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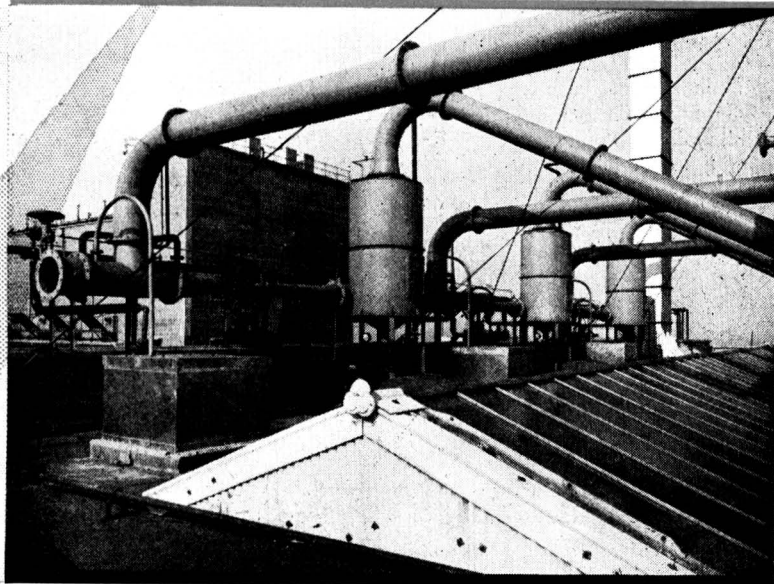
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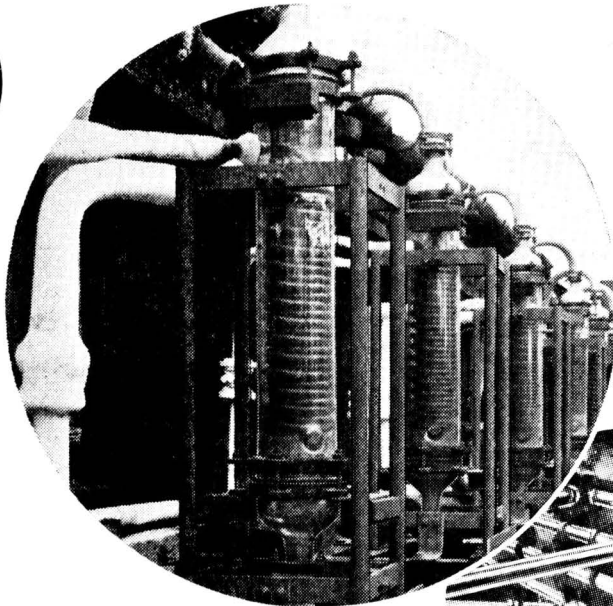


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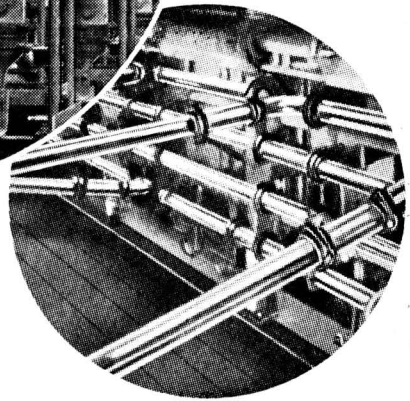
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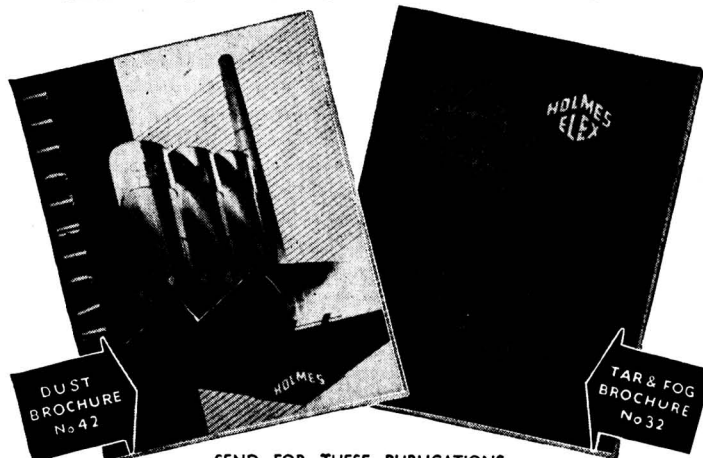
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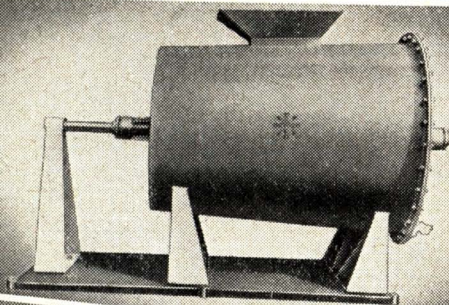
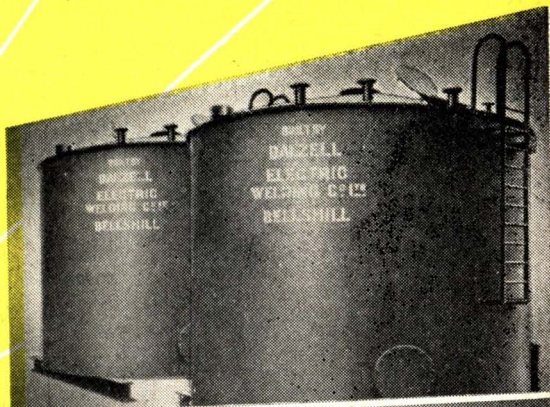
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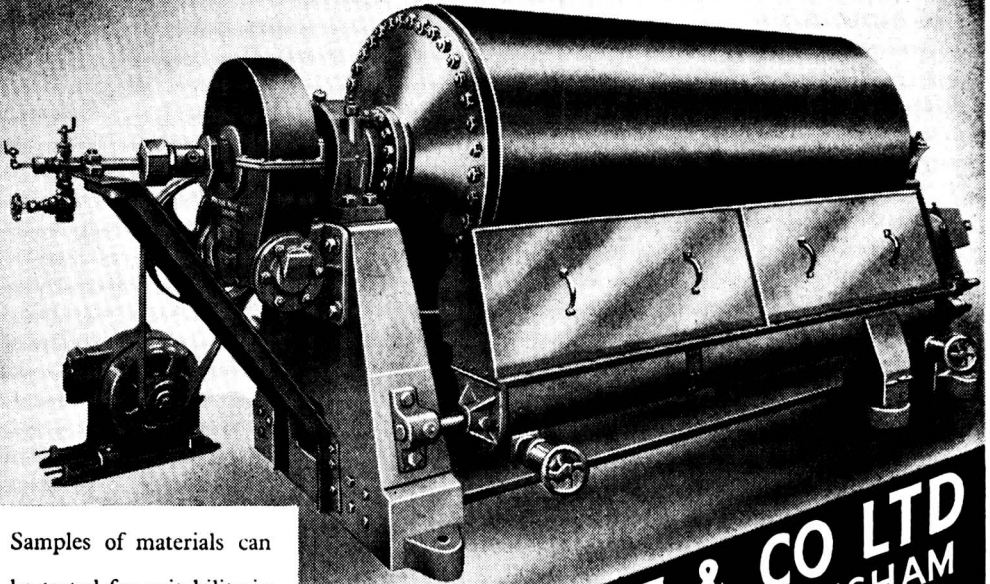
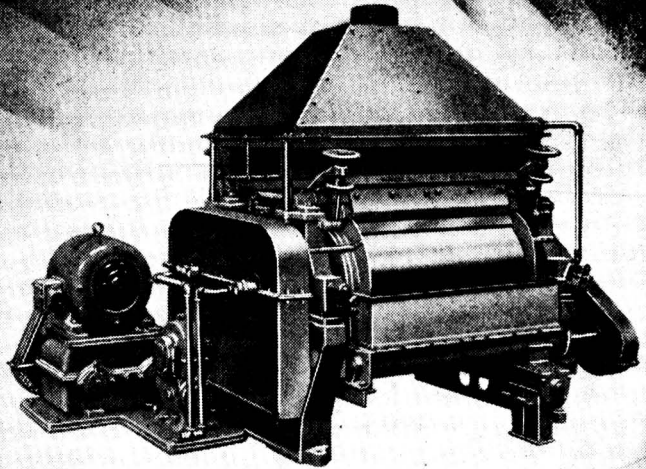
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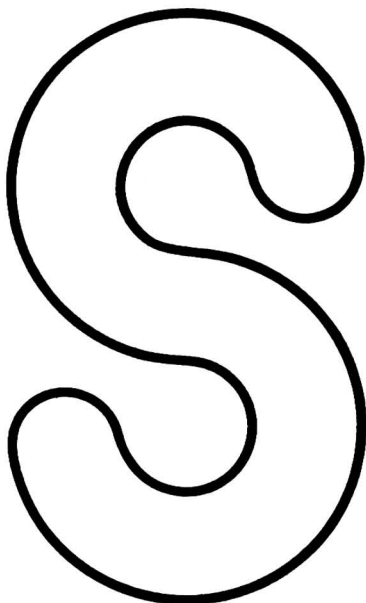
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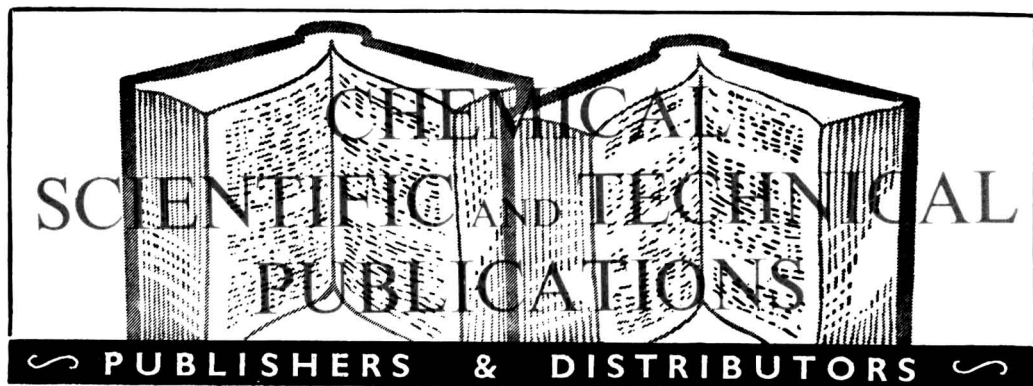
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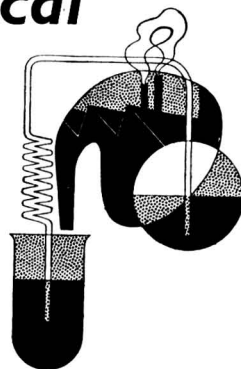
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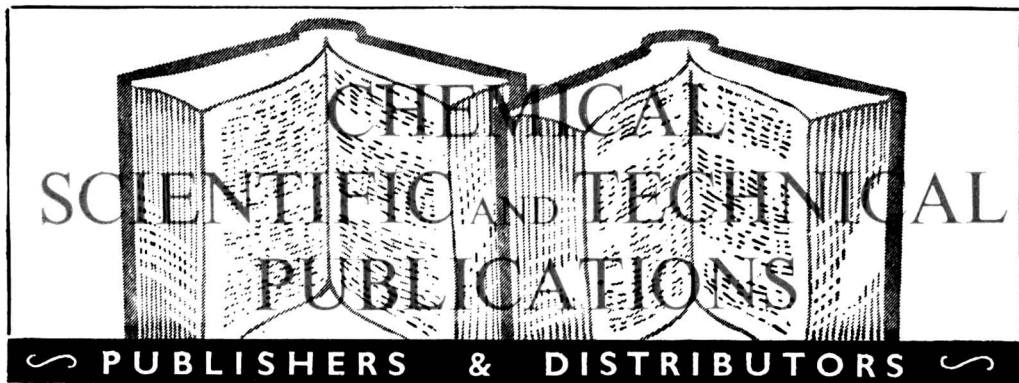


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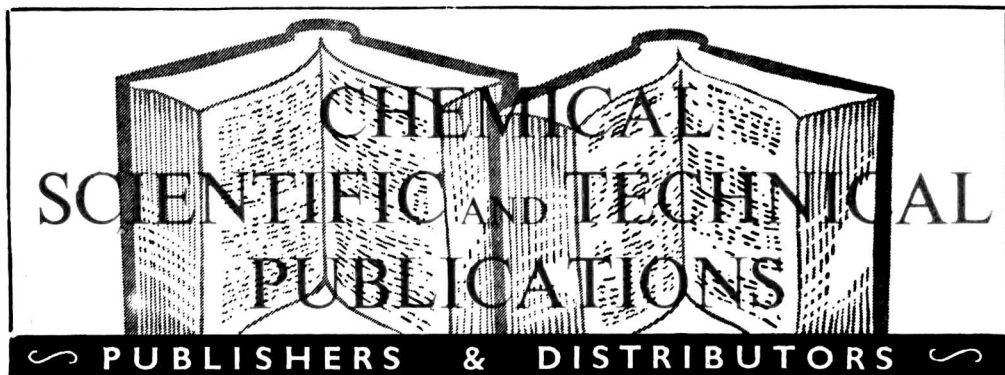
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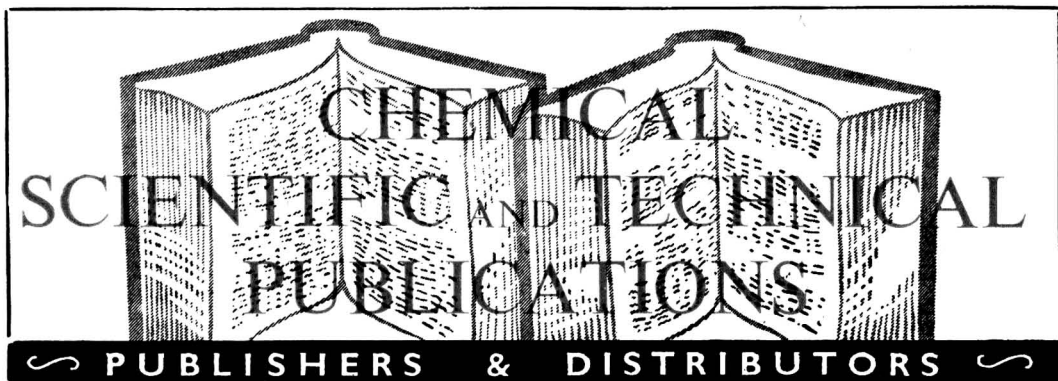
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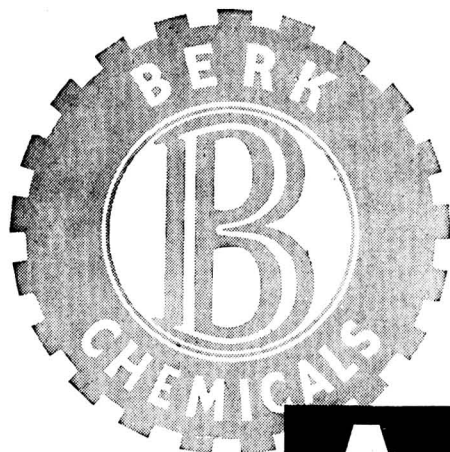
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## Synthetics Under the Sea

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**T**O hail the success of synthetic or man-made materials is hackneyed enough—indeed, there is more news value in any natural, animal- or vegetable-derived material able to hold its own in the face of competition from macromolecules born in laboratories. But 1954 has seen the twenty-first birthday of one of the most versatile of all synthetic materials—polyethylene.

When in 1933 a white powder turned up in a reaction vessel used by I.C.I. scientists for studying the behaviour of ethylene under high pressures, it is said that initial thoughts were that this was a highly expensive way of making 'candle grease.' Polyethylene certainly began life like a sudden baby left on the research doorstep, and it was, in fact, a chance remark that the waxy substance might prove to be a substitute for gutta percha which opened the door to practical development.

