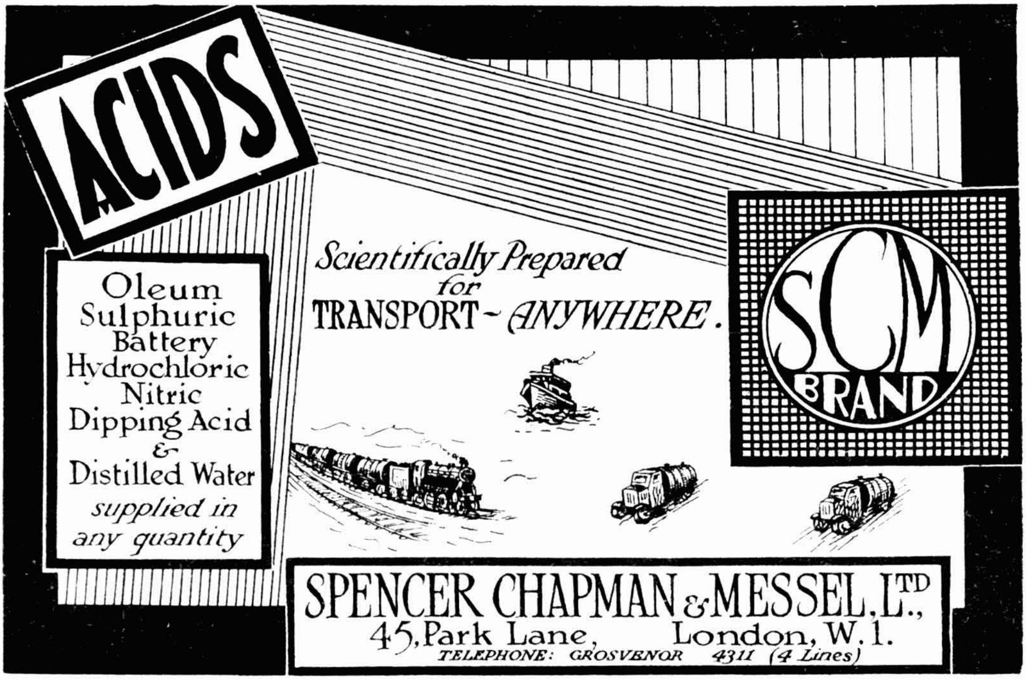
Telephone :
189-190 MILNSBRIDGE

Telegrams :
LEITCH, MILNSBRIDGE

INDIA
Khatau Valabhdas & Co.
Vadgadi, Bombay.

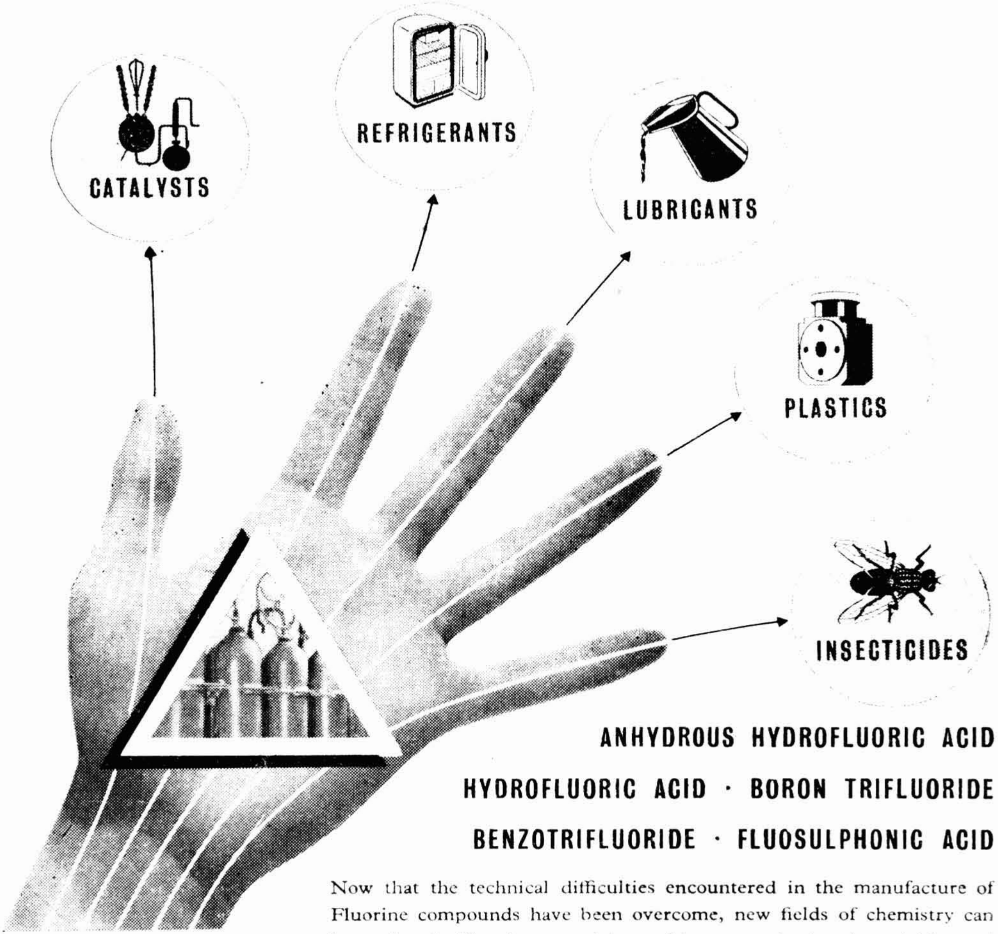
SCOTLAND
Kirkpatrick & Lauder Ltd
180, Hope Street, Glasgow C.2.

CANADA
Prescott & Co., Regd.
2209 Hingston Ave.,
N.D.G. Montreal 28, Quebec.



FLUORINE COMPOUNDS—

INCREASING USE IN INDUSTRY



ANHYDROUS HYDROFLUORIC ACID

HYDROFLUORIC ACID · BORON TRIFLUORIDE

BENZOTRIFLUORIDE · FLUOSULPHONIC ACID

Now that the technical difficulties encountered in the manufacture of Fluorine compounds have been overcome, new fields of chemistry can be explored. Fluorine-containing refrigerants, plastics, insecticides and intermediates all show great industrial promise. The above-mentioned compounds are of value in the manufacture of such fluorinated materials, and are available in commercial quantities. Our research department would be pleased to advise on any technical queries regarding the use of Fluorine compounds.

IMPERIAL SMELTING

U.K. MEMBER OF THE CONSOLIDATED ZINC CORPORATION LIMITED

A PIONEER IN THIS CHEMICAL FIELD

IMPERIAL SMELTING CORPORATION (SALES) LIMITED · 37 DOVER ST · LONDON · W.1

Printed in Great Britain by The Press at Coombelands Ltd., Addlestone, and published by Benn Brothers Ltd., at Bouverie House, 154, Fleet Street, E.C.4, 9 May, 1953. Registered at the General Post Office. Entered as Second Class Matter at the New York, U.S.A., Post Office.