

The Chemical Age

VOL LXVIII

6 JUNE 1953

No 1769



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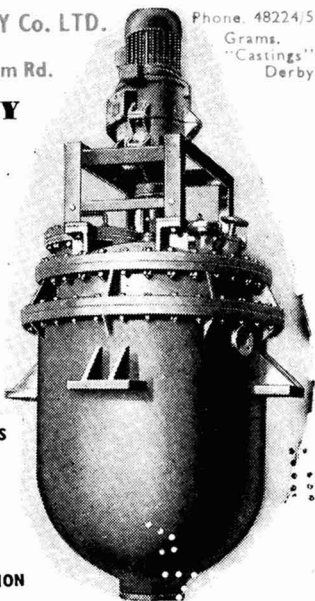
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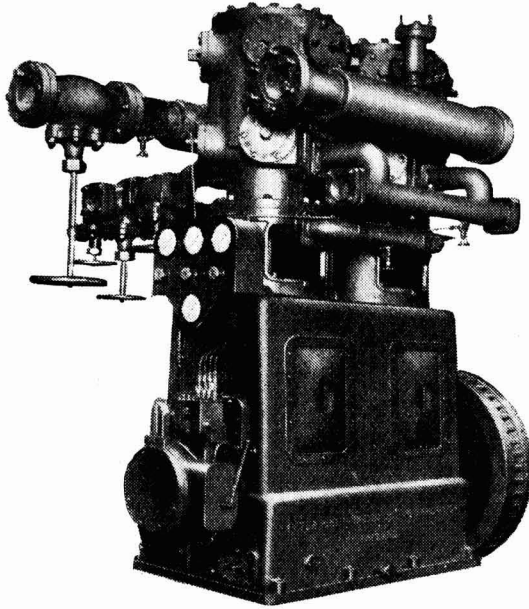
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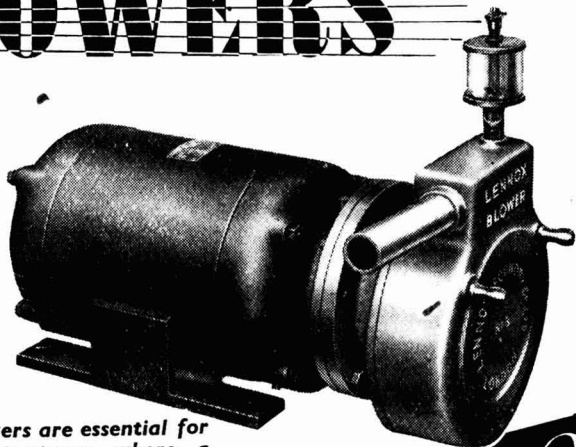


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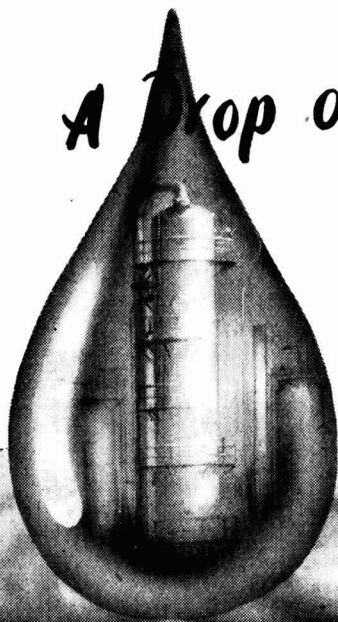
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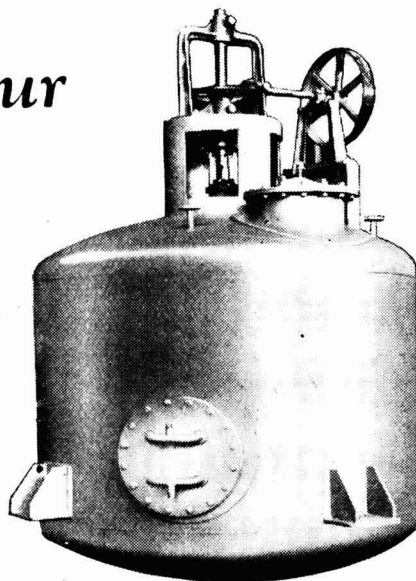
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INDEX TO ADVERTISERS IN THIS ISSUE

	Page		Page
Braby, Fredk., & Co., Ltd.	viii	Lennox Foundry Co., Ltd.	ii
British Acheson Electrodes, Ltd.	vii	Meldrums, Ltd.	878
British Electrical Development Assn.	ix	Metafiltration Co., Ltd. (The)	xvi
British Instrument Industries Exhibition	viii	Mirvale Chemical Co., Ltd.	Cover ii
British Oxygen Co., Ltd. (The)	v		
Brotherhood, Peter, Ltd.	i	National Enamels, Ltd.	vi
Browns Foundry Co., Ltd.	Cover ii		
		Paterson Engineering Co., Ltd. (The)	x
Callow Rock Lime Co., Ltd. (The)	Cover iii	Permutit Co., Ltd. (The)	873
Classified Advertisements	xii, xiii, xiv, xv	Pott, Cassels & Williamson	xi
Cruickshank, R., Ltd.	Front Cover	Powell Duffryn Carbon Products, Ltd.	877
Cygnat Joinery, Ltd.	iv	Prodorite, Ltd.	Cover iii
		Pulsometer Engineering Co., Ltd.	x
Danks of Netherton, Ltd.	iii		
		Reads, Ltd.	875
Elcontrol, Ltd.	xv		
		Spencer Chapman & Messel, Ltd.	iv
Farnell Carbons, Ltd.	xv	Staveley Iron & Chemical Co., Ltd.	ii
		Steel, J. M., & Co., Ltd.	xi
Guest Industrials, Ltd.	Cover iii	Streamline Filters, Ltd.	vi
Imperial Smelting Corpn. (Sales), Ltd.	Cover iv	Urquart's (1926), Ltd.	vi,
Kestner Evap. & Eng. Co., Ltd.	xvi	Whitaker, B., & Sons, Ltd.	Cover ii
Kilner, John, & Sons (1927), Ltd.	xv		
		Yorkshire Tar Distillers, Ltd.	xv