The polythene bag is an everyday item of modern life—polythene as an insulant for cables is no less familiar, but here it serves a human need not merely transparently but invisibly. The urgent requirement for an insulant for high frequency cables for radio location—later to become known as radar—accelerated the pace of research and development. Without polythene, could the war in the air have been won by the free countries and by Britain in particular? It was discovered after the war that Germany never found out how to make it, and she depended for such supplies as she had upon recovering polythene from shot-down British bombers.

Much of the story of polythene as

a vital material in cable construction has recently been told by Mr. J. N. Dean in his Atkinson Memorial Lecture to the Royal Society of Arts. It is a story of considerable topicality just now, when the new Atlantic cable between Scotland and Canada is starting its 1954-1956 schedule of construction. From the 1850s to the 1940s gutta percha and balata remained supreme in the cable-insulating field; it is safe to say that long distance communications would never have been established without them. 'Today all new submarine cables are being insulated with polythene.' Even ten years ago it could already be said that gutta percha's prospects in the cable industry had been reduced to that of a material for repairing existing cables; but this field also has now been invaded by the synthetic, for a huge mileage of polythene-insulated telegraph and telephone cable has been used in recent years to repair or replace cables originally insulated with gutta percha.

The similarities of polythene and gutta percha were listed in Mr. Dean's paper. Both are perfect thermoplastics; both at normal temperatures are firm, leathery materials, not easily distorted yet not difficult to bend; both are elastic at low stress and possess 'memory' when stretched near the breaking-point; both have very low water absorption and high resistance to water diffusion; both have low dielectric constants and high dielectric resistivity, and these properties are scarcely affected by immersion in water; both become brittle at low temperatures; and both are subject to oxidation, especially in sunlight, but this

deteriorating influence can be inhibited.

However, if there are so many similarities between a natural material and its entirely synthetic conqueror, there are also differences, and almost all the differences favour the use of polythene. It requires a temperature above 100° C to soften it while gutta percha softens at temperatures commonly met in tropical areas and sometimes met in English summers; indeed, gutta percha's stability to temperature varies with the type of gutta percha—in short, here is one of the variable-property weaknesses from which natural materials suffer so awkwardly. Polythene's resistance to water absorption and diffusion is greater than that of gutta percha, which means that its electrical characteristics have even greater stability. Polythene's dielectric properties are 'vastly superior' especially at the high frequencies used in speech transmission. Polythene is more inert, so that it is easier to inhibit oxidation; it is harder and stronger, and it has a lower density. As a synthetic substance, polythene can be produced under controlled conditions so that its properties show fewer and much smaller variations. Finally, polythene is much cheaper than gutta percha. This last point is worth a little emphasis. A synthetic material that offers superior properties often remains dearer than its natural counterpart; and when polythene was first experimentally produced, it had cost many pounds per ounce and its future as an economic product was far from readily foreseeable.

It would be misleading not to mention the less favourable characteristics of polythene as a cable insulant. Here, however, it must be remembered that polythene is not one substance but a long range of polymers created from the same monomer. Thus, one early fault, surface cracking, which tended to produce brittleness, has been overcome by using the harder and higher molecular-weight 'grades' of polythene. The use of plasticising diluents can also eliminate this trouble—polyisobutylene was much used in this country in the early days of development and today butyl rubber is also being used. To some extent the use of hard grades to eliminate the trouble

of surface cracking leads to a second fault; hard grades require higher temperatures for extrusion, and at these temperatures oxidation is more difficult to prevent with anti-oxidant additives. But time and testing has dispersed this problem as well, and today stability to oxygen is possessed even by grades so hard that they have to be heated to 275° C to be extruded.

A third 'growing pain' is due to a less adjustable difference between polythene and gutta percha. When a cable is stretched during laying the copper core will not swiftly retract on release like its insulating garment of polythene or gutta percha; the result is that the copper often buckles and cuts through the insulant material. Gutta percha, being softer and less elastic than polythene, is not nearly as exposed to this danger of insulation-fracture—often called 'knuckling.' However, with so many other reasons to choose polythene as a cable insulant, it has been well worth modifying cable design so as to obviate this fault; in the past few years, 'non-knuckling' cable of all kinds has been produced.

The two cables now to be laid between Scotland and Newfoundland will each be 2,000 nautical miles long. A very hard grade polythene will be used with 5 per cent of butyl rubber; the outer diameter of the insulating core will be 0.620 in. Extreme precision in chemical quality and dimensions is required, and Submarine Cables Ltd. have found it necessary to equip a special factory to ensure the high accuracy of production. Between Weybourne and Denmark 325 miles of polythene-insulated cable were laid in 1950 and this year a cable over 300 miles long was laid between Aberdeen and Bergen. Polythene in cable-lines under the sea may be out of sight for a long lifetime but it has cheapened the cost and widened the possibilities of nation talking to nation. And we can reasonably wonder whether any of the other more obvious uses of polythene would ever have been brought within the normal economic range if first of all this remarkable synthetic polymer had not been developed as a promising substitute for gutta percha in cables.

## Notes & Comments

### The Cost of Cargoes

SOME sections of the chemical industry are facing costs problems as a result of the steady rise in freight charges during 1954. Taking 1952 rates as 100, the tramp shipping freight rate this April was only 75.8; by August it was 80.1; the September index was 90.6; and October's was 99.5. Moreover, this is only an over-all summing up of the situation; freight charges for smaller-tonnage dry cargoes have in many cases risen much more sharply. There is every sign that freight quotations are still getting higher and higher; some companies have taken boats on charter for the next two years at rates well above the 1952-54 level. Probably the industry most affected by this trend is the fertiliser industry, which has to work on low costs and margins but imports all its phosphate rock and potash. The prices farmers are now asked to pay for fertilisers were calculated on the basis of costs that ruled in May and June; cargoes of phosphate rock coming into the country at present are incurring shipping bills 30 or 40 per cent. higher than the bills of a few months ago. The same applies to potash, though the sea journey is shorter; and with potash a more costly material, the proportional effect of freight costs on price is not as great. Nitrogen costs will be unaffected for none of the prime production costs involve imported materials. It is difficult to see how fertiliser prices can be kept at their present level much longer. When prices were generally reduced two years ago, the principal cause was the sharp fall in freight rates which began in 1952/53. The reverse swing of the pendulum cannot be ignored even though it is coming at an unfortunate time, when farming has not enjoyed a good harvest and when its future prospects are somewhat less certain. Farmers who buy their phosphatic and compound fertilisers now instead of waiting until the spring sowing season will be making a better bargain than they realise.

WITHIN a few days subscribers to THE CHEMICAL AGE will be receiving their free copies of THE CHEMICAL AGE YEAR BOOK 1955. A limited number of additional copies will be available at £1 1s. from this journal at 154 Fleet Street.

This year's edition of CAYB is, we feel, an improvement over any previous edition; and it represents another step forward in our efforts to make this the most comprehensive reference book to the chemical industry. Much of the deadwood has been cut away: twelve features of doubtful value have been replaced by new, useful sections, and others have been expanded to increased importance. Every single entry has been meticulously revised, and the book is altogether some 30 pages larger than in 1954.

Notable improvements include complete changes in the Buyers' Guide and 'A Guide to Chemical Literature.' The former has been re-styled, and very many more categories have been introduced. Some 420 companies are listed and there are approximately 5,000 entries under more than 2,500 commodity headings. The guide to chemical literature has now been arranged according to the Universal Decimal Classification, with adequate cross references at the beginning of each section. Out of date entries have been ruthlessly deleted, and replaced by nearly 300 new ones. We can safely say that no other publication contains such a complete list of modern chemical reference books.

Another great improvement is in our 'Who's Who,' which has been enlarged and widened in scope. Innovations include a collection of useful physico-chemical tables, and an important section on 'Dangerous Dust or Fumes & Explosion Hazards in Industry'—in fact THE CHEMICAL AGE YEAR BOOK 1955 is a volume in which every chemist, engineer, buyer or executive can find something of value at a moment's notice.

## The BIOS Complex

EVERYBODY knows how, at the end of the war in Europe, the British Intelligence Objectives Sub-committee, the Combined Intelligence Objectives Sub-committee and the Field Information Agency, Technical, descended on Germany like Assyrian cohorts, their spectacles gleaming with expectancy. How, with commendable eagerness, although very often they knew little about the subject, they proceeded to interrogate everyone who knew anything about German industry. And how they immediately rushed into print, producing several thousand reports which, whatever their shortcomings, were the only way in which industry in the Allied countries could discover rapidly what had been going on in Germany during the past six years. The most important of these reports were undoubtedly those dealing with plastics, and in 1946 the American Quartermaster Corps published a book by DeBell, Goggin and Gloor which reviewed the whole subject. Eight years have rolled away, and, like an old actor who has long missed his cue, BIOS Surveys Report No. 34—'The German Plastics Industry during the Period 1939-45'—at last sidles apologetically on to the stage. This extreme tardiness could be forgiven if the contents included much new information discovered since previous publication, but although the text is studded with references, it will be found that they all refer to old BIOS, CIOS and FIAT reports. What possible use can this pathetic report of reports serve? Without exception the processes it describes have been superseded, some for as long as 15 years; and there can be few manufacturers in the thriving British plastics industry who are not far ahead of the practice here outlined and, in some instances, of current German practice. The energies of able Ministry of Works scientists and the resources of the Stationery Office, have been squandered in entirely unnecessary activity. Not even the historians have gained, since all this material, in greater detail, has been in print for the past nine years.

## Preserving Timber

A NEW approach to the problem of protecting wood from rotting is reported by the Forest Products Laboratory of the US Department of Agriculture. It is a double diffusion method, the timber being first dipped into copper sulphate solution, then into sodium chromate solution. Originally the method was devised for treating farm fence posts. The formation of copper chromate not only on the surface but within the timber is attractive, for copper chromate has a very low solubility and is therefore not severely exposed to the risk of leaching; and it is toxic to both wood fungi and insects. The double diffusion technique was begun as long ago as 1940 and various combinations of soluble salts have been used; however, it takes many years to test the performance of any wood preservative or method of application for there is no short-cut laboratory technique which can reliably imitate the effects of time and exposure to natural conditions.

## Better Application

EVEN the 13 years since these US tests began in 1940 is a fairly short period for result assessment. The recent British report from our Forest Products Research Laboratory (1954, HMSO, *Bulletin* 32) described tests that have been running since 1929 and evidence from these was presented as an interim rather than final base for judgment! In all those tests the pressurised method of application had been used, and although most of the chemical and soluble preservatives had given effective performances the best results seem to have been obtained with high temperature creosotes. The main property required of a wood preservative, according to the British report, is that it must be able to stay in the wood for many years; this is a difficulty which must be overcome by the method of application. It may well be asked whether a better means of application has not now been found in the double diffusion technique.

# 'Tropotox'—New Selective Weedkiller

## May & Baker Exhibit at Smithfield

THE greatest indoors agricultural show of the year, the Smithfield Show, was held this week, 6-10 December, at Earls Court, London, when May and Baker Ltd. exhibited five selective weedkillers. Amongst these were two—Planotox and Spontox—which were introduced by the company only last month, and one—Tropotox—which was announced for the first time at the show.

### Very High Efficiency

Planotox is a new formulation of 2:4-D based on the butoxyethyl ester in oil and it is nearly twice as concentrated as previous formulations as it contains 70 per cent active acid equivalent. The nature of the ester is said to ensure very high weedkilling efficiency with a wider margin of safety to crops. It is suitable for use in cereals, including spring oats, and grass.

Spontox is a brand of concentrated spray material based on low volatility esters of 2:4-D and 2:4:5-T. It is used for the eradication of bramble and the woody weeds known as brushwood. Bindweed, docks, ragwort, sorrel and thistles are also susceptible to Spontox while grasses are unharmed. It can be applied to foliage, basal bark or stumps.

The newest product, Tropotox, is a selective weedkiller for all clovers and is a direct development from fundamental work carried out in the Agricultural Research Council's unit at Wye College under the direction of Professor R. L. Wain. This work was based on a study of the biochemical mechanisms which govern the fate in plant tissue of higher homologues of potent growth regulating substances such as MCPA, 2:4-D and 2:4:5-T.

It has been clearly established that a  $\beta$ -oxidation process, analogous to that promoted by enzymes in the animal, could also operate in the plant, the effect of which was to reduce the length of the aliphatic side chain by two carbon atoms at a time. This meant that if the total number of side chain carbon atoms was even, the end product of the biochemical breakdown would be an active aryloxyacetic acid. Professor Wain's detailed studies, however, revealed certain anomalies which suggested to him that

plants might well differ in their capacity to carry out this  $\beta$ -oxidation process and further that this offered a new approach to selective herbicidal properties (Wain & Wightman, *Proc. Roy. Soc.*, 1954, **142**, 525). Several aryloxybutyric acids which were higher homologues of the known active growth regulators MCPA, 2:4-D and 2:4:5-T showed promise as selective weed killers in laboratory and glass house experiments (Brit. Patent Applications Nos. 9497/54, 19812/54, 19813/54). Some of these substances had been prepared for Professor Wain in the May & Baker Chemical Research Laboratories (K. Gaimster, Ph.D. Thesis, London University) and were made the subject of intensive study at their Horticultural Research Station, Ongar (K. Carpenter & M. Soundy, Proceedings of the 2nd British Weed Control Conference 1954). As a result of many glass house and field plot experiments it was found that  $\gamma$ -4-chloro-2-methylphenoxybutyric acid (MCPB, M&B 3046) was extremely well tolerated by the principal varieties of clover at all stages of growth and yet controlled a useful range of common weeds. These properties are attributed to the inability of clovers readily to degrade MCPB to MCPA whereas the susceptible weeds species can do so.

### Some Interesting Problems

The development of a manufacturing process for this new product presented some interesting chemical and economic problems, in view of the need to make it available at a price acceptable to users, but these have now been solved (Brit. Pat. Appln. 26191/54). Production on an industrial scale has commenced at May & Baker Ltd.'s Dagenham factory and it is believed that adequate material will be available for full-scale user evaluation during 1955.

The development of Tropotox can be taken as an indication of May & Baker's increasing interest in agricultural chemicals. A division of their research department, it is understood, is now devoted entirely to work in this field. Smithfield is the first national agricultural show at which they have exhibited.

## The Polychromator

### For Routine Spectrochemical Analysis

A NEW direct-reading spectrograph, known as a Polychromator, has been delivered to I.C.I. Metals Division, Birmingham, by Hilger and Watts Ltd., Hilger Division, 98 St. Pancras Way, Camden Road, London N.W.1. Descriptions of this type of apparatus appeared in *THE CHEMICAL AGE*, 1954, 70, 1457; 71, 119.

The instrument has been designed for rapid routine spectrochemical analysis. Three to four minutes is required for a typical determination, thus making possible the application of spectrochemical techniques to problems where hitherto the time required for photography has been prohibitive.

Accuracy of determination of major and minor constituents is in general limited only by discharge conditions or by sample non-homogeneity, the instrumental reproducibility showing a coefficient of variation of about 0.25 per cent. The limits of detection of trace elements are similar to those obtained by photographic methods.

The production of further instruments is under way, and in the current issue of *Hilger Journal* the advantages of the two main systems of spectrochemical analysis—photographic and direct reading—are discussed so that spectrographers, as the new equipment becomes available, will be able to put it to the best use.

Direct reading methods of spectrochemical analysis are quick, because there is no photographic processing to be carried out. They are relatively free from some of the restrictions on measurement imposed by the peculiarities of the photographic emulsion and are less hampered by variations such as occur in the characteristics of the

emulsions or the processing methods. Once set up for a given analysis of a routine material for a specified series of metals, they give results instantly without any need for line selection.

On the other hand, these advantages only apply when the instrument is used for long periods on the analysis of a given set of constituents in a single type of material. Any change of material or constituent necessitates resetting of individual slits and the associated photomultipliers. When a wide variety of substances has to be dealt with, and when qualitative analyses are important, the photographic instrument is still necessary.

### Stress-Corrosion Cracking

ARISING out of a recent survey of 67 gas works installations where stress-corrosion cracking has been reported, the FM.9 Committee of the British Welding Research Association, although still awaiting the final analysis of the reports, believe that certain conclusions are justified. These are:—

Stress-corrosion cracking is not limited to welded gas mains, but appears, though less frequently, in welded vessels.

Its appearance has been found to be not related to any group of coals or any types of carbonising plant. No cases connected with water gas are known, and producer gas is not seriously suspected.

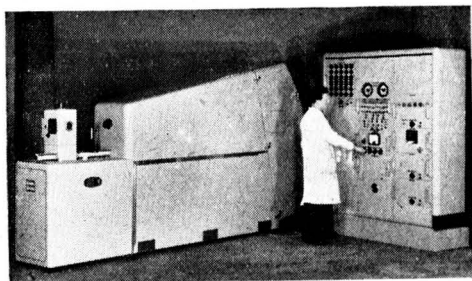
The range of expected occurrence is now extended to include the foul main and terminate at the outlet of the final ammonia washers.

Stress relief by heat treatment, to a not unduly exacting specification, is apparently able to prevent its appearance entirely, and probably also to meet the effects of added strains such as arise from mechanical vibration, ground movement, etc., if these are not excessive. Shot peening has not been tested with equal thoroughness.

Previously stress-relieved work should not be rewelded for alterations without afterwards restoring the stress relief.

High quality of welding does not confer immunity, and there are some doubts in regard to riveted work being completely resistant.

The interim report conveying these conclusions has been circulated to the authorities directly interested in the manufacture of coke and gas.



*The Hilger & Watts Polychromator*



MIDLANDS SOCIETY OF ANALYTICAL CHEMISTRY

# Analytical Chemistry of the Halogens

AT a recent meeting of the Midlands Society for Analytical Chemistry, Dr. R. Belcher, Reader in Analytical Chemistry at the University of Birmingham, gave a very comprehensive survey of the analytical chemistry of the halogens. Dr. Belcher opened his lecture by saying that as it was necessary to set some limits to a lecture of this kind, he would not include the analysis of fluorine or instrumental methods in his review, but that he would restrict his attention to the determination of the other three halogens. Consequently, the lecture fell into two sections, namely, gravimetric and titrimetric procedures.

The principal gravimetric method, of general applicability, involves precipitation of the halide as its silver salt. This procedure is, of course, well known, although time-saving titrimetric methods are normally preferred if they can be applied to a particular determination. Some other weighing forms have been proposed and include mercurous chloride for chlorine, although this is less satisfactory than silver chloride.

No alternative methods exist for the gravimetric determination of bromine, but in the case of iodine several weighing forms are available. These include the thallium, cuprous, palladium, and lead iodides. These weighing forms are, however, rarely used, although perhaps the palladium method has some merit in that it can be used in the presence of chloride and bromide. The characteristics and thermogravimetric properties of all these weighing forms have been described by Duval.<sup>1</sup>

## Moser & Miksch's Method

Gravimetric procedures are available for the estimation of combinations of the halogens and these include Moser and Miksch's<sup>2</sup> method, for the determination of any two, in which they are precipitated as the silver salts and the combined salts weighed. After this the precipitate is ignited with ammonium bromide or iodide to convert the mixed halides to silver bromide or iodide, in order to estimate the total silver associated with the precipitate. By the solution of the resulting simultaneous equations the original amounts of the two halogens may be determined.

Bekk's method<sup>3</sup> is perhaps the best gravimetric procedure for the determination of all

three halogens. He precipitates them as the silver salts, which are weighed prior to digestion with chromic and sulphuric acids. The iodide is then oxidised to iodate and the chlorine and bromine are liberated as the free elements and are expelled, leaving the silver with which they were associated as the sulphate in the digest. Following this, the iodate is reduced by  $\text{SO}_2$  to iodide, which is filtered off and weighed. The silver associated with the chloride and bromide in the filtrate is then precipitated as iodide and weighed, with the result that solution of the simultaneous equations derived gives the original amounts of the halogens present.

## Classical Titrimetry

Titrimetric methods for the determination of the halogens are numerous and many of these fall within the range of classical procedures. The so-called Mohr's method<sup>4</sup> is one of this number. It has been known by this name for many years in spite of the fact that it was Levof<sup>5</sup> and not Mohr who first suggested the use of coloured silver salts as indicators in the titration. Mohr recommended titration against silver nitrate using potassium chromate as indicator. Although this is, as already stated, a classical method, some disagreement can be found in the authoritative textbooks as to the optimum conditions of *pH* necessary for its use, the interference of other ions and the best means of determining the blank.

Kolthoff and Stenger<sup>6</sup> state that phosphate, arsenate, oxalate and fluoride interfere with the titration, whereas Mellor<sup>7</sup> indicates that ions such as those mentioned do not interfere, and quotes in support the work of Pellet<sup>8</sup>, who found that these ions only form silver salts after the precipitation of the chromate. Belcher and Parry<sup>9</sup> have investigated the method extensively and their results show that fluoride ions do not interfere even when present in quantity. Phosphate and arsenate only interfere when present in fairly large amounts and then only by causing the end point to appear slightly after the true value. This last-named interference is due to coprecipitation taking place with the silver chromate. Consequently, in technical analysis, phosphate and arsenate can generally be ignored, for their interference with the titration is negligible.

With amounts of oxalate about the same as the amount of potassium chromate used, however, the interference is greater and the results are correspondingly inaccurate. Levof<sup>8</sup> originally recommended the use of a phosphate or arsenate solution as indicator for this titration and it was Mohr who showed that it was preferable to use the chromate. The *pH* of the solution must be controlled to ensure reproducible results and Belcher and Parry<sup>9</sup> confirmed this range to be 6.5-9.0 by electro-metric measurement. In 1939 Berry and Driver<sup>10</sup> stated that the addition of potassium chromate to the solution could cause a change in *pH* value because of its alkalinity, and hence they recommended that the indicator be neutralised before its addition. However, Belcher and Parry<sup>9</sup> have shown that the neutralisation of the indicator is not necessary, as the change in *pH* is negligible owing to the buffering action of the chromate and this does not cause any inaccuracies for normal purposes.

#### Blank Determination Necessary

It is, however, essential to carry out a blank determination. This can be done in several ways, as follows :

- (1) Using Mohr's method of back-titrating the solution with chloride, until the yellow chromate solution returned.
- (2) Titrating an equal volume of water containing the indicator.
- (3) Titrating an equal volume of water containing the indicator plus a suspension of calcium carbonate to give an opalescence.
- (4) Carrying out a titration as in (3) except that freshly precipitated silver chloride is substituted for calcium carbonate.

Belcher and Parry<sup>9</sup> examined all these methods and from their results they concluded that the third method is the most convenient to use. The Mohr method can only be used for chlorine and bromine determinations, as iodine forms a complex of silver iodide/silver chromate which precludes its use.

The second classical method which Dr. Belcher dealt with was that ascribed to Volhard<sup>11</sup>, although as in the case of the Mohr method the real originator of the procedure is not credited with the work, since it was Charpentier<sup>12</sup> who introduced it in the first place. This method is applicable to all three halogens. With bromine and iodine, an excess of silver nitrate is added and back-titrated with

potassium thiocyanate, using ferric alum as the indicator. In the case of chloride determination, however, difficulty is encountered by the end-point fading. This is probably caused by the interaction of silver thiocyanate and silver chloride, as the former is less soluble than the latter.

To overcome the difficulty it is best to filter off the silver chloride before titrating, although the addition of an organic solvent to the suspension, when the silver chloride is withdrawn from the action of the thiocyanate solution, can achieve the same end. Of the solvents which have been examined, nitrobenzene, recommended by Caldwell and Moyer<sup>13</sup>, is by far the most effective. Schulek, Pungor and Kethelyi<sup>14</sup> claim that the fading end-point is not due to the difference in solubility between the silver salts but to the tendency of silver chloride precipitates to adsorb silver ions and to the resulting slow reaction of these ions with the thiocyanate.

The authors recommend boiling the solution, when the precipitate is desorbed of silver ions, and then adding potassium nitrate, which is preferentially adsorbed before the silver ions. Following this the solution is titrated with thiocyanate, and it is claimed that under these conditions the end-point is stable. This has been confirmed by the lecturer but it is inconceivable that solubilities play no part in the sliding end-point normally obtained. It is probable that the treatment given by Schulek *et al.*<sup>14</sup> causes rapid ageing of the precipitate and it dissolves too slowly in the medium for the end-point to be affected.

#### Sulphate Interference

Hillebrand and Lundell<sup>15</sup> state that sulphate interferes with the titration. This is only true in the case of small amounts of chloride in the presence of large amounts of sulphate, and since ferric alum is used as indicator this interference cannot be important. Belcher and Parry<sup>9</sup> found that sulphate in concentrations fifteen times that of the chloride had no effect. The optimum acidity recommended for this titration is 1N to 3N although acidities up to 8N can be used without any adverse effects.

As is well known, adsorption indicators<sup>16</sup> are useful in the titration of halides with silver nitrate, although when the first ones were introduced by Fajans<sup>17-19</sup> they were somewhat over-rated, especially as the end-points given by some of these indicators are not very well defined. In the presence of an excess of many electrolytes the end-points are extremely poor.

However, of this class of indicator dichloro-fluorescein, one of the earliest, is still one of the best when used in pure solutions. Methods using adsorption indicators, in which chloride and iodide are determined simultaneously, yield very poor results.

Mercuric nitrate is not a new titrimetric reagent for halides, as it was proposed by Liebig<sup>20</sup> in 1853 for use in the determination of chloride. Liebig used urea as indicator whereas Mohr preferred potassium ferricyanide but it was not until Votocek<sup>21</sup> recommended sodium nitroprusside, which gives a turbidity with excess mercuric ions, that the method became widely used. No precipitate is formed, as the feebly dissociated mercuric chloride is soluble in water. The main disadvantage of the method is the variable blank. Blank values have to be determined under the exact conditions in which the method is used and they increase with increasing halide content.

The titration can be carried out in an acid solution in this mercurimetric method. Dubsky and Trtilek<sup>22</sup> recommended the use of diphenylcarbazine or the corresponding carbazone as indicator, and although this indicator is a good one the end-point change is a gradual one. Parsons and Yoe<sup>23</sup> recommended the sodium salt of diphenylcarbazine sulphonic acid, screened with nickel nitrate and containing ferric nitrate to oxidise the azide to the azone *in situ*, as a superior indicator. The change is violet — grey — green, and their claim for a stable end-point and also sensitivity has been substantiated. It is better in artificial light than the original indicator.

#### Use of Mercurous Nitrate

Mercurous nitrate has also been used to determine the halides, when the mercurous halide is precipitated. Burnstein<sup>24</sup> used alizarin S as the indicator, whereas von Zombory<sup>25</sup> preferred bromophenol blue. One of the advantages of using a mercurimetric method is that no photochemical decomposition takes place, as in the case of the silver halides, although it cannot be used for iodide determinations.

In 1945 Gentry and Sherrington<sup>26</sup> put forward a neat method for the determination of the halides in coloured or turbid solutions. This procedure is strictly an argentimetric one, although the reaction between mercury and diphenylcarbazine is used to detect the end-point. For the chloride titration, mercuric chloride, diphenylcarbazine (equivalent amounts) and ether are added to the solution

when an ethereal solution of the indicator is formed. This is then titrated against silver nitrate and at the end-point mercury, released from the mercuric chloride by the action of the silver ions, reacts with the diphenylcarbazine. For the bromide titration mercuric bromide is substituted for the chloride and in the case of iodide, mercuric thiocyanate is used.

#### Newer Methods

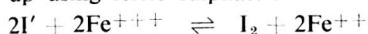
The newer methods for the determination of the halides are mainly amplification procedures and these are the best methods, especially in the case of bromine and iodine, which have such unfavourable equivalent weights. Leipter<sup>27</sup> proposed the method in the case of iodine, when the iodide is oxidised to iodate by means of bromine water. The excess bromine water being removed by formic acid, the iodate is treated with excess potassium iodide, when six equivalents of iodine are released. A similar method for bromide was put forward by Van der Meulen<sup>28</sup> in which the bromide is oxidised to bromate by the action of sodium hypochlorite. Sodium formate is used to destroy the excess oxidant and then by the addition of potassium iodide six equivalents of iodine are liberated.

There is no analogous direct method for the determination of chlorine but three indirect procedures are known. The first, worked out independently by Sendroy<sup>29,30</sup> and by Haslewood and King<sup>31</sup> depends on the reaction between silver iodate and the chloride ion to give the iodate, which can be treated with potassium iodide to give the sixfold amplification. Instead of silver iodate mercurous iodate may be used, and this was proposed by Avaliani<sup>32</sup>. Belcher and Goulden<sup>33</sup> examined these methods and also the use of mercuric iodate. Of the three possible reagents the last named is the least flexible as it is affected by acidity more than the other two, although generally speaking they are all good. The first two methods can give very exact results on the micro-scale if the conditions are standardised.

A method which has found much application in the micro field is the use of mercuric oxycyanide, which has been applied to the Viebock<sup>34</sup> determination of halogens in organic analysis. This reagent reacts with the chloride ion to release an equivalent amount of hydroxyl ion which can then be titrated with sulphuric acid. In the case of chloride it is necessary to run a control titration, although this is not essential in the case of bromide. A great asset

of this reagent is that it can be used to determine a combination of all three halogens. The total halogen content is determined using mercuric oxycyanide on one aliquot of the solution. On a second aliquot the iodide content is determined by a Leipter amplification and lastly, the combined bromide and iodide is determined by the Van der Meulen<sup>28</sup> method. From the results it is a simple matter to determine the original amounts of the three halides.

In the case of the determination of iodides there are more procedures available than is the case for chlorides and bromides. These include the starch-iodide method, in which starch is used to detect the end-point in the titration of iodide with silver nitrate. The typical blue colour observed when starch is added to iodine is only formed in the presence of iodide ions and if these are removed the blue colour disappears. This fact is utilised in the method, in which a small quantity of free iodine is formed by the addition of a few drops of an oxidising agent to the iodide solution. Bloom and MacNabb<sup>35</sup> used ceric sulphate, whereas Chirnoaga<sup>36</sup> preferred to use ferric sulphate as the oxidising agent. The following equilibrium is set up using ferric sulphate :



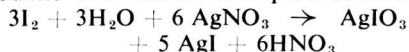
and as the titration proceeds the equilibrium is moved to the left until no more iodine remains at the end-point, when the blue colour formed with the starch is discharged.

A second method is that due to Schneider<sup>37</sup> who used palladium nitrate as an indicator for the titration of silver with an iodide solution. In the presence of iodide ions palladium nitrate gives a red-brown precipitate of palladous iodide and the appearance of this precipitate is used to detect the end-point in this determination. Uzel<sup>38</sup>, in his method, uses a solution of cinchonine and bismuth nitrate as indicator, a weakly acid solution of which gives a complex orange precipitate with iodide ions. On titration of the mixture with silver ions the uncombined iodide reacts first and then the iodide from the complex so that the end-point is indicated by a colour change from red-brown to a bright yellow.

Other methods which have been used in the determination of iodine and iodides include that due to Hahn<sup>39</sup>, who uses the reaction between iodine and the sulphite ion in aqueous solution, when sulphate ions and hydriodic acid are produced. Estimation of the hydriodic acid gives a measure of the iodine. This method is, however, much less convenient

than the more familiar one using thiosulphate. Helmer<sup>40</sup> adds a known excess of standard acid to an iodide solution, containing excess hydrogen peroxide. The iodine produced by oxidation is then extracted with carbon tetrachloride and the excess acid back-titrated in order to determine the iodide.

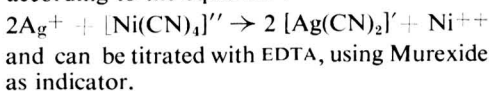
Alekseev<sup>41</sup> uses the reaction between iodine and silver nitrate in aqueous solution as the basis of his method for the determination of iodine. The reaction takes place as follows :



and the acid formed can be titrated to give a measure of the amount of iodine consumed. Another unusual method is that proposed by Marozeau<sup>42</sup> who determines iodide with mercuric chloride. When a mercuric salt is added to an iodide solution the complex ion  $HgI_4^{2-}$  is first formed, but near the equivalence point mercuric iodide begins to precipitate. As indicated above the red turbidity appears too soon and hence a correction table has to be drawn up in order to obtain an accurate result with this procedure.