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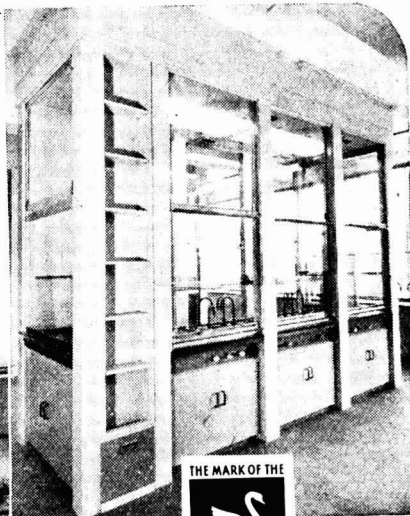
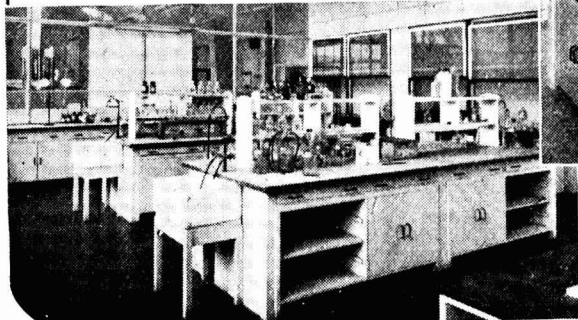
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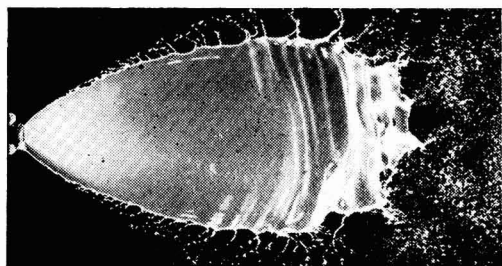
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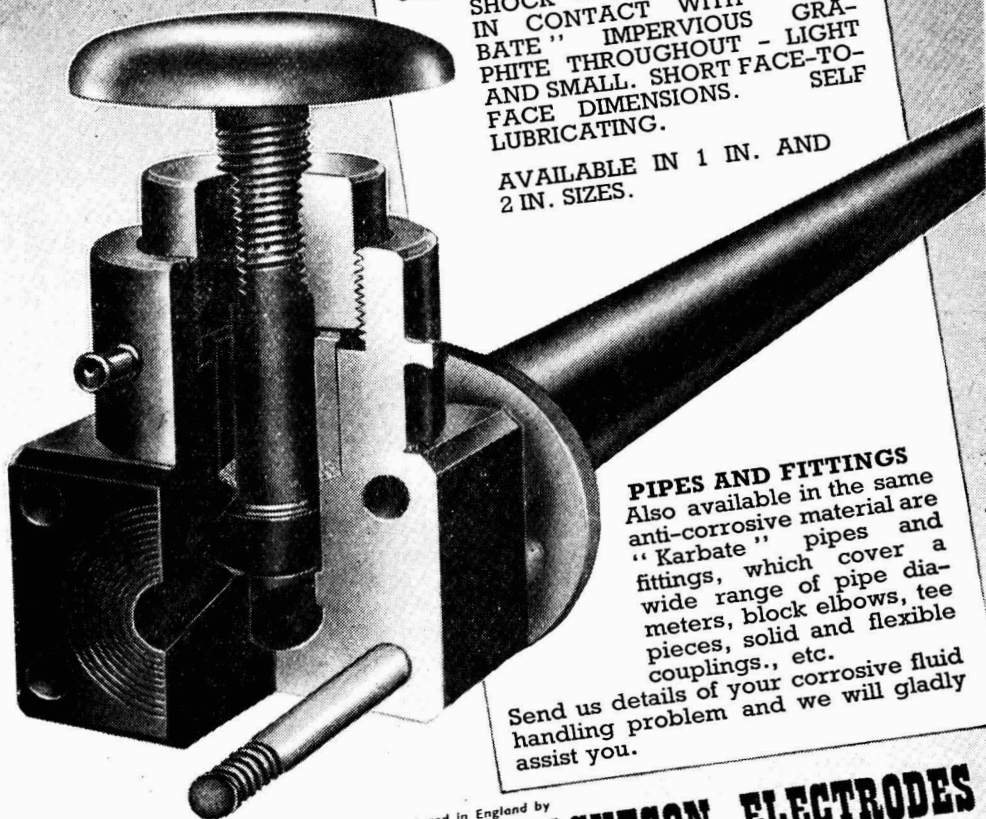
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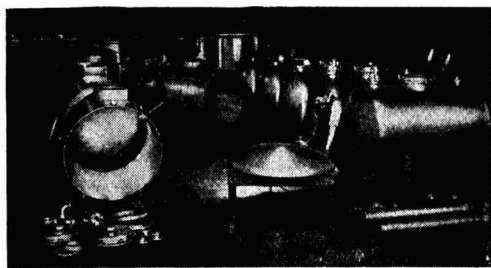
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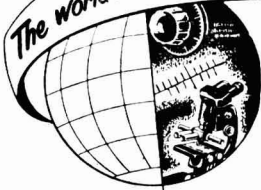
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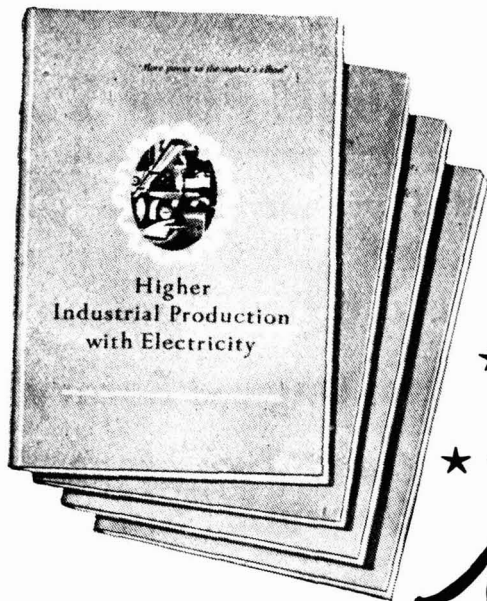
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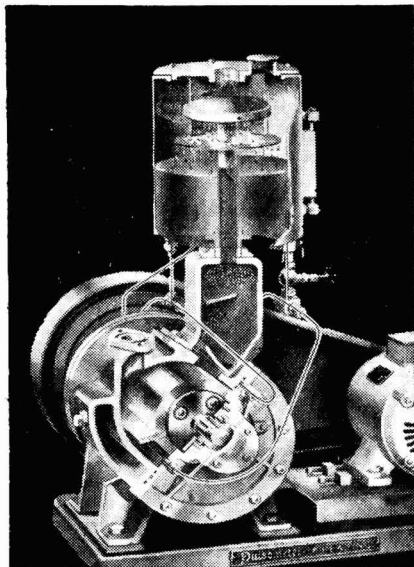
Handling in Industry" shows the way to increased productivity by improved handling; and "Electric Resistance Heating" indicates where, and how, this unique method of producing heat without combustion can be applied.

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

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

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6 June 1953

Number 1769

Out of Control

FOURTEEN years of statutory price control for fertilisers come to an end on 1 July. The announcement of this last week by the Ministry of Materials was welcomed both by manufacturers' and farmers' associations. During the fourteen years three separate departments have at different times been responsible for control—the Board of Trade, the Ministry of Supply, and the Ministry of Materials. Each July a new Order has laid down maximum selling prices for fertilisers. These annual Orders have never been easy to read or interpret. Fertilisers with their many variations in kind and degree are difficult to control without documentary complexity. It seems highly doubtful whether many buyers would have protected themselves against incorrect charges by possessing copies of these annual Orders. In some simpler instances, such as the sale of a fertiliser of constant composition like sulphate of ammonia, the permissible maximum price would be easily extractable from the Orders, but what of the proprietary compound fertiliser? With such fertilisers, the permissible maximum price for any

particular year was defined in terms of the price charged by the manufacturer for a similar fertiliser in 1939—but with additions according to an official scale for changes in analysis. To check the correctness of a price of this kind, the buyer would have had to possess the manufacturer's pre-war price-list! Such a situation could not in all sanity have persisted much longer. It had ceased to give genuine protection to the consumer.

During the war years there was, of course, every justification for measures of price control. Scarcity dominated the market. All fertilisers other than those made from organic wastes, etc., were directly subsidised. Any trader who acquired some stock of fertilisers could have sold at a highly profitable figure, squeezing not only the farmer but the tax-payers who were footing the subsidy accounts. Since the removal of direct subsidies, the market has become more competitive. Though distribution difficulties still make themselves felt at the peak of the spring season, scarcity of fertilisers is no longer a significant influence. The ordinary interplay of market quotations will, as once before,

be the buyer's surest shield against exploitation.

Throughout the long period of price control, the industry has co-operated with the Government and price fixing, so far as possible, has been realistically settled by examinations of actual cost factors. It follows, however, as with all such systems of price control, that the national level of prices is based upon average manufacturing costs and not upon the lowest costs that can be achieved. In the long run initiative and incentive for cost reductions tend to be discouraged. So, too, is high-quality or specialised production discouraged. A process that would add some desirable property to a fertiliser is exercised unless it involves no extra costs for the manufacturer or unless the extra property is recognised in the Statutory Order and permits a fair addition to the price. Indeed, it is greatly to the credit of the industry that it has, during this period of economic confinement, so widely introduced the process of granulation that this country can be said to lead the world in that particular technological field.