Berg<sup>43</sup> proposed an ingenious method which depends on the formation of iodide and bromide derivatives of acetone in which the halide ions are linked by covalency and so do not appear as halide ions in the solution. The total halide content was determined by any of the conventional methods enumerated above. When iodic acid and acetone were added to a further aliquot of the solution, iodine was removed and the other halides determined. When bromic acid and acetone were added to a third aliquot, bromide and iodide ions were removed and the chloride could then be determined. The bromide content was determined by difference. High results for iodine and erratic results for bromine have been reported by this method.<sup>44</sup>

Finally, Dr. Belcher mentioned the method due to Flaschka and Huditz<sup>45</sup> which hinges on the fact that silver has a greater affinity for cyanide ions than has nickel. The halide ion is precipitated as its silver salt and an ammoniacal solution of the precipitate is treated with potassium nickel tetracyanide. Nickel ions are released from the complex ion according to the equation :



After Dr. Belcher had completed his wide survey, the meeting was thrown open for discussion. A lively exchange of questions and

ideas took place and the lecturer was able to enlarge on several points which he had been forced to treat in outline during his lecture due to the lack of time. In reply to a question as to which method he considered to be the best, Dr. Belcher replied that for general purposes the Volhard titration was, from his experience, the best, although he had little personal experience with mercurimetric procedures and he thought that these might be better after suitable experience had been gained.

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## Flexibox Ltd. Continues Expansion

TO handle the rapidly rising sales of their unique design of rotary shaft mechanical seals, Flexibox Limited, Nash Road, Trafford Park, Manchester, are forming an associated company in France. This follows the announcement made earlier this year of the setting up of an associated company in Germany.

The new French company, Flexibox S.A.R.L., will be responsible for handling the sales and service of Flexibox mechanical seals throughout continental France, Algeria, the French Mandate of Morocco and the International Territory of Tangier. Offices and works will be situated at 40 Avenue de Verdun, Croissy-sur-Seine, where operations will commence in the very near future. At the moment, certain seal parts for the French market are manufactured at Manchester but, ultimately, all components will be produced in France. This will help to relieve the heavy burden on the Manchester works and, at the same time, im-

prove speed of delivery to French customers.

In Germany, Flexibox GmbH, with offices at Zeil 68, Frankfurt-am-Main, has now been in operation for some months. This company is handling the sales and service of mechanical seals in the Federal German Republic and in the Western Sector of Berlin. Partial manufacture of Flexibox products is already in full swing and facilities are being rapidly extended with a view to complete manufacture in Germany as soon as possible.

The home factory at Trafford Park, Manchester, has also been considerably expanded in recent months. Total floor area of the works has now been increased by 50 per cent over that in use last year. This has been necessitated by a continually rising volume of business. Additional machinery has been installed to increase manufacturing capacity and the research and development department has transferred its equipment to a section of the new building.

IN THE EDITOR'S POST**'Lesson for Grandma'**

SIR,—In your 'Notes and Comments' (issue 6 November, Vol. LXXI, No. 1843, page 973) under the above title, you took me to task over the booklet 'Simplification in Practice' which I wrote at the invitation of the British Productivity Council. After your generous review in an earlier issue of an article I wrote on work study I can hardly complain of the tone of the above comment. However, there are two points to which I should like to reply. Firstly, it is a matter of opinion whether the language of the pamphlet is itself oversimplified. I do not think so. An experienced industrial panel of the BPC did not think so, and neither did the management in my own company where a considerable programme of simplification has been carried out.

I realise on reading your comment that through the use of the word 'imaginary' the charts in the pamphlet had been made to look fictitious in spite of a qualifying footnote. They were, however, based on the actual experience of this company, only the figures being modified to avoid disclosing confidential information. Simplification in this company has resulted in cutting out a great deal of the unprofitable dead-wood with benefits all round. As a newcomer to the chemical industry I should be loth to generalise as to whether simplification is a good thing, but any firm which follows through the investigation and routine suggested in the pamphlet may find, as my company did, substantial benefit to be gained.—

Yours faithfully,

B. WHITE

Deputy Managing Director,

A. Boake, Roberts & Co. Ltd.

London.

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**E-MIL Micro Pipettes**

SIR,—Thank you for the prominent reference you have given to our E-MIL Auto Self Set Zero Micro Pipettes, but we cannot resist adding that 'tautologically' speaking your comments are perfectly 'right and correct.'

So far as we are aware you are the first people to recognise this unintentional 'Siamese' description with which we have inadvertently christened these pipettes, due

undoubtedly to being able to offer users 'the best of two worlds' in this field, i.e., higher accuracy without personal errors.

Thanks to you, we will shorten the name of these pipettes in the next printing of literature but we will not call them—as they are domestically referred to now—'Tautological Pipettes.'

Yours faithfully,

S. H. ELLIOTT

Director,

H. J. Elliott Ltd.,

Pontypridd, Glam.

\* \* \*

**Value for Your Money**

SIR,—I was interested to read in 'Notes and Comments' of 13 November issue some figures from the *Esso Magazine*, showing that 60 per cent of the oil industry's capital is employed in the initial work of extracting the crude oil from the ground. The monetary sums involved and the amount of plant, labour and skill, are enormous. The first result is then only a black messy stuff which further has to be shipped over thousands of miles to the refineries where it is cooked and cracked, and cut and doctored before it reaches our garages at 4s. 6d. a gallon. Since we think it is then expensive, it is interesting to compare petrol with two other commodities, equally well known to many of us.

For an extremely dilute alcoholic solution manufactured primarily from water, cereal, sugar and herbs, none of which is particularly difficult to obtain, brewed in simple plant and with only minor distance transport problems, we pay, say, for draught bitter beer, 1s. 6d. a pint or 12s. a gallon. Even worse is the case of tobacco which leaves its native shores as crude leaf at a few pence a pound. The price we pay for it after processing is surely bad enough at something like a hundred and twenty times the price of petrol, weight for weight. Yet, sir, it is to me more irksome to know that my own brand of pipe tobacco contains 15 per cent to 17 per cent of water and that every six months or so I purchase a pound of water for £3 10s. Thirty-five pounds sterling per gallon!

Yours, etc.,

R. C. RETER

Ickenham, Middx.

# New Du Pont Laboratory

## Extends Basic Research & Customer Service

**D**U PONT'S new textile research laboratory at Chestnut Run, near Wilmington, Delaware, regarded as one of the most complete installations of its kind in the United States, is dedicated to providing a sound technical base for improvement and diversification in the use of Du Pont's man-made fibres.

Du Pont, which manufactures no finished fabrics, but only the raw fibres—rayon, acetate, nylon, Orlon acrylic fibre, and Dacron polyester fibre—built the \$5,000,000 laboratory last year to carry out three major research functions. These are: development of basic technology required to make good end products; discovery of new end-use opportunities through study of fibre and product properties and new processing techniques; practical evaluation of new fibres and modifications of existing fibres resulting from research. These activities will supplement other research carried on at Du Pont laboratories, at textile fibre plants and at the company's main experimental station.

The building contains approximately 100,000 sq. ft. of floor space. Offices and laboratories are in a two-storey section 282 ft. long and 62 ft. wide. Additional laboratory equipment, textile areas, service and operating areas are in a single storey section 202 ft. wide extending back 298 ft.

### Seventeen Laboratory Areas

Seventeen physical and chemical laboratory areas in the front section provide facilities for studying properties and applications of textile fibres. To the rear, areas are provided for mock-ups of experimental processing. The remainder of the floor space is devoted to textile processing equipment on which fibres can be made into fabrics suitable for end-product use.

Complete small-scale equipment is available to handle fibres in quantities ranging from less than a pound up to several hundred pounds, from yarn and staple to the finished dyed fabric. Standard machines or special small-scale equipment allow mill-type runs through processes used in American mills for producing and finishing yarns and manufacturing fabrics of spun and continuous filament yarns. In the dye

area, standard dyeing operations of yarns or fabrics may be performed.

Facilities of the textile area are available jointly for research on basic principles of yarn and fabric construction by the Textile and Industrial Products Research Division and for Customer Service Section study of specific mill problems referred to them. Operations are carried out on a continuous three-shift basis, five days a week.

Dr. Linton G. Ray, Jr., director of the laboratory, has been connected with the investigation of properties of synthetic fibres since joining the company in 1943. Describing the development of basic technology required to make good fabrics and end products as the 'number one assignment' of the laboratory, Dr. Ray said:

'Work on this objective accounts for approximately 75 per cent of the research efforts at the laboratory. This is a remarkable figure, considering the importance of other objectives and the fact that the Du Pont Company does not manufacture or sell fabrics and end products.

'It would be a natural reaction,' he added, 'to say that the problems of handling and using synthetic fibres are the responsibility of the textile trade, since converting fibres to end products is their business. Like most new products, however, the synthetics require new techniques and the trade cannot be expected to shoulder the full burden. We accept our responsibility in this regard and it is the job for our laboratory and our trained personnel to help see that this work is accomplished.'

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### German Oil Output Increasing

The output of mineral oil in the German Federal Republic at present meets 30 per cent of the German demand, according to a statement made at the recent annual meeting of the German Association for Mineral Oil Science and Coal Chemistry. In October 1953 the mineral oil output of West Germany reached almost 200,000 tons. This is a new record. Three years ago, mineral oil production exceeded 100,000 tons for the first time since the war.

## Royal Society Medals

### President's Address at Annual Meeting

**P**RESENTING The Royal Society medals at the anniversary meeting on 30 November, the president, Dr. E. D. Adrian, O.M., M.D., M.A., Hon. D.Sc., Hon. Ll.D., F.R.S., F.R.C.P., said the advance of science must depend on the initiative of those in the front line of research. 'It must be the aim of each special branch to explore the alleys it has opened up, including those which are most probably blind, but as long as the branches are not controlled from headquarters their members will decide how this is to be done,' he went on.

Among the recipients of medals were Sir John Cockcroft, K.C.B., C.B.E., M.A., Ph.D., M.Sc., D.Sc., Hon. Ll.D., M.I.E.E., F.R.S. (Royal A Medal), Professor H. A. Krebs, M.D., M.A., F.R.S. (Royal B Medal) and Professor J. W. Cook, Ph.D., D.Sc. (Lond.), Sc.D. (Dublin), F.R.I.C., F.R.S. (Davy Medal), and Dr. Adrian had these words to say about them:

**Sir John Cockcroft:** 'In conjunction with Dr. Walton, he was the first to transmute elements by purely artificial means, setting the crown on Rutherford's work which had proved that bombardment by  $\alpha$ -particles from radioactive substances could transmute many of the lighter elements. Cockcroft's work in this field is outstanding both for its scientific consequences and as a discovery of technique. The original experiments of Cockcroft and Walton are the seed from which has grown the whole new science of nuclear chemistry, in which artificially accelerated particles are the reagents which produce varied changes in the nuclei of elements which they bombard.'

**Professor Krebs:** 'He has made unique contributions to our understanding of the intermediary metabolism of nitrogenous substances and of carbohydrates in living cells and in his recent work he has helped to bridge the gap which exists between our understanding of the chemical activities of cells and of the way in which these activities help to maintain ionic gradients within the living organism. In the course of these researches he has devised many valuable new methods for the study of cell metabolism.'

**Dr. Cook:** 'He is distinguished mainly for

his contributions to our knowledge of the polycyclic aromatic compounds, the carcinogenic hydrocarbons and the tropolones, including the alkaloid colchicine. . . . More recently Cook has extended his studies to the examination of the structure of metabolic products of the carcinogen, 3:4-benzopyrene, and to the oxidation of benzenoid hydrocarbons by novel methods. In these original studies Cook has tackled a series of extremely difficult and complicated problems with an exceptional knowledge of general organic chemistry coupled with exceptional experimental ability.'

### Geigy Six Years Older

GEIGY, one of the oldest dyestuff and chemical manufacturers, for some considerable time traced their origin back to the year 1764. This was the date when the name of Johann Rudolf Geigy, the founder of the firm, first appeared in the 'Ragionenbuch,' the trade register of the city of Basle in Switzerland.

Professor Dr. Eduard His, who is an authority on legal and industrial matters, when delving into the city archives some time ago, found that J. R. Geigy's name could be found already before that date, and came to the conclusion that he must have been trading for quite some time when the entry in the 'Ragionenbuch' was made.

The Guild Book of the Safran Zumft, to which most Basle merchants belonged, records the names of all apprentices bound to the guildsmen. Among these names are four of men who were indentured with J. R. Geigy between 4 July, 1759, and the end of July, 1764. Customs invoices, however, of the Basle bonded warehouse further show that in the second quarter of 1758 'Rudolf Gygi' paid seven 'Schillinge' in customs duty, and in the third quarter fourteen 'Schillinge' and four 'Batzen.' From the last quarter of that year onwards the name appears regularly against customs payments and warehouse charges and tol's.

According to the law of the time Johann Rudolf Geigy attained his majority on his 25th birthday—23 June, 1758—and on that day would become legally entitled to open a business on his own account. It is obvious, therefore, that it was the year 1758 when the firm was officially founded.



## HCl Absorption

### An Adiabatic Process Described

A MEETING of the North-Western Branch of the Institution of Chemical Engineers was held at Manchester on 22 November, when T. A. Kantyka and H. R. Hinckleiff presented a paper on 'Adiabatic Absorption of Hydrogen Chloride.'

Mr. Kantyka described the method of designing the absorbers and the performance of the plant which recovers hydrochloric acid of 28 per cent concentration from the gas evolved during the chlorination of organic chemicals. Hydrogen chloride is very soluble in water; it forms an azeotrope which boils at 108°C; and it has a large heat of solution, the removal of which is the major problem in the design of the absorber. The normal practice is to absorb the gas in dilute, cooled hydrochloric acid which is re-circulated throughout the system of absorption towers. Under adiabatic conditions, the acid is not re-circulated, the hydrogen chloride is absorbed at or near the boiling point of the acid and the heat of absorption evaporates water into the gas stream. This evaporation by boiling prevents the condensation of organic compounds in the acid and thus aids the recovery of acid of good quality.

### Steps in Design

The first step in the design is to draw the vapour-liquid equilibrium curve for hydrogen chloride/water. The dimensions of the absorption plant are calculated by a step-wise procedure from heat and material balances and from a calculation of the gas-film coefficient, because the resistance to absorption of the gas film is the controlling factor in the process. Calculations based on the height of either a transfer unit or a theoretical plate and the assumption of a straight line for the operating line on the vapour-liquid equilibrium diagram simplified the calculation and gave a satisfactory agreement with the step-wise procedure.

A lagged, glass absorber, 5 ft. high and 6 in. diameter, was packed to a depth of 4 ft. with  $\frac{3}{8}$  in. earthenware Raschig rings, and a glass coil heat exchanger of 15 sq. ft. surface area was attached to the absorber. Water vapour, chlorine and organic chemicals from the top of the absorber were passed to a glass jet condenser. All parts of the plant in contact with gas or acid were

made of glass and the joints were made of Hycar rings in Fluor envelopes; the storage tanks and pipes for cold acid were rubber-lined mild steel.

The flow of water to the absorber is automatically controlled by the boiling point of the acid leaving the absorber and this is a convenient measure of its concentration; the output of acid is about 28 gal. per hr. and its concentration 28 per cent. The flow of gas to the absorber is controlled by working the chlorinators on a rota system. The absorber will work satisfactorily at such very low liquid rates that they are below those required adequately to wet the packing, thus making adiabatic absorption an attractive proposition from the operational viewpoint when gases from chlorinators are to be absorbed, particularly as the acid from the absorber is only faintly yellow and is nearly free from organic matter.

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## NCRT Diplomas Awarded

ALTHOUGH it is six years since the National College of Rubber Technology was established by the Ministry of Education, the first presentation of diplomas took place on 30 November. The diplomas, covering the years 1949 to 1954, were presented in the theatre of the Northern Polytechnic, London, by Lord Baillieu, chairman of the Dunlop Rubber Co. Ltd. and president of the Research Association of British Rubber Manufacturers. Fellowships for Rubber Technology were presented to C. G. Richardson, Ph.D., and K. O. Lee, B.Sc., Ph.D., and a large number of certificates, licentiateships and associateships were also presented. The report on the National College was given by F. H. Cotton, Ph.D., M.Sc., F.R.I.C., F.I.R.I., head of the college.

The College was founded by the Ministry of Education at the request of the rubber industry as part of its policy to provide national centres for advanced technological education. The College is located in a new building which was opened last year by Lord Baillieu and which adjoins the Northern Polytechnic. Since 1948, 35 certificates for rubber technology and 35 certificates for plastics technology have been awarded as well as 28 licentiateships and 43 associateships for rubber technology. Four fellowships for rubber technology have been awarded.

## Epikote Resins Exhibition

A FIVE day exhibition is being held this week by Shell Chemicals Ltd. to demonstrate to industry the wide variety of uses to which their Epikote resins are being put. The exhibition, which commenced on Monday and closes at 1 p.m. today (Saturday), is not open to the general public but is being widely attended by plastics, surface coatings and adhesives manufacturers as well as by representatives of the trade and technical press. A similar exhibition, although on a slightly smaller scale, is to be staged in Birmingham, Manchester and Glasgow early in the new year.

Shell's epoxide and epoxy resins are now being manufactured in the US at the rate of approximately 11,000 tons per annum and a plant at Pernis in Holland began production 18 months ago. A British plant, at the Shell chemical plant at Stanlow, will be producing by the middle of 1955. At present the main outlet is in surface coatings including lacquers, paints, stove enamels, varnishes and printing inks. So far formulators have concentrated on industrial applications but a number of paint manufacturers are now actively considering the use of Epikote resins in paints intended for domestic use and one large company is already using them in one of their decorative enamels.

## Another Bumper Contract

A CONTRACT for two large blast furnaces, amounting in value to nearly £3,000,000, has been placed by the Indian Iron and Steel Company Ltd. with Ashmore, Benson, Pease & Company, of Stockton-on-Tees. The furnaces, to be built at Burnpur, India, will have hearths of 25 ft. diameter and each will be capable of an output of 1,200 tons of iron per day. The first furnace will go into production in 1958 and the second a year later.

This contract has been awarded to a British firm in the face of keen competition from both the Continent and the US. The consulting engineers, who planned and who will supervise this major extension to the Burnpur works, are the International Construction Company of London.

Ashmore, Benson, Pease & Company are a member-firm of the Power-Gas group and blast furnace engineering is one of their main interests. It was announced recently

(THE CHEMICAL AGE, 1954, 71, 1045) that Simon Carves Ltd. of Stockport had received a contract for the building of two batteries of 78 coke ovens each, with other plant, at the Burnpur steelworks.

## Alcohols Plant Extends

I.C.I. have decided to expand their plant at Billingham, County Durham, for the manufacture of higher alcohols by the carbonylation process. The Billingham plant is the only one operating this process in the UK, and when the extensions are completed, it will be the largest in the world, with a potential capacity of 40,000 tons of products per year, valued at more than £5,000,000.

The carbonylation process converts olefines into alcohols by reaction at high pressure with carbon monoxide and hydrogen. Among the alcohols made on this plant are Alphanol 79 and nonanol. These are the basis of plasticisers used throughout the plastics industry with PVC and similar materials. The process also yields butanol and iso-butanol, which are used as solvents, principally in paint manufacture.

Consumption of these products at present exceeds home production, but the extensions will make unnecessary the importation of large quantities, or of substitutes, from Germany and the US. Indeed, I.C.I. plan to export a substantial proportion of the output.

## H<sub>2</sub>O<sub>4</sub> Production Up

Production of sulphuric acid in the UK during August reached 162,900 tons, an increase of 160 tons over the figure for July, but still lower than during the rest of the year. 20,500 tons of sulphur were used in its manufacture and 7,100 tons of sulphur used for other purposes. During the month 152,000 tons of sulphuric acid were used.

## Boost in Synthetic Rubber Output

Because of a big increase in orders and higher prices for imported natural rubber, the US is to boost its production of synthetic rubber in the next few months. In the meanwhile, the proposed sale of Government-owned synthetic rubber plants to private firms (THE CHEMICAL AGE, 1954, 71, 1046) has run into difficulty because the Government agency and the firms concerned have been unable to agree on purchase prices.



**OIL IN THE MIDDLE EAST: Its Discovery and Development.** By Stephen Hemsley Longrigg. Oxford University Press, London. 1954. Pp. 305, with maps and appendices. 25s.

This book is a history of the oil industry in the Middle East during the first fifty years of the twentieth century, written with a remarkable understanding of the problems of the industry and of the peoples of the Middle East. The important periods in this history are from 1900 to 1933, the Second World War and the final period from 1946 (the development of Arabian fields) to 1953 including the Iranian oil dispute. The first seven chapters of the book deal with the first period, the discovery and development of oilfields in Persia, Egypt, Turkey and the Levant, the First World War and developments during the period up to the 1933 agreement between the Anglo Iranian Oil Company and Persia. The next two chapters deal with the Second World War in Iraq, Persia, Arabia and the Levant and the final five chapters with the 'Tragedy of Persia' and the developments during 1946 to 1953 in Arabia, Iraq and the Levant countries.

The oil industry has had to face many problems, both political and technical, and it has had a far-reaching effect upon the life and government of the people of the Middle East. These problems are discussed from the viewpoint of the economist and historian, with a sufficient account of the geology and technical problems to make a balanced picture. The final chapters also give a detailed account of the many oil companies operating in the Middle East and their inter-relationship.

Brigadier Longrigg has had a long connection with the people of the Middle East as well as the oil industry, and has a deep understanding of, and regard for, the ancient civilisation and culture of this area. His book will give great pleasure to many people for whom the complicated structure of a great oil industry and its effects upon

a previously nomadic and agricultural population are matters of interest. To students of economics, social history and to all who wish to understand the importance in world affairs of the Middle East, and particularly the Arab states, this book is highly recommended.—F.M.

**THE ELEMENTS OF CHROMATOGRAPHY.** By T. I. Williams. Blackie and Son Ltd., Glasgow. 1954. Pp. 90. 9s. 6d.

The number of books on chromatography, although increasing, is still not sufficiently large to require an apology for the appearance of another. Dr. Williams, in 1946, produced a book entitled, 'An Introduction to Chromatography,' which is a well-known, commendable work. In the preface of the present volume he states that a completely new book seems called for rather than a revised edition of the old one. In this sense the book is a little disappointing as one tends to expect at least an expansion of the old volume, but this publication is a much smaller book and contains less detail.

After a comprehensive historical introduction, chapters on adsorption, partition, and ion-exchange chromatography follow. The chapter on ion-exchange is new and treatment is in a general and elementary manner. Miscellaneous forms of chromatography, the treatment of colourless substances and chromatography in industry are among other useful topics discussed. A glimpse of the theory of development of a chromatogram is presented in chapter 7.

On reflection, it can be said that this book gives a very good, general survey of chromatography and examples of its applications. It is logically presented, very easy to read and, because of the minimum of technical details, it could be perused profitably by the student and even the interested layman. It is well edited, neatly printed on good paper and contains 36 illustrations, some of which are coloured.—R. J. MAGEE.

## Chemist's Bookshelf

STATISTICAL ANALYSIS IN CHEMISTRY & THE CHEMICAL INDUSTRY. By Carl A. Bennett and Norman L. Franklin. John Wiley & Sons, New York; Chapman & Hall, London. 1954. Pp. xvi + 724. 58s.

This volume is sponsored by the Committee on Applied Mathematical Statistics of the American National Research Council, whose declared aim it was to make available 'a comprehensive book on applied mathematical statistics with illustrative examples and materials drawn from chemistry and the chemical industry.' Dr. Bennett, a statistician working in the chemical industry, and Dr. Franklin, a chemical engineer with statistical experience, have given us just that.

The book follows the traditional lines for such a work. The first four chapters introduce us to the main descriptive statistics—measures of location and dispersion, of correlation and regression—and to the elements of probability, including the binomial, normal, Poisson, *t*-, *F*-, and  $\chi^2$ -distributions. The hypergeometric distribution is also introduced but does not seem to be used in the book. These are followed by a lengthy chapter on Statistical Inference, largely devoted to methods of comparing means and variances. The discussion of basic principles is rather meagre. Next comes a short chapter on regression and correlation techniques, including the use of orthogonal polynomials when the independent variable increases in equal steps. Here as elsewhere computational procedures are carefully described. This chapter includes a brief but informative section on the discriminant function.

The next two chapters—on the Analysis of Variance and on Experimental Design—form the heart of the book. Together they cover almost 300 pages, over 40 per cent of the text, and these are the most closely packed pages in the whole volume. The principles of experimental design are well brought out, and the many examples from the fields of chemistry and chemical engineering appear to the present reviewer—who is not a chemist—to be excellently chosen and most suggestive. This is not true of all the examples in the earlier chapters. The discussion of the analysis of covariance, and

of confounding in factorial experiments are especially good. This is at once the most important and the best section of the book.

The final chapters—on the Analysis of Counted Data, Control Charts, and Some Tests of Randomness—are comparatively short and in some respects rather inadequate. In particular the use of the  $\chi^2$ -distribution in the analysis of contingency tables is dismissed in seven pages and it is stated that 'the test is only approximate, especially when the smallest expectation  $np_i$  is, say  $< 50$ .' This is an old fallacy; it is well known that a single expectation may be as low as 0.5 without greatly affecting the test in many applications, while all the expectations may lie between 2 and 4 as long as the number of cells is neither very small (say  $< 6$ ) nor very large (say  $> 60$ ).

It is rather surprising that an American textbook of this type should contain no reference to Abraham Wald's 'Statistical Decision Functions.' Wald regarded the problems of statistical inference as essentially economic rather than logical; the aim is to take decisions which are in some sense least harmful, not to discover absolute truth. This approach seems particularly useful in industrial applications. The neglect of such economic factors make some of Bennett and Franklin's examples rather misleading. For example, they discuss the decontamination of counters in low-background  $\alpha$ -counting. This is to be carried out whenever the background  $\lambda$  exceeds 0.25 counts per minute. They make an experiment and decontaminate the counters if it is proven at the 5 per cent level that  $\lambda > 0.25$ . As far as the logic of the situation goes they might as well decontaminate the counters unless it is proven at the 5 per cent level that  $\lambda < 0.25$ . It is not a matter of discovering the absolute truth about the magnitude of  $\lambda$ , but of taking the 'best' decision; to do this we must at least know what happens if the counters are decontaminate when  $\lambda > 0.25$ , or not decontaminated when  $\lambda < 0.25$ . Again, there is very little discussion of sequential procedures, though their use may frequently be expected to halve the size of samples required to determine a given point, at the cost of more complicated planning.

On the whole, this is an excellent textbook of the conventional type. Chemists and chemical engineers wishing to learn statistical methods should find it very valuable, while teachers will be overjoyed at the

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host of examples it contains. On the other hand, students will be glad to know that most of the ground is adequately covered in either M. J. Moroney's 'Facts from Figures' or O. H. Brownlee's 'Industrial Experimentation,' at a fraction of the price.—W. M. GORMAN.

**BRITISH PHARMACEUTICAL CODEX, 1954.** The Pharmaceutical Society of Great Britain. The Pharmaceutical Press, London. 1954. Pp. xxxii + 1340.

Owing to the tremendous advances being made in medical and pharmaceutical knowledge it has been decided to bring out new editions of this invaluable reference work every five years; hence the appearance of this sixth edition. A comparison with the 1949 BPC is proof of the need for shortening the intervals between issues.

More than 80 crude drugs and about 100 galenicals have been deleted and the new issue contains 200 fewer pages than its immediate predecessor. On the other hand, monographs for more than 60 drugs not described before have been included. In the Formulary, many new preparations have been added and the formulae for others improved. Additional tolerances and assay processes have been included in the new edition. Much of this information was obtained from experimental work carried out by members of the sub-committees and in the Pharmaceutical Society's laboratories.

Eighty-eight experts collaborated on the 11 committees and sub-committees to provide authoritative accounts of the chemical, physical and therapeutic properties of all drugs of importance. Many more experts gave advice. All information contained in previous editions which has been retained has been completely revised and the 1954 BPC is as accurate and up to date as it is possible to make a book which deals with pharmacy, chemistry and medicine.—A.C.

**THE STRUCTURES AND REACTIONS OF AROMATIC COMPOUNDS.** By G. M. Badger. Cambridge University Press, London. 1954. Pp. xii + 456. 63s.

One of the most important advances in chemistry during the past 25 years has been the enormous growth of our insight into the nature of 'aromatic character'. The structures, properties and reactions of aromatic compounds for long remained paradoxical

and perplexing, but today there are no paradoxes and few real perplexities. This revolution has been accomplished mainly by the co-operation of the experimental physical chemist and the theoretician. It has come about comparatively quickly because conjugated molecules lend themselves more readily to fruitful quantum mechanical investigation than do any other polyatomic systems.

Although the main ideas embodied in the modern outlook are relatively easy to grasp, they are the outcome of rather intricate experimental and theoretical techniques. A great mass of observations and calculations has accumulated over the years. There has, therefore, been a need for someone sufficiently expert to present the essentials of the whole subject in a straightforward and palatable form. By a very judicious selection of material and argument, Dr. Badger has succeeded in doing just this.

The book is divided into 11 chapters. The first of these gives an outline of the physico-chemical experiments which are the foundation of our knowledge of the benzene structure. The treatment is in general quite adequate, but the spectroscopic work of the Ingold school might have been discussed in somewhat greater detail. Chapter II contains a simplified but, from the chemist's viewpoint, a very useful theoretical discussion of the benzene problem. The third chapter deals with some properties (mainly ground state) of condensed polynuclear aromatic systems, non-benzenoid aromatic hydrocarbons, heterocyclic aromatic compounds containing six-membered rings, and molecular complexes. The treatment is lucid and thorough in general, but the inclusion of the important work of Craig on pseudo-aromatic systems and of Mulliken on molecular complexes would have enhanced the value.

Chapter IV is devoted to addition reactions and Chapter V to the properties of the aromatic double bond. The latter chapter underlines forcibly the way in which the reactivity of a bond can indicate the amount of double bond character and vice versa. The various methods of estimating double bond character are also discussed. Inductive and mesomeric effects are treated in Chapter VI. The experimental evidence is invariably well presented. In Chapter VII,

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100 pages are devoted to the topic of aromatic substitutes. This is perhaps the most important chapter in the book from the organic chemist's point of view.

Other topics treated are the Diels-Alder Reaction (Chapter VIII), photo-oxidation and photo-dimerisation (Chapter IX), absorption and fluorescence spectra (Chapter X), and optical activity in aromatic compounds (Chapter XI). There is at least one point in these later chapters which needs comment. It concerns the structure of diphenyl. Whatever evidence there may be for the planarity of diphenyl in condensed phases, it is pretty certain (Bastiansen 1950) that in the gaseous state the benzene rings are tilted at an angle of about 45° to each other. This is simply because the *ortho* hydrogens get in each other's way and swamp the tendency towards maximum delocalisation energy. It is a fact which is too often ignored in discussion of the diphenyl problem and Dr. Badger is no exception in this respect.

Apart from the few minor blemishes already indicated, indeed in spite of them, this book is one of unusual merit.—  
H. MACKLE.

ARBEITSGEMEINSCHAFT FÜR FORSCHUNG DES LANDES NORDRHEIN-WESTFALEN. HEFT 34. Lectures by Rudolf Schenck and Emil Lehnartz. Westdeutscher Verlag, Cologne. 1954. Pp. 67. DM. 5.50.

This booklet contains the substance of two lectures which were given in July 1933 under the auspices of the organisation named in the title. The first is entitled 'Bedingungen und Gang der Kohlenhydratsynthese im Licht.' Professor Schenck is mainly concerned with the initial step in the photosynthetic process—the photolysis of water in the presence of hydrogen acceptors. In the course of his argument he develops several stimulating, though highly controversial ideas about the mechanism of photosynthesis.