From next month, fertiliser manufacturers will be free to make their own selling prices and to adopt any particular selling policy. Farmers may harbour fears that increases in price levels will follow, but anxiety of this kind is unjusti-

fied. World prices determine costs to a considerable extent and during recent months these important factors in price make-up have been falling slightly rather than continuing to rise. Secondly, there is bound to be some degree of price-leadership in the market by those firms whose production costs reflect the highest standards of efficiency and economy. Manufacturers with unduly high costs will be unable to secure any compensation from their customers. However, judging from a statement issued by the two leading associations of the industry, the Fertiliser Manufacturers' and the Superphosphate Manufacturers' Associations, no major changes in selling policies are to be expected in the immediate future. Such factors as rebates for out-of-season deliveries, charges for delivery to farm rather than station, etc., will be unlikely to display significant differences as between this or that producer. This should not be looked upon as price regulation by a 'ring.' There have been periods in the industry's history when diversities on small economic factors have created chaotic market conditions, and any relapse of this kind would have serious repercussions for producers and consumers alike. If steady technological progress is to be maintained, stable market conditions must be achieved.

On Other Pages

<i>Some Aspects of Absorptiometric Analysis</i>	. . . 847
<i>Fertiliser Prices</i>	. . . 852
<i>Corrosion Research</i>	. . . 853
<i>Terephthalic Acid</i>	. . . 855
<i>Food Investigation</i>	. . . 857
<i>Uses of Thiourea</i>	. . . 860
<i>In the Editor's Post</i>	. . . 861

<i>BDH's Annual Report</i>	. . . 864
<i>The Chemist's Bookshelf</i>	. . . 867
<i>Home News Items</i>	. . . 870
<i>Overseas News Items</i>	. . . 871
<i>Personal</i>	. . . 872
<i>Publications & Announcements</i>	. . . 874
<i>Law & Company News</i>	. . . 876
<i>Market Reports</i>	. . . 878

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Notes & Comments

Corrosion Research

ON pages 853-854 appears a report of the address given recently to the Corrosion Group of the Society of Chemical Industry by its retiring chairman, Dr. W. H. J. Vernon. He outlined the history of corrosion research under public or official sponsorship in this country and concluded that the resources now available fall far short of present-day needs and demands. Dr. Vernon is in a unique position to make such a statement for he has been the head of the Corrosion Group at the Chemical Research Laboratory since he succeeded the late Dr. G. D. Bengough in 1936. In 1945 he prepared a memorandum urging the authorities to establish a corrosion research organisation to deal effectively with fundamental and practical problems and to reply adequately to the growing stream of inquiries from industry. Realisation of the economic importance of corrosion has increased enormously since 1945, but no official action has been taken. Despite, or (may we suggest?) as a result of, this failure, and at an age when many would be anticipating the ease of retirement, Dr. Vernon has devoted much time and energy to the formation of the Corrosion Group of the SCI. Merely to have formed such a group for occasional meetings in London would have given much satisfaction, but in the two years of its existence the Group has also held successful provincial meetings, welcomed a number of distinguished overseas visitors, and launched an ambitious educational programme. In asking for increased public support for corrosion research, Dr. Vernon has no axe to grind, for he will soon have reached the age of retirement. Moreover, as those who are acquainted with him will know, he is a man of moderation, and not given to exaggeration or to making unreasoned demands. Like the older corrosion scientists whom he affectionately recalled in his address, he is concerned for posterity; and that posterity is within the lifetime of many of us.

Fused Phosphatic Fertilisers

INTEREST in fusion processes for making the phosphate of rock phosphate available goes back to World War I. In England, pilot-scale production at a cement works in Kent produced 'Silico-phosphate' during the last years of World War II. It is now reported that India may develop this type of fertiliser (*J. Scientific & Industrial Research* [India], 1953, 12, 3, 106). Low-grade apatite nodules found in the Trichinopoly area can be used. Fusion with a potash feldspar, also indigenous, in an oil-fired rotary kiln, gives a product with about 15 per cent citrate-soluble phosphoric acid and also about three per cent of citrate-soluble potash. Costs of production are stated to be only three-quarters of the current market price for acid-produced superphosphate of similar phosphatic value, but there is no indication in the paper referred to whether wear-and-tear depreciation has been set against these costs. One of the major disadvantages of fusion methods is the constant wastage of furnace linings, and the economics of the fertiliser industry cannot easily support heavy plant depreciation costs. Technically, the new and interesting feature of this Indian research—so far limited to pilot-scale manufacture—is the choice of a potash-containing fusion agent and the claim that some of its potash is also made available. As in other instances when the fusion process has been investigated, it was found that phosphate availability depended upon the rapid quenching and cooling of the fused material.

Salesmanship

THE technical director of a small but well-known chemical company recently told us the following story. There had been increasing underground leakage from the base of a wash-tower, the warm acid liquors collecting in the saucer of the tower gradually attacking the resisting-cements originally used. His company decided to call in the advice

of experienced chemical engineering firms and from a short list of specialised firms selected two; broadly, they invited quotations from these firms for rebuilding the saucer so that the trouble was cured. With one firm they had recently had dealings, a trial batch of acid-resisting cement having successfully cured a serious point of leakage. Each firm was asked to send a technical representative to inspect the plant and suggest effective treatment. The directors had already agreed that price should not be a deciding factor and that the work was to be given to the firm most likely to provide a genuine solution. One firm sent a representative who arrived without copies of preliminary correspondence and who was totally unaware that within the six weeks prior to his call his company had been trunk-called for advice and had supplied the cement used for the successful emergency repair. Discussions soon revealed the technical limitations of this representative for on any major issue of acid-resistance he could only say that he would have to refer the matter to 'their chief technical man.' A scheme for lining the saucer was worked out, the materials to be used to be left to the judgment of a man who would never himself inspect the premises. The main function of the representative who called would seem to be that of measuring and estimating. The second firm sent a qualified chemical engineer. While making it clear that any scheme he suggested would have to be 'vetted' by his firm's technical manager, he put up a variety of proposals based upon a specific lining material. One of these proposals economised on the area to be lined—by reducing the area exposed to acid—by about 30 per cent. This idea was divorced from the subject of acid-resisting surfaces—it was simply the product of experience in wash-tower construction and mechanics.

Must Lessons be Re-learnt ?

IT was made clear to both representatives that the work was urgent and could only be carried out during a specific month of the summer when the main plant was shut down for other repairs. The second firm quoted within six days, every important detail of the

work being set out clearly. The quotation from the first firm arrived more than two weeks later—tersely undetailed and slightly higher in price. By then, the work had already been entrusted to the other company with specific dates fixed for starting. Technically both proposals may have been effective solutions for the wash-tower trouble. It is possible, indeed, that the scheme chosen was not the more certain of the two—though backed with a guarantee. But in one case the elementary rules of salesmanship were studied and in the other they were ignored. Is it fair to draw the moral that business-getting has had too many easy years and that many commercial lessons of the past will have to be entirely re-learnt in the competitive period ahead? It seems sadly probable.

Loyal Address

A LOYAL address on the occasion of the Coronation has been sent to Her Majesty the Queen by the Institute of Fuel. It was signed by the president, Dr. G. E. Foxwell, and the secretary, Mr. R. W. Reynolds-Davies.

Part of the address reads as follows:—
'And we desire to assure Your Majesty of our continued constant endeavour faithfully to perform those professional and technological duties in proper utilisation of the fuel resources especially of your realms which are so vital to the material welfare of Your people and in the conservation of which we were entrusted with special responsibilities in the Charter of Incorporation granted us under the hand of Your Royal Father, His Majesty King George VI of revered memory.'