Professor Lehnartz's contribution—'Die Endstufen des Stoffabbaues im Organismus' is a brief review discussing, among other things, the importance of acetylcoenzyme A in metabolic processes. It contains no original ideas and no references are given.—J.C.P.S.

TECHNICAL AID TO FOOD INDUSTRIES. The proceedings of a symposium held at the CFTRI, 1953. Central Food Technological Research Institute, Mysore. 1954. Pp. 270. Rs. 5.

This book describes the present status of the Indian food industry and the technical and other problems being faced. It contains the full proceedings of the third symposium held by the Indian Central Food Technological Research at Mysore on 5 and 6 February, 1953. Among the subjects dealt with are food preservation, quality control, the importance of standards, chemical engineering in food industries, storage methods, quick freezing and refrigeration, the production of protein hydrolysate from waste shark flesh, the manufacture of edible gelatine from tannery by-products, vegetable oil refining and the need for developing a fermentation industry in India.—B.W.

SEMI-MICRO QUANTITATIVE ORGANIC ANALYSIS. By R. Belcher and A. L. Godbert. Longmans, Green & Co. Ltd., London. 2nd edition, 1954. Pp. x + 222. 21s.

Amongst organic research workers in universities and other establishments there is the ever-present and ever-growing demand for carbon, hydrogen, halogen, sulphur, nitrogen and alkoxy group determinations. Not often, rarely indeed, does the research worker undertake these determinations himself, due mainly to the belief that such ventures require (a) a special training, (b) a lot of apparatus and (c) more material than he has available.

Semi-micro analysis is now an established practice and in this second edition of a popular text-book on semi-micro organic analysis the authors have gone a long way to remove these erroneous beliefs. They rightly stress that many of the semi-micro methods indicated can be carried out by the research worker himself with the minimum of apparatus, including the use of nothing more than a good analytical balance for all weighings and 20-50 mg. of material.

The arrangement of the text is similar to the previous edition but the following important additions have been made: the direct determination of oxygen after Unterzaucher; determination of halogens by means of wet combustion and a modified Stepanow method; the determination of fluorine; the bomb fusion method for halo-

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gen, sulphur, phosphorus and arsenic; the Wiesenberger method for the determination of acetyl groups and the Furst and Bohner method for boiling points. A further interesting feature is the inclusion of Ingram's modification to the carbon and hydrogen determination. Experience in the use of this modified assembly has shown it to be very satisfactory and an improvement on former methods.

Alternative methods of completing determinations, e.g., a new method for the determination of sulphur, titrimetrically in the presence of nitrogen, add to the value of the book.

The section on the determination of physico-chemical properties has been varied very little since the first edition. Ebullioscopic methods for determining molecular weight are, to say the least, not very satisfactory, but, of those available for semi-micro work, the Bobranski-Scuharda apparatus is hardly the most precise, although it is simple to manipulate. This section could be expanded.

The balance and methods of weighing are again excellently covered and include a revised method for the standardisation of weights based on the transposition method of weighing. New appendices include descriptions of the construction of electrically-heated furnaces for combustion tubes, the preparation and standardisation of volumetric solutions and suitable standard substances for the determinations. The number of references, now included at the end of each chapter, is expanded.

In conclusion it can be said that this edition has brought the first volume right up to date in the field of semi-micro quantitative organic analysis. It is laid out in an excellent manner, well written, and no one will find it difficult to follow the logical method of presentation. The first edition has found use in universities and technical colleges as a standard reference, and it is believed that this new edition will find even wider application. It can be confidently recommended.

—R. J. MAGEE.

ELEMENTARY CHEMICAL ENGINEERING. By Max S. Peters, McGraw Hill Publishing Co. Ltd., New York and London. 1954. Pp. ix + 322. 46s. 6d.

This is a remarkably concise textbook dealing in an elementary way with the so-called unit operations. The book sets out to

present the principles of chemical engineering in a form such that they may easily be understood by readers with no previous training in the field and it succeeds admirably in doing this. The author points out that 'the profession of chemical engineering might be said to be built around technology (or the complete process) rather than around the individual unit operations.' For convenience in teaching, at least in the early stages, the unit operations are usually discussed separately. However, it is useful that the student should be reminded that alone they are of little value; combined, they result in a complete plant.

This book will serve as an excellent introduction to the subject for chemical engineering students to whom it will be particularly useful in revision prior to examinations. It will also prove of value to chemists and technologists who wish to become familiar with the basic principles of chemical engineering. It will be valuable to the student studying privately because of the selection of problems which it contains with answers provided.

The topics dealt with include stoichiometry, industrial chemical engineering equipment, fluid flow, heat transfer, evaporation, distillation, absorption and extraction, humidification and dehumidification, drying, filtration, chemical engineering economics and plant design. Useful data are included in one appendix and another includes a number of derivations considered to be other than elementary. Illustrative examples have been used throughout the book.

Certain minor criticisms can be made. The whole of chapter 13 (dealing with chemical technology) is too brief to be of any real value. In the section on fuels and combustion the author refers to the 'proximate' analysis as an approximate method, which it is not. The 'proximate' analysis of a solid fuel can be reproduced accurately and has its own particular value to the fuel technologist.

This book is compact and clearly written, and the emphasis placed on practical applications of the principles discussed enhances its value to the beginning student. It should prove to be very popular as an introductory text book, although the price is rather high for the British student.—R.L.

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**SEMIMICRO QUALITATIVE ANALYSIS.** By H. H. Barber and T. I. Taylor. Harper and Brothers, New York; Hamish Hamilton Ltd., London. Revised edition, 1953. Pp. xi + 404. 35s.

This impresses one as a pleasant book from which to learn qualitative analysis. Theory and practice are thoroughly intermingled in a refreshing way not often used in textbooks of analytical chemistry. As a consequence, no student can work through the book without acquiring a modicum of theoretical background, and the student with a really inquiring turn of mind is not irritated by having to refer continually to an isolated section of the book.

Techniques for analysis on a few drops of solution are described. Although the authors prefer the 'Barber Pressure Bulb' method for separating precipitates, and thioacetamide for the precipitation, in hot solution, of the sulphides, they point out that it is readily possible to use the book with the more generally acceptable methods of centrifuging, and the application of hydrogen sulphide in gaseous form.

The chemistry of the ions considered is dealt with in considerable detail. The student is required to work for his knowledge, however, and is by no means spoon fed. After a course based on this book he should have a very sound grasp of the behaviour of a good range of inorganic ions. Only the more familiar cations are described in detail, but sufficient information for an elementary course is included regarding the behaviour of less familiar elements. Useful tables of such data as the composition of reagent solutions, and solubility products, are added as appendices.

Occasionally an idiom is used which may be acceptable in America but which strikes unfamiliarly on British ears. Thus, to say that certain hydroxides are 'rather completely precipitated' is reminiscent of the Chandleresque school of writing in which an unfortunate character is shot rather dead.

Undoubtedly the book is first rate for its purpose, and in spite of the rather high price by British standards, it might well be considered seriously in this country as a teaching text. Students could have many worse introductions to this branch of analytical chemistry.—CECIL L. WILSON.

**REPORTS ON THE PROGRESS OF APPLIED CHEMISTRY: Vol. XXXVIII: 1953.** Edited by F. Clark. Society of Chemical Industry. 1954. Pp. 989.

They can't possibly keep it up. Although this latest volume is only six pages more than its immediate predecessor, and in fact three less than the reports for 1950, it gives the impression of covering more ground than ever. Between them, 105 authors, all experts, have reviewed 7,529 references under 78 different headings. Of these, no less than 392 concern polymerisation, and petroleum and brewing come very close second and third. The name index extends to 71 pages, and the subject index to 74.

This, in view of the magnitude of the enterprise, the diversity of the material, and the eminence of the reviewers, is about all the appraisal one can give the 'Annual Reports.' Their value and importance are known to all, and how the editor and the contributors manage to keep their heads above the rapidly-rising flood of chemical publications will remain a marvel.—B.I.

**SUCCESSFUL WINE MAKING.** By S. M. Tritton. Grey Owl Laboratories. Almondsbury, Glos. 1954. Pp. 38. 5s.

A few years ago Mr. Tritton, who is a consulting chemist specialising in fermentation and wines and ciders, published a pamphlet entitled 'Grape Growing & Wine Making' which was designed to assist the amateur. This apparently proved a great success and so a companion volume, 'Successful Wine Making,' has appeared, giving more detailed information on methods for making mead, perry, cider, fruit and sparkling wines together with suitable recipes. This new booklet is supplementary to the previous volume and does not contain any details regarding grape growing or the making of wines from grapes. Those who possess Mr. Tritton's first volume will want to acquire 'Successful Wine Making.' Those who have always felt that they would like to make their own wines from English fruit or vegetables will find this book makes the achievement of this dream quite easy.

### Printing Ink Output Up

Canadian production of printing inks rose to an all-time peak total of 25,735 lb. in 1953 from the preceding year's 22,068,770 lb., and the value advanced to \$11,125,566 from \$9,375,202.



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# HOME

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## Christmas Closing

Howards of Ilford Ltd. announce that their offices and works will be closed for the Christmas holidays from Friday, 24 December, until Monday, 27 December, inclusive. The offices and factory of Kaylene (Chemicals) Ltd., Waterloo Road, London N.W.2, will also be closed from the evening of 23 December to the morning of 28 December.

## Chemical Society Library

The Chemical Society library will close at 1 p.m. on Thursday, 23 December, for the Christmas holidays and re-open at 10 a.m. on Wednesday, 29 December.

## Yarn Price Cut

Courtaulds Ltd. announced on 1 December a reduction of 9d. per lb. in the price of their spun dyed continuous filament acetate rayon yarn. The reduction affects all shades except the popular black which is still cheaper than the other colours.

## Gas in Salt Mine

The Northern Gas Board and I.C.I. have agreed in principle to a scheme that will enable 10,000,000 cu. ft. of gas to be stored in a salt mine between Seaton Carew, near West Hartlepool, and Port Clarence, near Stockton. The gas will be stored 1,000 ft. below ground.

## Imports in September

September imports of phosphate rock fell to 71,600 tons from the previous month's figure of 91,600 tons. Imports of sulphur were also down, the month's total being 24,000 tons, compared with 53,000 tons in August.

## Informal Discussion

The Institute of Metals announce that it has been decided not to proceed with an informal discussion on 'Non-Metallic Die Materials' due to be held in Birmingham on 16 February next. Instead, under the auspices of the Metallurgical Engineering Committee of the Institute, an all-day informal discussion on 'The Treatment of Swarfs, Sawings and Residues in the Non-Ferrous Metal Industries' will be held at the University, Edgbaston, Birmingham, at 10.30 a.m. on the same date.

## Mystery Fire at Chemical Works

Fire broke out at the Whitefield chemical works of Theodore St. Just Ltd., Manchester, on 1 December, causing damage estimated at 'several thousand pounds.' Night workers at the firm discovered the fire which had gained a firm hold in a two-storey building used as a store. An official said that the cause of the outbreak was a mystery.

## Carbon Black Output

An average of 1,130 tons of carbon black were produced a week during August, according to figures published by the Central Statistical Office. This compares with a weekly average of 1,250 in the previous month. Consumption also fell from 940 to 920 tons a week. More synthetic rubber was used, the weekly figures going up from 120 to 170 tons.

## Dorothy Pile Trophy Award

At a meeting at the Birmingham Exchange and Engineering Centre, sponsored by the Birmingham Metallurgical Society, on 2 December, the Dorothy Pile Trophy, which is competed for annually by teams taking part in the technical quiz on metallurgy, was won by the Birmingham School of Technology. Wednesbury County Technical College were second. Five teams took part in the quiz.

## BISOL Price Reductions

British Industrial Solvents have announced reductions, with effect from 6 December, in the UK prices of BISOL acetic acid, *n*-butyl alcohol and the major acetates. Acetic acid is reduced by £3 per ton for all grades and all sizes of delivery. The other reductions, per ton, are: *n*-butyl alcohol, £7 10s.; butyl acetate, £4; ethyl acetate and isopropyl acetate, £2. Prices are for products delivered carriage paid, all containers returnable at seller's expense, with the exception of those for technical acetic acid which are free and non-returnable. The allowance for delivery of glacial acetic acid in road tank wagons has been increased to £2 per ton for minimum 2,500 gallon loads. Other allowances, charges for packing in small containers and charges for unreturned packages remain unchanged.

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# • OVERSEAS •

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## **Bagasse for Newsprint**

A US firm, it is reported, is to build a newsprint mill which will use bagasse as raw material in the Province of Tucuman, Argentina. A daily output of 100 tons of newsprint is planned, and production is expected to begin early in 1956.

## **Argentina May Have Polystyrene Plant**

It is reported that a representative of Koppers Co. Inc., Pittsburgh, Pa., USA, has been in Buenos Aires to negotiate the establishment of a polystyrene manufacturing plant. This would be Argentina's first plant of this kind.

## **Sulphur Refining Plant for Chile**

A North American firm have submitted a proposal to the Chilean Government for establishing a plant for refining sulphur near the free port of Arica, in the far northern sector of Chile. The province of Arica was recently exempted from exchange control restrictions and certain customs duties, and the port is near important mining sources in Chile, Bolivia and Peru. Total sulphur deposits in Chile are estimated at 30,000,000 tons, making it the third largest potential producer, following North America and Italy.

## **Cement Ban Lifted**

The Government of Iraq has lifted the ban on imports of cement into the country for a period of six months. The ban was imposed to protect Iraq's cement industry, but the demand has been greater than the industry's output.

## **Fall in Chromite Consumption**

Apparently continuing a month-by-month rise and fall which began in April, American metallurgical consumption of chromite in August dropped 23 per cent from July, according to the Bureau of Mines, US Department of the Interior. Total consumption declined 14 per cent. Imports of metallurgical chromite in August were at the lowest point since April 1951; total imports were the lowest since February 1952. Production of chromium metallurgical products, such as ferrochromium and chromium metal, during August totalled 12,283 short tons. Production of chromic acid, chrome oxide green and other chromium chemicals totalled 7,093 tons of sodium dichromate equivalent.

## **Oil Company's New Pipeline**

The Assam Oil Company has built a 23-mile long pipeline connecting the company's new oilfields with the refinery.

## **Italian Fertilisers**

Output of 50,000 tons a year is expected from a new fertiliser plant in the south of Sicily, now nearing completion. The site was chosen because of its nearness to supplies of phosphorite minerals from North Africa and sulphur from the mines of Sicily.

## **Copper Refinery Proposals**

A Yugoslav Trade Mission and a German firm have both offered to install copper refineries in Chile, and their proposals are being studied by the Chilean Government. The Yugoslav proposal is for a refinery at Antofagasta in the north which would process ore produced by medium and small mining companies in that area. The German firm, Montangesellschaft GmbH would supply machinery and the Government would be expected to invest the money for building the refinery.

## **US Metals Stockpiling**

The US Cabinet Committee on Minerals Policy has recommended that 'dangerous and costly dependence' on sources of minerals outside the US should be reduced. At the same time it admits that assured access to necessary sources abroad is necessary to the operation of an active economy and a sound defence, but says that long-term buying of strategic metals for the stockpile gives emphasis to the need for buying metals produced domestically.

## **US Cadmium Imports Down**

US cadmium production at domestic plants in the third quarter of 1954 was 4 per cent below the output in the second quarter and 5 per cent lower than the quarterly average for 1953, the peak year, according to the Bureau of Mines, United States Department of the Interior. In July-September production of primary and secondary metal totalled 2,315,000 lb. compared with 2,403,000 lb. in the preceding quarter. One of the most significant developments in cadmium statistics so far in 1954 has been the marked decrease in United States imports coupled with a substantial increase in exports.

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# PERSONAL

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MR. N. L. RIGBY has joined Genatosan Ltd. as marketing manager, and has been elected to the board. He fills the vacancy caused by the appointment of MR. H. P. P. HODGKINS as commercial general manager of Pest Control Ltd. (another Fison company) earlier in the year. Mr. Rigby was an RAF Intelligence Officer during the war attached to the French Air Force. Since then he has had general administrative experience in the engineering industry and six years with Thomas Hedley & Co. Ltd. as a senior marketing executive, including a period spent in the United States studying marketing methods.

Immediate past president of the Fertiliser Society, MR. J. ANGUS, B.Sc., A.R.I.C., has been appointed a director of Scottish Agricultural Industries Ltd. Mr. Angus is the production and technical manager of the company.

MR. V. A. WEXHAM has resigned as director and secretary of Ashe Chemical Ltd., and has been succeeded by MR. K. H. W. YOUNG who remains director and secretary of Ashe Laboratories Ltd. His brother, MR. C. R. G. YOUNG, managing director of Ashe Laboratories, has been appointed to the same position with Ashe Chemical. Ashe Chemical were formerly Solidol Chemical. The name was changed when they acquired the capital of Ashe Laboratories (THE CHEMICAL AGE, 1954, 71, 898).

It has been announced that PROFESSOR J. S. ANDERSON, B.Sc., Ph.D., M.Sc., F.R.S., Professor of Chemistry in the University of Melbourne, and PROFESSOR T. G. HUNTER, D.Sc., Ph.D., Professor of Chemical Engineering in the University of Sydney, have been appointed to the Australian Atomic Energy Commission's Advisory Committee. Professor Anderson recently returned to Australia after serving as deputy head of the Chemistry Department of the British Atomic Energy Research Establishment at Harwell. Professor Hunter is a chemical engineer best known for his work in the field of solvent extraction.

MR. JOHN BISHOP has been appointed secretary of the Gas Purification and Chemical Co. Ltd.

At the annual general meeting of the British Tar Confederation held on 25 November, the following were elected as officers of the Confederation for the year 1954/55:—*President*, MAJOR A. G. SAUNDERS; *Honorary Treasurer*, MR. L. W. BLUNDELL; *Chairman of the Executive Board*, MR. S. ROBINSON; *Vice-Chairman of the Executive Board*, MR. R. H. E. THOMAS, O.B.E., and MR. HENRY F. H. JONES, M.B.E. The Executive Board consists of ten representatives nominated by each of the Association of Tar Distillers, the British Coking Industry Association, and the Gas Council, and one representative nominated by the Low Temperature Coal Distillers' Association of Great Britain Ltd. The following constitute the board for the year 1954/55: *Representing the Association of Tar Distillers*: MR. L. W. BLUNDELL (North Thames Gas Board); MR. E. P. BUTLER (Bristol & West Tar Distillers Ltd.); MR. C. E. CAREY (South Eastern Gas Board); MR. J. COLLIGON (Dorman, Long & Co. Ltd.); MR. E. HARDMAN (E. Hardman, Son & Co. Ltd.); MR. C. LORD (Lancashire Tar Distillers Ltd.); MR. WM. MCFARLANE (Scottish Tar Distillers Ltd.); MR. S. ROBINSON (Midland Tar Distillers Ltd.); MR. J. B. VICKERS (Yorkshire Tar Distillers Ltd.); MR. W. A. WALMSLEY (Thomas Ness Ltd.). *Representing the British Coking Industry Association*: LT.-COL. P. F. BENTON JONES (United Coke & Chemicals Co. Ltd.); MR. A. BRADBURY (Staveley Iron & Chemical Co. Ltd.); MR. G. W. J. BRADLEY (National Coal Board [East Midlands Division]); MR. W. ROBSON BROWN MP (Richard Thomas & Baldwins Ltd.); MR. K. MCK. CAMERON (Stanton Ironworks Co. Ltd.); MR. F. W. O. DODDRELL (National Coal Board [North Eastern Division]); MR. C. F. DUTTON (National Coal Board); MR. C. M. FRITH (South Yorkshire Chemical Works Ltd.); MR. C. F. SULLIVAN (National Coal Board [South Western Division]); MR. R. H. E. THOMAS, O.B.E. (National Coal Board). *Representing the Gas Council*: MR. S. BLACK (Northern Gas Board); MR. D. D. BURNS, O.B.E. (Scottish Gas Board); MR. E. H.

HARMAN (East and West Midlands Gas Boards); MR. W. HODKINSON, O.B.E. (North Western Gas Board); MR. W. K. HUTCHISON, C.B.E. (South Eastern Gas Board); MR. H. F. H. JONES, M.B.E. (Gas Council); MR. A. McDONALD (North Eastern Gas Board); MR. M. MILNE-WATSON, C.B.E. (Eastern and North Thames Gas Boards); MR. J. POWDRILL, M.B.E. (Wales Gas Board); MR. S. E. WHITEHEAD, O.B.E., J.P. (South Western and Southern Gas Boards). *Representing the Low Temperature Coal Distillers' Association of Great Britain Ltd.*: COMMANDER COLIN BUIST, M.V.O., R.N. (retd.).

At the anniversary meeting of the Royal Society on 30 November the following Fellows were elected as new members of the council: PROFESSOR W. BAKER, B.Sc., M.Sc., Ph.D., D.Sc. (Manchester), M.A. (Oxon.), F.R.I.C., Alfred Capper Pass Professor of Chemistry in the University of Bristol; PROFESSOR F. W. R. BRAMBELL, M.R.I.A., D.Sc. (London), director of the ARC unit of embryology, University College of North Wales; SIR ALAN DRURY, Kt., C.B.E., M.A., M.D., F.R.C.P., M.R.C.S., Agricultural Research Council; PROFESSOR J. H. GADDUM, F.R.S.E., Sc.D., M.R.C.S., L.R.C.P., Professor of Materia Medica in the University of Edinburgh; PROFESSOR L. HOWARTH, B.Sc., M.A., Ph.D., professor of applied mathematics in the University of Bristol; PROFESSOR W. B. R. KING, O.B.E., M.C., M.A., Sc.D., Hon. D.Sc. (Lille and Rennes), Woodwardian Professor of Geology in the University of Cambridge; PROFESSOR W. H. MCCREA, M.A., Ph.D., B.Sc., F.R.S.E., F.R.A.S., M.R.I.A., Professor of Mathematics at Royal Holloway College; PROFESSOR K. MATHER, D.Sc., Professor of Genetics in the University of Birmingham; J. A. RATCLIFFE, O.B.E., M.A., reader in physics, University of Cambridge; and PROFESSOR J. M. ROBERTSON, M.A., Ph.D., D.Sc. (Glasgow), F.R.I.C., F.Inst.P., F.R.S.E., Gardiner Professor of Chemistry in the University of Glasgow.

Awards under the Royal Society and Nuffield Foundation Commonwealth Bursaries Scheme include the following:—DR. T. A. O'DONNELL, M.Sc., Ph.D., lecturer in chemistry, Melbourne University, to enable him to study inorganic fluorides at Cambridge during 1955; DR. J. C. SMITH, B.Sc., M.A., M.Sc., Ph.D., D.Sc., demonstrator and lecturer in chemistry, Oxford, to enable him to

visit Pretoria and Melbourne to study the methods of research there on the chemistry of fats and waxes, from January to September, 1955. This is the second group of awards under the scheme, which was instituted in 1953 to provide facilities for increasing the efficiency of scientists of proven ability by enabling them to pursue research, learn techniques or follow other forms of study in natural science in countries other than their own in the Commonwealth where the physical or personal environment, or both, are particularly favourable.

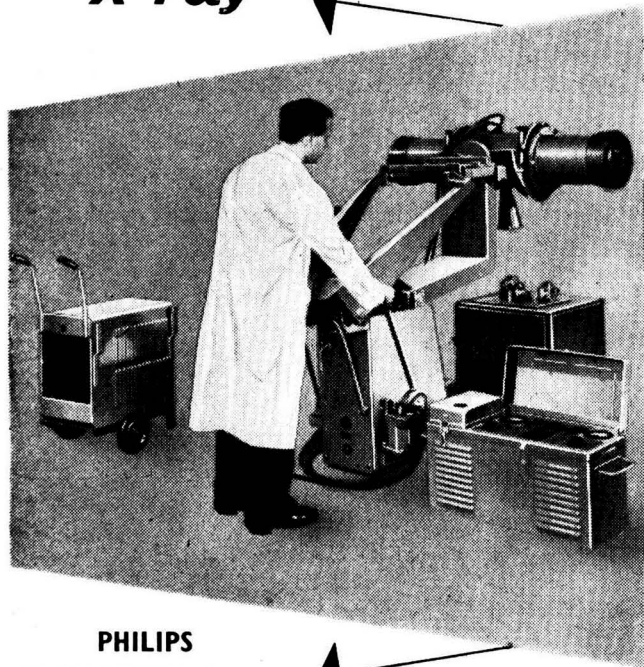
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## Obituary

We regret to announce the sudden death, at the age of 49, of MR. HAROLD BARKER, M.Inst.F., manager of the Newcastle office of Babcock & Wilcox Ltd. Mr. Barker had been with Babcock & Wilcox since 1921, except for a short period in 1927 and 1928, which he spent in the Merchant Service, on the engineering staff of the *Berengaria*. He had had extensive sales experience in Leeds and London and was appointed manager of the Newcastle office in 1950.

MR. HAROLD ASHLEY MASON, overseas trade director of Evans Medical Supplies Ltd., died suddenly at Mildura, Victoria, Australia, on 26 November. Mr. Mason, who was on a business trip in Australia, was fatally injured in a motor accident when the car in which he was travelling skidded, overturned several times and finally hit a telegraph pole. With him was MR. J. A. DAVIES, managing director of Evans Medical Australia (Pty.) Ltd., who sustained injuries. Mr. Mason was buried at Mildura on 29 November, and a memorial service was held in Liverpool on 1 December, at which the pharmaceutical industry and Liverpool business circles were well represented as well as relatives and family friends. Mr. Mason, who was 43, was educated at Edinburgh Academy and Magdalene College, Cambridge, graduating B.A.(Hons.). He joined Evans Medical in 1946, and in December, 1947, he was appointed overseas trade director, in due course becoming director of several other companies in the Evans Medical Group. In December, 1949, he became a member of Council of The Association of British Pharmaceutical Industry, and was chairman of the export executive of the association in 1951.

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# Publications & Announcements

A NEW series of data sheets is being issued by Henry Wiggin & Co. presenting in concise form essential physical and mechanical data on wrought high-nickel alloys. The second in the series, dealing with Monel, a corrosion-resisting nickel-copper alloy of wide engineering application, has just been issued. Copies of this and of the first in the series, dealing with Nimonic 90 for springs, are obtainable from the Publications Department, Henry Wiggin & Company Limited, Thames House, Millbank, London S.W.1.

\* \* \*

FIRST issue of *Hilger Journal* made its appearance recently. This is a house magazine published by Hilger & Watts Ltd. (Hilger Division) of 98 St. Pancras Way, Camden Road, London N.W.1, and is at present in the nature of an experiment. It is hoped to publish it every three months. The eight-page magazine contains details of Hilger products, including some in use in industry, with photographs, and the exhibitions at which the Division plans to be represented. Another feature is the publication of short abstracts from a series of recently published papers.

\* \* \*

THE seven papers presented at the Symposium on Cathodic Protection organised in November, 1953, by the Corrosion Group of the Society of Chemical Industry have now been collected in one volume, together with the report of the contributions to oral and written discussion made by many other authorities. The papers included are: 'Cathodic Protection in Relation to Engineering Design,' by K. A. Spencer (Great Britain); 'The Effect of the Composition of Magnesium Anodes on their Efficiency,' by M. Oudeman (Holland); 'Development of Cathodic Protection in Belgium,' by A. Weiler (Belgium); 'Economic Aspects of Corrosion Control,' by D. H. Lewis and O. C. Mudd (USA); 'Cathodic Protection and Corrosion Control in the Middle East,' by W. C. R. Whalley (Iraq); 'Cathodic Protection: Its Application to Canadian Marine Vessels in Active Service,' by K. N. Barnard (Canada); and 'Application of Cathodic Protection to Ships and Establishments of the Royal Navy,' by J. T. Crennell (Great Britain). The volume *Cathodic Pro-*

*tection* is obtainable for 12s. 6d. from the SCI Publications Department, 9/10 Savile Row, London W.1.

\* \* \*

ETHYLBENZENE is described in a four-page technical bulletin recently released by Carbide & Carbon Chemicals Co., a Division of Union Carbide & Carbon Corporation. Information is given on physical, chemical, and physiological properties; specifications; shipping container contents; and suggested applications. Typical reactions of ethylbenzene are also described. High-purity ethylbenzene is commercially available for syntheses and solvent uses. In vinyl-type polymerisations it promotes the formation of low-molecular-weight resins which are of particular interest as adhesives, coatings, and viscosity index improvers for lubricating oils. Ethylbenzene is a raw material for drugs and chemicals. It is suggested for trial as a starting point in the manufacture of dyestuffs and detergents, and as an extraction solvent. Copies of this technical bulletin (F-8596) are available from Carbide & Carbon Chemicals Company, 30 East 42nd Street, New York 17, New York.

\* \* \*

METAL Propellers Ltd. have issued a new and enlarged edition of their brochure BT.54 on the subject of Glitsch 'Truss-type' distillation tower internals, which are widely used by oil refineries and chemical plants, both in Great Britain and in many other countries abroad. This well-illustrated brochure gives much useful and interesting information regarding the application of Glitsch designs and patented engineering features to distillation plant of all types and sizes. Copies of this publication may be obtained from Metal Propellers Ltd., 74 Purley Way, Croydon, Surrey.

\* \* \*

MACK & Chesley Ltd., 4 Silchester Road, W.10 (Telephone: PARK 6333) have been appointed sole distributors for Polly-Ply plastic bottles. These bottles, made in polythene with screwed-on tops, range from 1 oz. to 10 gal. capacity. They are light, acid resisting and virtually unbreakable, and their wide range ensures that almost all toilet, household and industrial needs can be catered for. Deliveries will commence in January.



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## Borax Take-Over Bid

### Discussions on US Group's Offer

THE directors of Borax Consolidated Ltd. have made a further announcement about the approach by an American group to take over control of the company (THE CHEMICAL AGE, 1954, 71, 898).

The announcement states: 'Discussions are taking place with a view to seeing whether terms of an offer can be formulated that would form the basis of an application to the Treasury, under Section 468 of the Income Tax Act (1952), for consent to a change of domicile of the company from the United Kingdom to the United States. The consent of Foreign Exchange Control to the transfer of shareholding control would also have to be sought. A further announcement to the stockholders will be made, if and when an application is made.'

'The American group, for whom Messrs. Robert Benson, Lonsdale & Co. Limited are acting, have written a letter of commitment to make an offer to acquire the whole of the issued share capital of the company subject, *inter alia*, to: acceptance by holders of not less than 90 per cent (or such lesser percentage as the American group may determine) of each class of stock; and appropriate consents being granted by the Foreign Exchange Control and the Treasury, for the transfer of shareholding control to foreign residents, and for change of domicile.

### Suggested Prices

'The letter of commitment includes a price of not less than the dollar equivalent of £5 per £1 unit of deferred ordinary stock; and refers to appropriate prices for the whole of the preference and preferred ordinary stocks. The American group also confirms in its letter that though this is a commitment with respect to the deferred ordinary stock at a stated price they regard such price as a minimum which might be improved or re-expressed so as to include, providing HM Treasury agrees, a continuing interest for present stockholders such as an option to reinvest part of the proceeds in the American company that would be formed to take over the assets of the existing company.

'It is proper to point out that, should the discussions with the representatives of the American group result in an application to the Treasury, some time may elapse before a decision is given, and it is impossible to forecast what that decision would be.

'In view of this uncertainty, and for many other reasons, the board has advised Messrs. Robert Benson, Lonsdale & Co. Limited, as well as the representatives of the American group, that it cannot give any undertaking that it will recommend stockholders to accept their proposal at some future indefinite date. The board feels that it should maintain complete freedom to make such recommendations in the future to the stockholders as then existing conditions warrant.'