Industrial Disputes

The *Ministry of Labour Gazette* for May, giving particulars of industrial disputes in 1952, states that in chemical and dye concerns three stoppages began in 1952 and 700 workers were involved in all stoppages in progress, the aggregate number of working days lost through all stoppages in progress being 2,000. Relative figures for concerns making pharmaceutical preparations, paints, soaps, matches, oils, etc., were three stoppages, 1,300 workers and 5,000 working hours lost.

MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Some Aspects of Absorptiometric Analysis

AT a meeting of the Midlands Society for Analytical Chemistry held recently in Birmingham the speaker was Dr. T. B. Smith, Lecturer in Analytical Chemistry, The University of Sheffield. Following is an abbreviated account of Dr. Smith's lecture which was entitled 'Some Aspects of Absorptionmetric Analysis':—

It has recently been shown by Smith, White, Woodward, and Wyatt¹ that the Hilger Spekker photoelectric absorptiometer can be used to determine pH with an accuracy comparable with that of the usual types of glass electrode meter. The main aim of this lecture is to discuss the precautions necessary to achieve the desired accuracy of 0.02 in pH , and to consider in detail some of the difficulties encountered which have significance for absorptiometry in general.

DETERMINATION OF pH

Although they are convenient, potentiometric methods necessarily involve liquid junction potentials which may cause appreciable errors if unusual liquids are to be tested. Even with dilute aqueous solutions, for which the method is especially suitable, the maximum accuracy is not always maintained in the routine testing of a series of solutions without resetting the instrument against a standard buffer each time. For some purposes therefore an absorptiometric method may be especially suitable. Even if in a large proportion of cases only equality of accuracy and convenience could be claimed, this would still be of interest since so many laboratories are now equipped with absorptiometers. The more elaborate instruments of this type have long been used in the investigation of indicators.

A preliminary consideration of analytical types such as the Spekker, which normally gives an accuracy of about 1 per cent, suggests that the desired accuracy in a pH determination can be achieved. The instrumental error will affect the determination by the corresponding error in \log (alkaline form/acid form) and since an error of +1 per cent in one form usually involves -1 per cent for the other, the error of the ratio may reach 2 per cent and will influence its

logarithm by $\log 1.02 = 0.009$. While this is within the suggested limits, it is not the only source of error and hence it is essential to do everything practicable to reduce instrumental errors to a minimum.

Lothian Method

Lothian² proposed the use of the Spekker for determining pH with a white light source and special filters, and he gave empirical calibration curves for several indicators. A precision was claimed varying between 0.01 and 0.04 depending on conditions. Such curves would only give accurate results in the testing of solutions having the same ionic strength as the buffer solutions used when making the graph. Although ionic strength does not enter explicitly into a calculation of an individual result, it is nevertheless necessary to assess its approximate value in order to determine whether a particular curve is suitable. Furthermore, reproducibility within the limits claimed could be achieved only if the indicator concentration could be controlled with precision. Unfortunately, the purity of indicators in common use is variable and by no means high. Even if they were specially purified and standardised for this work there would remain the problem of accurately measuring very small volumes of indicator solution, and unless calibrated micro-volumetric apparatus were used the errors might be large compared with those of the absorptiometer.

These difficulties of the Lothian method can be avoided by using the instrument to determine the ratio [alkaline form]/[acid form], for which purpose the absolute concentrations of the indicator species are unimportant. The Spekker's optical density scale might have to be calibrated unless errors are negligible. With the instrument used no perceptible differences could be observed on determining the density of a heat-absorbing filter (H503) by a series of drum-reading differences over the entire portion of the scale between 0.2 and 1.1. Errors were, in fact, negligible down to 0.1, but in the neighbourhood of full aperture variable errors occurred when a cell containing water was also present in the light path, due to

reflection from the bottom—an inevitable consequence of the fact that the lamp does not provide a point source and the beam through the cell is appreciably divergent especially when a mercury arc is used. For the addition of indicator solution it is merely necessary that the same volume of the same solution should be added respectively to (i) a solution which will turn the indicator substantially to its more acid form, (ii) a solution which gives the alkaline form, (iii) the solution to be tested. If the corresponding drum-readings are a , b , and R , the required ratio is given by $(a-R)/(R-b)$. Initially, three rapid operations at the absorptiometer are called for instead of the usual two when an empirical graph is used. In general the instrument can be set up with the aid of either (i) or (ii) and the third operation can be omitted except when different uncalibrated apparatus (or a different batch of indicator solution) is to be used for the first time.

pH Calculation

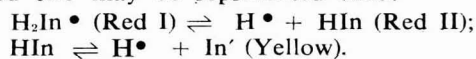
To calculate pH from the experimental data, activity effects must usually be taken into account. For a simple indicator (e.g., a nitrophenol) for which the essential equilibrium can be written $\text{HIn} \rightleftharpoons \text{H}^{\bullet} + \text{In}'$, it is sufficiently accurate to write

$$p \{ \text{H}^{\bullet} \} = pK_{\text{In}} + \log[\text{In}']/[\text{HIn}] - 0.5\Phi(I) \dots (i)$$

where $\Phi(I)$ is Davies's function of the ionic strength I , viz. $\sqrt{I}/(1 + \sqrt{I}) - 0.2I$. There is no need, of course, to compute the value of $0.5\Phi(I)$ for every determination, since it can be read from a graph or table once the value of I has been roughly assessed; this labour of multiplying the concentration of each ionic species by the square of the valency and taking half the sum of all such terms has been shown necessary even for the accurate application of the Lothian method. The activity correction in the above case is small, being 0.066, 0.110 and 0.134 respectively for I values of 0.025, 0.10 and 0.20. If, however, the equilibrium is of the type $\text{HIn}' \rightleftharpoons \text{H}^{\bullet} + \text{In}''$, as with the sulphonephthaleins, the correction will be three times as large as in the previous case, and for the method here proposed it is preferable to avoid their use. Brilliant colour changes, so attractive for visual comparisons, are of no advantage in absorptiometry since the narrow wave band used

ensures that the variation of only one coloured species is assessed.

Of the several changes shown by methyl red two may be represented thus:—



These stages overlap and methyl red should for present purposes only be used for pH values not less than 4.5, thus ensuring that the proportion of Red I is never appreciable. Assuming, as is generally done, that Red I is an uncharged molecule, the magnitude to the activity correction should be $0.5\Phi(I)$. Kolthoff,³ while giving due weight to the arguments in favour of this view, has pointed out that it does not explain the comparative insensitivity of methyl red to the influence of neutral salts. Red II might well be at least partly in the form of a zwitterion

HI' . Even though at present no quantitative allowance can be made for this, it would have the effect of reducing the magnitude of the activity correction. If it be conceded that all the possible forms are present to some extent, then the conventional treatment of the activity effect is not theoretically justified and can at best be regarded as a not unreasonable approximation. Furthermore, even if the proportion present as zwitterion is small in a solution of low ionic strength, it would assume greater importance with increasing values of I . It has been shown empirically¹ that if pK_2 is calculated on the assumption that the activity term can be completely ignored, the determination of pH can then be based on the same assumption, with results as least as good as (and probably slightly better than) those based on the conventional treatment.

Activity Effect Negligible

This complete neglect of activity effects amounts formally to assigning to the zwitterion an activity coefficient equal to that of the univalent ion In' in which case the effects would cancel. The data at present available must not be taken as justifying such a quantitative conclusion, but only that the overall activity effect is negligibly small for present purposes.

If a , b , and c denote the Spekker readings which ideally should correspond to the indicator being wholly in the forms Red I, Red II, or yellow respectively, only c can be determined simply by using a solution of such pH that the proportions of two of these forms are negligible. White¹ has observed

a change of Red I to another yellow form in solutions of very high acidity and this change overlaps the first of those previously considered; the other stages also overlap. Nevertheless, in an acetic acid solution roughly diluted to fall within the range N/30 to N/70 a flat minimum for the drum-reading R may be observed, and the hypothetical value of b to be used in calculations is given by the expression $(1.043 R_{\min} - 0.943c)$. This need only be calculated when a new batch of indicator is taken into use. Hence, in spite of the complexity of the methyl red equilibria, its application to the absorptiometric determination of pH is unusually simple, the relevant equation being

$$p \{H^+\} = 4.91 - \log(c - R) + \log(R - b) \dots (ii)$$

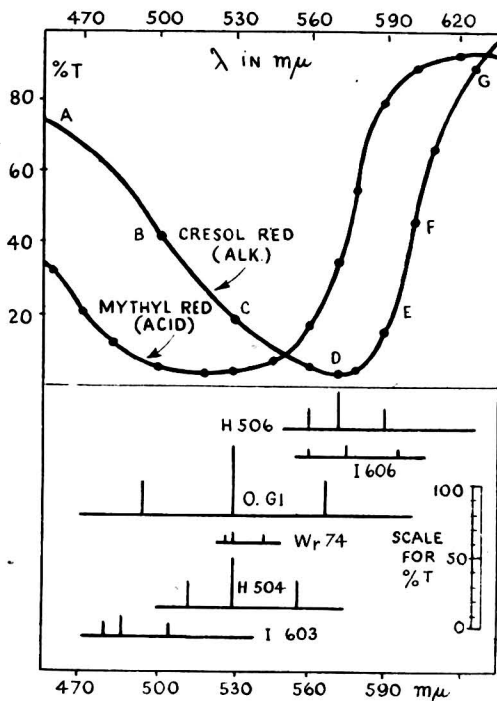
LIGHT SOURCES & FILTERS

The difference of two Spekker readings (ΔR) accurately measures the optical density (D) of an absorbing solution, where $D = \log(\text{incident intensity/emergent intensity}) = -\log T$, where T denotes transmittancy. In the above discussion it has been presumed that D is proportional to the concentration (C) of the absorbing species, and for monochromatic light this would be the case since the Lambert-Beer law may be expressed $D = \epsilon l C$, where l is the path length and the extinction coefficient ϵ is constant for a given wave-length.

When a tungsten lamp and light filter is used, the well-known departure from linearity must not be ascribed to inapplicability of either Lambert's law (D proportional to l) or Beer's law (D proportional to C). The latter has sometimes been regarded as merely approximate even for monochromatic light, but its claim to validity when allowance is made for the effect of dilution on any equilibria involved has been defended by Hardy and Young⁴ who give a method of determining (i) T curves and (ii) the concentrations of several absorbents when only D values of mixtures containing unknown proportions can be observed.

Assuming then the validity of the law, a relationship between D and C with polychromatic light can be deduced⁵ which would only reduce to a linear form ($D = \epsilon l C$) if ϵ had the same value for all wave lengths involved. For this to be true the relevant parts of the T curve would have to be horizontal—a condition which would

not be met in practice. Too often the case involving polychromatic light is dismissed with the unhelpful statement that linearity is not to be expected, whereas even the hypothetical condition for linearity is of some help and would enable one to conclude from the T curves for methyl red and cresol red (see figure) that the former is much closer to the ideal than the latter. If, however, one desires information concerning the extent of errors caused by a given departure from ideal conditions, or help in the choice of the most appropriate light source, filters, etc., it is necessary to consider numerical data in particular cases.



Transmittance characteristics of indicators and filters: the horizontal line for each filter represents the band width for transmissions of 10 per cent of the maximum and upwards. The vertical lines show the position of the maximum and the band width for 50 per cent of this maximum

As a convenient measure of departure from linearity the following is proposed: let instrument readings be taken when two cells of equal path length are placed in the light beam when (i) both are filled with water, (ii) one is filled with water, the other with a solu-

tion of absorbent, (iii) both are filled with the same absorbent solution. Ideally the difference (Δ_1) between readings for (i) and (ii) should be the same as the difference (Δ_2) between (ii) and (iii), and the ratio Δ_1/Δ_2 should be unity.

The percentage error in this ratio is of the same order of magnitude as that caused by departure from linearity in the determination of [alkaline form]/[acid form] of an indicator. To achieve the desired accuracy this must not exceed about 2 per cent. In general the concentration of absorbent should be such that ($\Delta_1 + \Delta_2$) covers the best part of the working scale of a particular instrument. If only one cell can be accommodated, C may be varied, using for observation (ii) a solution of half the concentration used for (iii).

If desired, $\Delta_1 + \Delta_2$ can be calculated for an actual or hypothetical case provided that the T curves for all filters used, and of the absorbent, are known in addition to the photocell response (P) for narrow bands of the light source. With a tungsten lamp the right-hand photocell of the Spekker used gave the following responses:

λ in $m\mu$	400	450	500	550	590	605	630	650	680	700	750	800
per cent response	2.5	10	30	67	96	100	83	54	13.5	6.5	2.5	1

These data were obtained by using monochromatic radiations from a Beckmann spectrophotometer and noting the deflections of the Spekker galvanometer and rescaling them as percentages of the maximum deflection. The unit chosen does not, however, affect the subsequent calculation. In a study of alkaline cresol red it was found adequate to assume the applicability of the Lambert-Beer law to wave bands of 10 $m\mu$ between 540 and 850. Data for a few of these bands are quoted in Table I to illustrate the nature

of the calculation. The column headed T_F refers to the combined effect of Hilger filters H506 and H503. T_1 and T_2 designate respectively the transmittance when 1 and 2 cm. cells are used.

If the effective wave-range scan were strictly limited to 560-600 $m\mu$ we should then have

$$\Delta_1 = \log 43.18 - \log 3.279 = 1.019$$

$$\Delta_2 = \log 3.279 - \log 0.602 = 0.736,$$

$$\text{and } \Delta_1/\Delta_2 = 1.38.$$

The fact that for each line of the table, T_2 is exactly the square of T_1 , shows that each 10 $m\mu$ band is sufficiently near to monochromatic for the Lambert-Beer law to apply. On taking logarithms for one of these lines the expression for $\Delta_1/2\Delta$ necessarily reduces to $-\log T_1/(\log T_1 - 2 \log T_2) = 1$. This would still be true for the summation of any number of lines such as 1 and 2 where the T_1 and T_2 values agree; despite any differences in P values, the expression for Δ_1/Δ_2 for n such lines would take the form $\log nT_1/\log nT_2 = 1$. If only lines 1, 2 and 3 were summed, Δ_1/Δ_2 would only be 1.06, whereas in the actual investigation it was considered necessary to cover a wave band from 540 to 800 $m\mu$ and the calculated value of Δ_1/Δ_2 proved to be 4.2, in good agreement with experimental determinations.

Such studies bring out the fact that a close approach to the desired linearity can be achieved even if there is a moderate variation in ϵ (as shown by the addition of line 3 to 1 and 2), but if the wave band scanned is wide enough to include parts of the T curve approaching 1 (i.e. 100 per cent) this has the effect of adding almost the same figure to each of the last three columns of Table 1, and the total effect of such influences can cause extreme departures from

TABLE I

	$m\mu$	P	T_1	T_2	PT_1T_2	PT_1T_1	PT_1T_2	
1.	560-570	79	0.16	0.03	0.0009	12.63	0.380	
2.	570-580	87	0.17	0.03	0.0009	14.80	0.443	
3.	580-590	94	0.105	0.07	0.0049	9.87	0.692	
4.	590-600	98	0.06	0.30	0.0900	5.88	1.764	
Totals						43.18	3.279	0.6021

TABLE II

Light Source	Δ_1	Δ_2	Filter	Δ_1	Δ_2
Tungsten lamp	Heat absorbing H503 also used in all cases
"	H506 (Lothian special yellow)	..	1.68
"	1606 (Iford yellow)	..	1.41
"	O.G1 (Chance's glass, green)	..	1.31
"	Wratten 74 (green)	..	1.14
"	H504 (Lothian special green)	..	1.13
"	1603 (Iford blue-green)	..	1.12
Hg Arc	1606 (isolating lines 577-579 $m\mu$)	..	1.04
"	Wratten 74 (isolating line 546)	..	1.02

linearity. If the absorption band of the material to be determined is sufficiently broad it is by no means necessary that the transmission curves of the filters should be extremely narrow, provided that the cut-offs at the fringes are sufficiently abrupt; it is the skirts of such filter-curves that signify trouble. The unwanted effects corresponding to the fringes will be the more pronounced the smaller the contribution to the photocell excitations in the region of maximum absorption. The Δ_1/Δ_2 ratio could be brought nearer to unity by decreasing concentration; naturally if $(\Delta_1 + \Delta_2)$ were so reduced as to cover only a small part of the instrument scale, any advantage would be offset by increased reading errors.