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## Market Reports

LONDON.—Active conditions prevail in most sections of the market and the movement, in the aggregate, is probably greater in volume than is usual for the period. The chief industrial users are giving increasing attention to contract replacement business and new forward delivery bookings have been on a good scale. There is a good outlet for most of the coal tar products with pitch, creosote oil and phenol moving well on home and export account. Crude naphthalene remains strong for spot delivery.

MANCHESTER.—Little change in chemical prices on the Manchester market has occurred since the last report and the general undertone is steady to firm. Most industrial users of soda compounds and other heavy chemicals are taking reasonably good deliveries under contracts and a moderate weight of replacement business has been booked during the past week. Between now and the turn of the year, however, the usual seasonally quiet conditions are looked for. In the fertiliser trade buying interest is on quiet lines apart from basic slag and one or two other items, while in most of the tar products a steady demand has been maintained.

GLASGOW.—There has been a slight slackening off in business during this past week, but trade has by no means been poor, with a steady and fairly wide demand for the usual run of general chemicals. It is pleasing to note that some fairly substantial reductions will be coming into force soon for certain products, more details of which will be available during the next week or so. The demand for goods for export still remains brisk with a fair percentage of business booked for forward delivery.



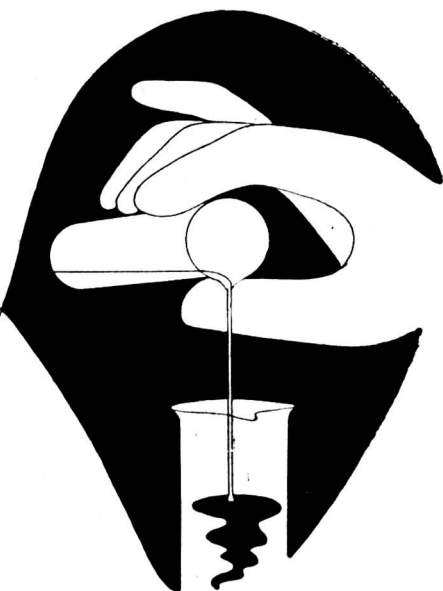
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A booklet on the method may be obtained on request.

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## Next Week's Events

### MONDAY 13 DECEMBER

#### Royal Institute of Chemistry

Bradford: The Technical College, 7 p.m. 'Configuration and Properties of Polymer Molecules in Dilute Solution' by Professor P. J. Flory (joint meeting with Bradford Chemical Society).

#### Institute of Fuel

Newcastle-on-Tyne: Chemistry Lecture Theatre, King's College, 6.30 p.m. 'Experience with Spreader Stokers' by T. H. Lindsay and P. Pilkington.

#### Institute of Metals

Glasgow: Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2, 6.30 p.m. 'Casting, Fabrication and Testing' by members of the Scottish Local Section.

Sheffield: University Buildings, St. Georges Square, 7.30 p.m. 'The Park Gate 11 Continuous Bar Mill' by W. Udall (joint meeting with the Engineers' Group of the Iron and Steel Institute).

#### Institute of Metal Finishing

London: Northampton Polytechnic, St. John Street, London E.C.1, 6.15 p.m. 'Recent Developments in Chromium Plating' by H. Silman.

#### Institution of the Rubber Industry

Manchester: The Engineers' Club, Albert Square, 6.15 p.m. 'Determination of Free Sulphur in Hard Rubbers' by C. Wynne-Evans and 'Zinc Complex Formation with Latex Serum Constituents' by H. E. Wechsberg.

### TUESDAY 14 DECEMBER

#### Society of Chemical Industry

London: Geological Society, Burlington House, Piccadilly, 5.30 p.m. Chemical Engineering Group. Six papers on 'The Drying of Wheat Grain' by Professor Ewan McEwan and others (joint meeting with the Institution of Chemical Engineers and the Institution of British Agricultural Engineers).

### WEDNESDAY 15 DECEMBER

#### Society of Chemical Industry

London: Chemical Society's Rooms, Burlington House, Piccadilly, 6.30 p.m. Corrosion Group. 'The Prevention of Corrosion in the Telecommunications Industry' by C. E. Richards.

#### Institution of Chemical Engineers

Birmingham: The University, Edmund Street, 6.30 p.m. Graduates and Students Section. 'The Handling of Fine Powders' by M. G. Bailey.

### THURSDAY 16 DECEMBER

#### Chemical Society

London: Rooms of the Society, Burlington House, Piccadilly, 7.30 p.m. Hugo Müller Lecture: 'Some Newer Aspects of the Organic Chemistry of Nitrogen' by Professor G. R. Clemo.

#### Institution of Chemical Engineers

Leeds: Fuel Department, the University, 7 p.m. 'The Adiabatic Absorption of Hydrogen Chloride' by T. A. Kantyka and H. R. Hincklieff (repeat of paper delivered in Manchester on 22 November).

Manchester: Students' Common Room, College of Technology, 6.45 p.m. Graduates and Students Section. 'The Application of Ultrasonics in the Chemical Industry' by H. M. Stanier.

#### Institute of Fuel

Birmingham: Imperial Hotel, Temple Street, 6 p.m. Paper 1 in sulphur study: 'Social and Industrial Consequences of the Presence of Sulphur in Fuels' by Dr. A. Parker.

#### Institute of Metals

London: 4 Grosvenor Gardens, S.W.1, 6.30 p.m. 'Melting and Casting under Reduced Pressure' by Dr. H. H. Scholefield.

#### Liverpool Metallurgical Society

Liverpool: Rooms of the Liverpool Engineering Society, 9 The Temple, Dale Street, 7 p.m. 'Protective Atmospheres for the Heat-Treatment of Steels' by I. Jenkins.

### FRIDAY 17 DECEMBER

#### Chemical Society

Exeter: Washington Singer Laboratories, 5 p.m. 'There and Back Again: Some Aspects of the Problem of Hysteresis' by Professor D. H. Everett.

#### Society of Dyers & Colourists

Manchester: The Textile Institute, 10 Blackfriars Street, 6.30 p.m. 'The Wear Properties of Resin-Treated Fabrics' by Dr. T. H. Morton.

#### North East Metallurgical Society

Middlesbrough: Cleveland Scientific and Technical Institution, 7.15 p.m. 'Some Aspects of Iron Production' by Dr. P. K. Gledhill.

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| <b>DE-ACIDITE E</b>  | A high capacity anion exchange material of medium basicity.  | <b>DECOLORITE</b>      | A resin of high porosity for removing colour from solutions.   |
| <b>DE-ACIDITE FF</b> | A unifunctional very highly basic anion exchange resin in bead form based on cross linked polystyrene and containing quaternary ammonium groups. | <b>PERMAPLEX G-10</b>  | A highly selective cation exchange resin membrane containing $\text{SO}_3\text{H}$ groups.                                     |
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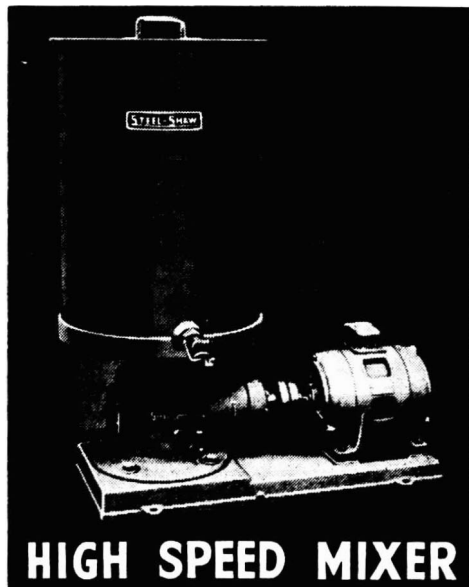
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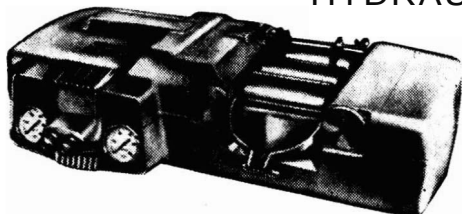
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**A. BOAKE, ROBERTS & CO., LTD.**, are seeking a **CHEMIST OR CHEMICAL ENGINEER** to carry out **WORK STUDY** investigations at their London factories. Applicants should be between 25-30 years of age and have a Degree in Chemistry or Chemical Engineering. At least two years' experience of plant operations is required and preferably some experience in Work Study, although this is not essential. Salary will depend on qualifications and experience. **APPLY MANAGER, WORK STUDY DEPT., A. BOAKE, ROBERTS & CO., LTD., LONDON, E.15.**

**APPLICATIONS** are invited by **MUFULIRA COPPER MINES, LIMITED, NORTHERN RHODESIA**, for a post as **GENERAL FOREMAN** in furnace and casting section of electrolytic refinery. Successful candidate will be required to commence work early in 1955. Applicants must have expert knowledge of casting copper wirebars, cakes and billets, together with long experience in position of responsibility connected with furnace refining of copper. Commencing basic salary, £1,296 per annum, plus copper bonus at present 60 per cent on basic salary, and cost-of-living allowance currently £66 per annum. Free outward passage. Leave at 51 days per annum may be accumulated over three years. Write **MINE EMPLOYMENT DEPARTMENT, SELECTION TRUST BUILDING, MASON'S AVENUE, COLEMAN STREET, LONDON, E.C.2.**

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Candidates must have obtained a University Degree with First or Second-class Honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

**AGE LIMITS.**—Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted. For Scientific Officers and Patent Classes, between 21 and 28 during 1954 (up to 31 for permanent members of the Experimental Officer class). Salary (London) Senior Scientific Officers: (men) £975-£1,150; (women) £845-£1,025. Scientific Officers, (men) £470-£855; (women) £470-£750. Patent Examiner and Patent Officer Classes, (men) £440-£760 (rates under review). Women's rates somewhat lower. Somewhat lower rates in the provinces.

Further particulars from **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, 30, OLD BURLINGTON STREET, LONDON, W.1**, quoting No. S/53/54 for Senior Scientific Officers and S/52/54, S/128/54, for the other posts. Completed application forms must be returned by 31st December, 1954. 3590/35/c/11/54/CP

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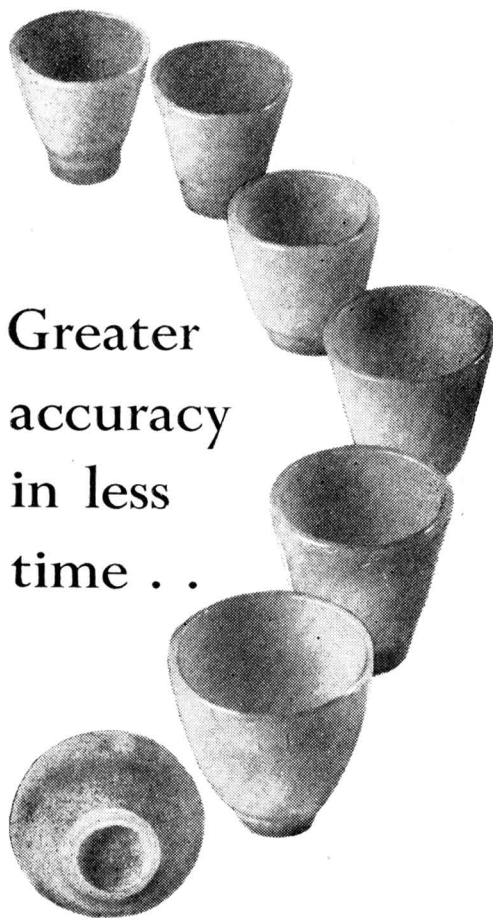


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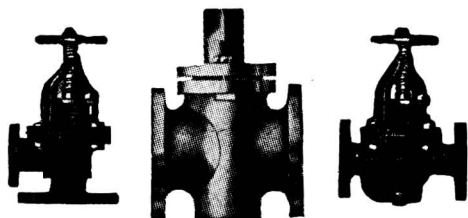
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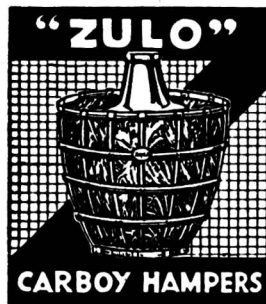
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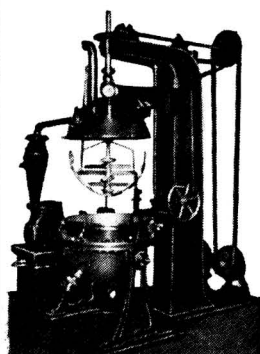
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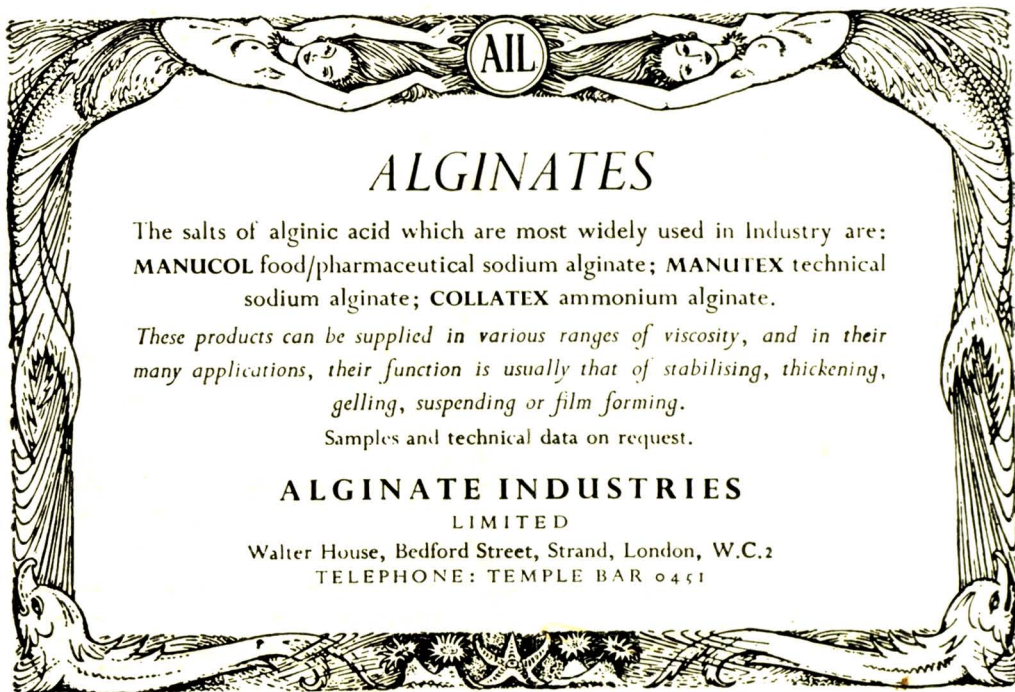
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2209 Hingston Ave.,  
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**AIL**

## ALGINATES

The salts of alginic acid which are most widely used in Industry are: **MANUCOL** food/pharmaceutical sodium alginate; **MANUTEX** technical sodium alginate; **COLLATEX** ammonium alginate.

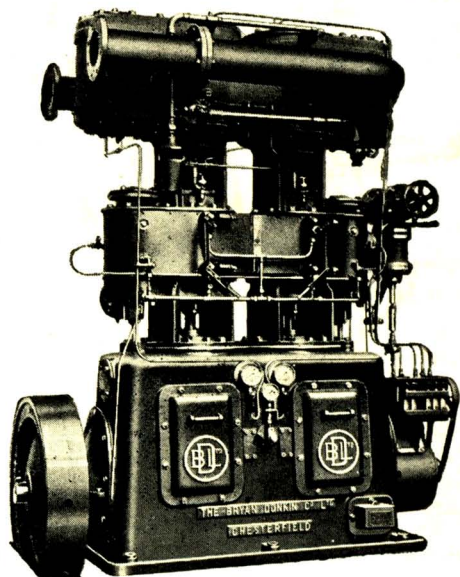
*These products can be supplied in various ranges of viscosity, and in their many applications, their function is usually that of stabilising, thickening, gelling, suspending or film forming.*

Samples and technical data on request.

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**High Speed Vertical  
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*Automatic Control  
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