Certain further conclusions can best be illustrated by considering the experimentally determined values for Δ_1/Δ_2 , obtained with a weaker solution of cresol red. These are shown in Table II and particulars of the filters used are given in the diagram. These data show very strikingly that (i) coincidence of λ for T_{\max} of the filter and T_{\min} of the solution does not ensure that the best choice of filter has been made, (ii) the commercially available "narrow band" filters are not narrow enough to ensure that the linear law is more closely followed than with wider band filters.

Lothian Method Filter

The first point is well illustrated by the special filter supplied for the Lothian method (H506) since the (at first sight desirable) matching of filter and indicator characteristics is very close. The trouble is due in part to the filters having such high transmittances in the red, and more especially in the infra red, that even in conjunction with the heat absorbing filter the transmittance at 750 $m\mu$ is actually higher than in the nominal range. Despite the low sensitivity of the photocell in the infra-red the unwanted effect is considerable between 670 and 750 $m\mu$. If desired, the unwanted transmission could be stopped by cupric sulphate solution, but although this can cut a Δ_1/Δ_2 ratio from 4 to about 3, it still remains very high because of the inadequate cut-off of the filter for wave lengths higher than 572 $m\mu$ (i.e. T_{\max} for H506); the fact that the photocell response increases from 88 per cent at this wave length to 100 per cent at 605 $m\mu$ exaggerates the effect.

The narrower band I606, having about the

same wavelength for T_{\max} , is noticeably better than H506 but with a white light source still shows appreciable errors because it embraces wavelengths on the steep absorption edge of the indicator curve. If, however, I606 is used to isolate the 577 and 579 $m\mu$ mercury lines the divergence from linearity is only 4 per cent. This is still too high for our purposes, whereas with the Wratten 74, which isolates the 546 line, giving an almost perfect monochromatic source, the error is within the desired limits. Returning to the remaining observations made with a tungsten lamp, the great band width of O.G.I., leads one to expect that the departure from linearity should be considerable, but at first sight it is surprising that this filter is noticeably better than I606.

Choice of Filters

If T curves for absorbent and filters were symmetrical and if photocell responses were constant for the relevant wave band then it would be best to use a filter having λ for T_{\max} the same as for T_{\min} of the substance to be determined. If an absorbent having the usual feature of a steeper absorption edge towards the red than towards the blue were scanned by a wave band of appreciable width which had hypothetically ideal cut-offs on either side, then the best choice of filter would be one that embraced regions exemplified on the diagram by C to E or B to F, i.e. regions between points of equal T values. This would involve displacing the centre of the filter's wave band somewhat to the left. A further consequence would be that if filters having the same band width were compared, one extending from C to E would be better than one from B to D; but if a wide band filter extending from B to F were compared with a narrower one from B to D, their Δ_1/Δ_2 ratios would be practically the same.

Actual filters, however, do not have ideally sharp cut-offs. Also, the steepness of the limb DG of the curve for the absorbent calls for a sharper cut-off than does DA, but unfortunately the corresponding asymmetry found in the usual filters furnishes the less satisfactory cut-off to the side requiring the better one. The effect of this is accentuated by the photocell characteristics. It will be seen that several factors combine to displace the maximum transmittance of the ideal filter considerably to the left of D. Even with the best choice a tungsten lamp

would be unsatisfactory and only a mercury arc would enable cresol red to be used for the proposed method for pH determination. Methyl red could be used not only with a mercury arc, but also with a white light source, provided that with the latter an appropriate filter be used; the filter H504 specially made for the Lothian application of methyl red (and thymol blue) is not as good as the others in the usual Wratten or Ilford series. The special filters were developed at a time when the Spekker was fitted with a much less sensitive galvanometer than is now the case and they were characterised by relatively high transmittances in the wavelength regions which were then considered the best.

The case of cresol red has been discussed in some detail because, of the many indicators examined, it is by far the most prone to give high Δ_1/Δ_2 values and is therefore very suitable for testing various types of absorptiometer to ascertain whether the band widths used are narrow enough to ensure a linear $R-C$ relationship. The severity of the test must be borne in mind since an instrument which showed discrepancies with cresol red might well give satisfactory linearity with other absorbents.

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- ⁴ *J. Opt. Soc. Amer.*, 83, 854 (1948).
- ⁵ Moneypenny, BISRA (Study Group on Absorptiometric Work) Report, R.G.2, April 1949, discusses the circumstances in which an equation for a discontinuous spectrum containing many lines reduces to a linear form.

Fertilisers Freed

Manufacturers Issue Statement

THE Minister of Materials has made an Order which frees fertilisers from price control at the start of the 1953/54 agricultural season, i.e., 1 July next. The Fertilisers (Prices) (No. 4) Order, 1952 (S.I. 1952 No. 1313) and the Fertilisers (1952 Prices) (Amendment No. 1) Order, 1953, (S.I. 1953 No. 99), which provides maximum prices for fertilisers, are revoked with effect from 30 June.

Farmers will naturally be interested to know how they will be affected by the Government's decision to end statutory price control on fertilisers and will be reassured by this statement from the Fertiliser Manufacturers' and the Super-

phosphate Manufacturers' Associations:—

'The fertiliser industry has been working under statutory price control since 1939. When the subsidy payable to the manufacturer ceased on 1 July, 1951, and the Government handed back to the industry the purchase of its raw materials, the control of maximum prices was retained in Government hands. The associations have felt for some time that the method of determining statutory maximum prices tended to discourage initiative by manufacturers, while on the other hand reasonable prices to the consumer would be effectively encouraged by the trade's concern for its own long-term interests. Moreover, it is not certain that the existence of a statutory maximum price has in fact always given the consumer the lowest possible price.

'The associations therefore welcome the Government's decision to remove this control, and the opportunities for better service which it presents. Members of the associations are now free to adopt their own selling policy and prices, but it is understood that no major changes in policy are likely in the immediate future. The industry has achieved high standards of service and the agricultural industry may have the fullest confidence that these standards will be maintained.'

International Exhibition

PRODUCTS resulting from new ideas of chemistry as applied to industry will be included among the exhibits at the 2nd International Chemistry Exhibition which will be held in Paris from 18-29 June.

Four separate congresses will be held during the period of the exhibition — the 26th International Congress of Industrial Chemistry, the 2nd session of the Genie Chimique, the 1st International Anti-rust and Corrosion Congress and the 7th International Congress of Cosmetic Experts.

The first results of atomic research in France will be shown, as well as more than 600 exhibits in the field of gas, coal by-products, paint and varnish, fertilisers, etc.

Although the British section of the exhibition will be one of the smallest, it will be a representative one, the exhibitors including ICI and Vickers-Armstrongs.

Professor M. R. Belcher, senior lecturer in analytical chemistry, Birmingham University, will speak on 'New Methods of Analysis in Organic Chemistry.'

Corrosion Research

Plea for More Facilities by Dr. W. H. J. Vernon

THE annual general meeting of the Corrosion Group of the SCI, held in London on 13 May, was notable for a stimulating address entitled 'Corrosion—A Field for Action', by the retiring chairman and founder-chairman of the Group, Dr. W. H. J. Vernon, O.B.E.

Dr. Vernon recalled the inaugural lecture delivered to the Group two years previously by Dr. U. R. Evans, who had reviewed the development of the science of corrosion. Instead of covering the same ground, Dr. Vernon proposed to trace the history of officially-sponsored corrosion research in the UK, in relation to public demand and national necessity. It could clearly be divided into three epochs, separated by the cataclysmic impetus provided by the two wars.

This work could be said to have started in 1911, when Dr. G. D. Bengough, then at Liverpool University, produced his first report to the newly-instituted Corrosion Research Committee of the Institute of Metals. Corrosion research was not new, even then, and Dr. Vernon paid special tribute to the work of Dr. J. Newton Friend and his contemporaries around 1905-1910. In those days, the approach to corrosion tended to be more philosophical than practical, and the experiences of World War I brought the realisation that sponsored research had begun at least ten years too late. The story of the Navy's almost disastrous condenser tube problem was well known. Use was made of views that had already been accepted, but lack of practical experience proved a serious obstacle; an early application of cathodic protection, for example, was a failure because no attention had been paid to problems of design.

Upsurge in Sponsored Research

The years immediately following the 1914-18 war saw an upsurge in sponsored corrosion research, the initial impetus again coming from the non-ferrous side with the formation in 1921 of the Atmospheric Corrosion Research Committee jointly by the Institute of Metals and the RIBA and its subsequent absorption by the newly-founded British Non-Ferrous Metals Research Asso-

ciation, with Dr. Vernon as its first investigator. In 1924 the Corrosion Research Committee of DSIR was formed, with Professor (later Sir Harold) Carpenter as chairman, to consider the study of corrosion entirely from a fundamental standpoint. Dr. Bengough and later Dr. Vernon, who were then at the Royal School of Mines, accepted appointments under this Committee, and in 1928 moved into the new Chemical Research Laboratory of DSIR at Teddington. In the same year the Iron and Steel Institute formed its Corrosion Committee under the inspiring chairmanship of Dr. W. H. Hatfield, who remained in that office until his death. Dr. J. C. Hudson was appointed the first investigator to this committee, the work of which was taken over by BISRA in 1946.

Activity Between the Wars

In the inter-war years, official research was carried out by these organisations and by other research groups, notably at the Admiralty Research Laboratory, Emsworth, the Royal Aircraft Establishment, Farnborough, the Armament Research Establishment, Woolwich, and the Post Office Research Station, Dollis Hill. The actual numbers of people working at these and similar laboratories was small, but their output was considerable. On the outbreak of World War II, corrosion laboratories were hard pressed by the increased and urgent demands made on their services, but they had at least the advantage of previous peacetime experience.

Before discussing post-war conditions, Dr. Vernon digressed a little to summarise the present position of corrosion science. It was now realised that there was no such thing as one corrosion problem with one overall solution. Corrosion was seen in a broader context in relation to physics, metallurgy, and chemistry, with their concomitant sciences of engineering, mineralogy, and microbiology. The emphasis of research was passed principally to a consideration of controlling environment as distinct from that of the metal itself. The older attitude toward the necessity for conserving materials by preventing corrosion had been based philosophically on a concern for posterity. Today,

however, the problem was far more immediate, since the world trend was to put more and more strain on material resources. In 1922, Dr. W. H. Hatfield had estimated the world cost of ferrous corrosion to be £200,000,000 p.a. In 1949, Professor H. H. Uhlig told a UN Scientific Conference at Lake Success that the annual cost of corrosion in the USA alone amounted to \$5,500,000,000, and Dr. J. C. Hudson estimated that the annual cost of rust prevention in this country was now £200,000,000. These were estimates of tangible costs alone, and could not take into account losses due to inconvenience and stoppage. It mattered less in prewar days than now if plant was shut down for repairs.

Upsurge of Interest

Professor Uhlig's pronouncement in 1949 had strong repercussions particularly in Belgium, where the Government and many industrial concerns co-operated to form 'Cerelcor'—*Centre Belge d'Etude de la Corrosion*. Among British industrial concerns, there had been a great upsurge in interest in corrosion prevention during and since the war, a trend which was well illustrated by a soaring graph of numbers of enquiries received annually by the Chemical Research Laboratory Corrosion Group during the period 1939-1949. The trend showed that industry was becoming more aware of what could be gained from consulting the corrosion expert.

This upsurge of interest, combined with the greater economic significance of corrosion problems, had not been matched by increased action on a national scale. The proportion of corrosion research workers to research staff in other fields was no more—probably less—than in 1939. The increase in the numbers of those engaged in corrosion research bore no relation to the demand for information and results. Symptomatically, committees had multiplied, with a correspondingly increased pressure on the few people engaged in experimental research.

The difficulty which confronted corrosion scientists was not only one of personnel, but also of status. A great step forward had been the establishment of a Readership in Corrosion Science at Cambridge in 1946, but this had no parallel in the Government Scientific Service. Dr. Vernon revealed that in 1945 he had prepared a memorandum advocating the formation of a Corrosion

Research Organisation, with full facilities for fundamental and practical research, and other concomitants of a research station, including a comprehensive information service for industry. The need for public support for such an organisation was the more desirable since corrosion problems were not peculiar to any one group of industries; they were user problems, in the widest sense. Though demands on corrosion workers had increased since 1945, there had been no positive advance in officially-sponsored corrosion research. The Corrosion group of the SCI was taking the best possible action in promoting schemes of education in corrosion science, and as its Annual Report had indicated, special courses had been given during the present session at Northampton and Battersea Polytechnics, London, and at Birmingham. Attention was being given to the need to educate the industrial executive as well as potential corrosion workers in the importance and usefulness of corrosion research. There could be no complacency about the Corrosion Group's membership of 300; in the U.S.A., where the economic situation was less grave, the National Association of Corrosion Engineers had 4,000 members.

Constant Vigilance

Concluding his address, Dr. Vernon referred to the recent Messel Lecture by Sir Henry Tizard, who had urged that constant vigilance be kept on the need for readjustment of research effort to match economic demands. A big increase in attention to the development and application of corrosion knowledge would be abundantly justified on such grounds. After the address, tributes were paid by Mr. J. Henry Turner, Dr. J. W. Jenkin, and (in a letter read by Dr. J. C. Hudson) by Dr. L. A. Jordan, chairman of the SCI Council, to Dr. Vernon's work for the establishment of the Corrosion Group and to his chairmanship in the crucial and productive first years of its existence.

At the annual general meeting of the Corrosion Group the following officers were elected to serve during the coming year: Chairman, Dr. J. C. Hudson; vice-chairman, Dr. W. H. J. Vernon; hon. secretary, Mr. S. C. Britton; hon. treasurer, Mr. W. E. Ballard; committee, Dr. S. G. Clarke, Mr. J. B. Cotton, Dr. T. P. Hoar, Mr. L. Kenworthy, Mr. H. T. Shirley, Mr. K. A. Spencer, and Dr. F. Wormwell.

Terephthalic Acid

Methods of Production in Petrochemical Industry

AS recently as 1950, terephthalic acid was available only in pilot-plant quantities. Today, it has become a major raw material for the production of synthetic fibres of the ethylene glycol terephthalate type ('Terylene' or 'Dacron'). On the heels of this important development, polyethylene-terephthalate films have been shown to have useful properties and promise to expand further the lustily growing demand for terephthalic acid.

This newly important dicarboxylic acid is produced by the liquid-phase oxidation of *p*-xylene. Early forecasts predicted a para-xylene demand for the production of terephthalic acid at the rate of 114 million pounds/year by 1960. More recently, this forecast (made in 1952) has been declared as pessimistic. *p*-Xylene is available to the petroleum industry in admixture with its *m*- and *o*-isomers and with ethyl benzene. *o*-Xylene with an atmospheric boiling point of 144.4° can be separated from the other components in sufficiently pure form for the production of phthalic anhydride. *p*-Xylene, *m*-xylene, and ethyl benzene boil within a one-degree range (138.5-139.5°) and separation by straight fractionation is out of the question. The similarity in chemical structure and in physical properties creates formidable purification problems. Methods of extractive distillation have been proposed but show little commercial promise.

Para-xylene by Crystallisation

The commercial recovery method reputedly used by Humble Oil & Refining Co., involves the crystallisation of *p*-xylene. A typical xylene fraction from petroleum hydroforming will contain 21 per cent *o*-, 50 per cent *m*-, 19 per cent *p*-xylene, and 10 per cent ethyl benzene. The first step in *p*-xylene purification is the distillative separation of *o*-xylene.

The system *p*-, *m*-xylene forms a eutectic mixture containing 88 parts of the *m*-isomer and 12 parts of *p*-compound. Its freezing point is -58.5°. It is therefore possible to crystallise substantially pure *p*-xylene from any starting mixture containing more than 12 per cent of the isomer. Various methods are employed to boost the *p*-content of the

depleted mother liquor in order to make it suitable for recycle through the crystallisation stage. Birch (U.S.P. 2,532,276) separates a mixture of xylenes and ethyl benzene into three distillate fractions. The lightest cut, with a boiling point up to 137° is richest in *p*-xylene which may be separated out by crystallisation. The mother liquor from this separation is combined with the intermediate *m*-rich distillation fraction, either directly or following a second distillation-crystallisation treatment of the mother liquor. A portion of the *m*-xylene in the blend is converted to the *p*-compound by vapour phase isomerisation over silica-alumina catalyst. The product so realised is recycled to the fractionation step.

Method of Boosting Yield

Displacement of the eutectic composition by the addition of a solvent offers means for boosting the single-pass yield of *p*-xylene and for recovering pure *m*-xylene as well. Illustrative is a patent due to McArdle and Mason (U.S.P. 2,435,792) by which the crystallisation step is carried out in the presence of a light solvent such as pentane. Starting with a mixture of 71 per cent *m*-, 21 per cent *p*-xylene, and 8 per cent other C₈ aromatics, McArdle adds an equal volume of *n*-pentane. The mixture is cooled to -70°, at which temperature 70 per cent of the initial *p*-xylene is separated out by crystallisation and can be removed by centrifugation. This treatment shifts the residual C₈-composition to the other (i.e. high-*m*) side of the eutectic point observed for pure xylenes. After the pentane has been removed from the mother liquid (by distillation), it thus becomes possible to recover fairly pure *m*-xylene crystals by cooling to -52°. In the example cited above, 27 per cent of the initial *m*-isomer can be so recovered. It must be noted, of course, that the markets for purified *m*-xylene are quite limited at this time, and that its recovery is not being practised commercially. Even better results are reported for crystallisation in the presence of *iso*-pentane. McArdle found that up to 91 per cent could be recovered in crystalline form by diluting the above mentioned mixture of

C₈-aromatics with an equal volume of *iso*-pentane and cooling to -85° .

Other Methods Sought

Low-temperature crystallisation processes are quite costly and other means have been sought to raise the initial *p*-xylene content. Such an approach will permit crystallisation of this compound in fairly pure state at higher temperatures. Of importance in this connection is the use of preferential sulphonation of *m*-xylene to form high-boiling sulphonic acids. Both the *p*- and *m*-isomers of xylene are susceptible to sulphonation. The main difference is the greater reaction rate exhibited by *m*-xylene, and conditions must be adjusted to minimise the conversion of the desired *p*-xylene. L. K. Beach (U.S.P. 2,519,336) proposes the use of 95 per cent sulphuric acid at 40° . Starting with a mixture containing approximately 30 per cent *p*- and 67 per cent *m*-xylenes enough sulphuric acid is added to convert part of the *m*-xylene. (Only a small portion of the total H₂SO₄ content is utilised in the sulphonation proper. Acid below 85-90 per cent strength is no longer active in the desired reaction.)

Hetzner (U.S.P. 2,511,711), who also proposes partial sulphonation separates the un-sulphonated organic layer from the reaction liquor and recovers *p*-xylene therefrom by cooling to -54° . The separated crystals are approximately 90 per cent pure *p*-xylene. Beach (U.S.P. 2,519,336) combines the un-sulphonated portion prior to crystallisation with a recovered high-*p*-fraction from the sulphonation mass. This recovered material is obtained by steam hydrolysis of the xylene-sulphonic acid. The patent states that *m*-xylene is first regenerated and is followed by a *p*-rich fraction. Sturrock *et al.* (U.S.P. 2,439,228) take advantage of the preferential reaction of paraldehyde with *m*-xylene to effect separation of this hydrocarbon from its *p*-isomer. The reaction is carried out in several stages. Substantially complete conversion of all *m*-xylene present is claimed.

Oxidation of *p*-Xylene

While the technique at present employed commercially involves the purification of *p*-xylene as such, it is possible to carry out the oxidation to terephthalic acid in two stages and to separate the isomeric toluic acids formed as intermediates. These mono-

carboxylic acids exhibit a sufficiently wide difference in boiling point to permit ready purification by fractionation. This approach, proposed in a Dutch Patent (63,987), envisages oxidation of a xylene mixture with air. The reaction is carried out at 115° in the presence of cobalt linoleate as catalyst. The toluic acids so formed are separated by distillation and are converted to terephthalic acid with an over-all yield of 60 per cent (based on the *p*-xylene contained in the initial feed-stock). The oxidation of *p*-toluic acid may, for instance, be carried out in the presence of lead acetate, which serves as catalyst. Air is used as oxidising agent. The reaction medium is acetic acid. Typical operating conditions are 180-220° and a pressure range of 700-1,000 psi. The use of an oxidation initiator (such as acetaldehyde or methyl ethyl ketone) is indicated.

Not Suitable for Batch Production

The process is not suitable for batch operation. A pseudo-equilibrium is established between the various products of oxidation after a portion of the xylene has been converted. Once this point has been reached, further oxygen absorption becomes negligible. Under such conditions, yields of terephthalic acid are unsatisfactory. This difficulty can be overcome by supplying a continuous makeup of hydrocarbon feed, and withdrawing the product either continuously or semi-continuously. It is necessary that the *p*-xylene is free of anti-oxidants which are sometimes present as impurities. The presence of minor amounts of hydrocarbon impurities is not objectionable.

A method for carrying out this oxidation reaction has been described by Bowden (B.P. 62,836). The reaction vessel is provided with a high-speed agitator and with means to effect the thorough distribution of the incoming air stream. A short ring-packed column is provided on top of the reactor. Here, refluxing xylene serves as scrubbing medium for the removal of intermediate oxidation products (notably toluic acid) from the rising gas stream. An overhead condenser removes xylene and most of the water of reaction from the waste gases. After separation from the aqueous phase, the recovered xylene is returned to the converter via the scrubber column described above. The catalyst is introduced with the *p*-xylene

continued on page 859

Food Investigation

Widespread Activity at National Research Stations

THE report of the Food Investigation Board and of the Director of Food Investigation for 1952 is once again an extremely interesting publication, and it is disturbing to read, as indeed in all the reports of national research establishments for the last year, that 'the programme of research for 1952 was prepared . . . on the assumption that there would be an increase of staff. It included new items relating to food research problems of rearmament. Although these and other additions were included . . . there were the same number of scientific officers in the organisation on 1 December 1952 as there were on the same date in 1951.' Fortunately, however, the number of visiting scientists has substantially increased, and the outside assistance thus given has been equivalent to that of 15 full-time officers. Even so the Board feel that the progress made will be insufficient to meet the requirements of Government departments and industry.

At the Cambridge Low Temperature Research Station, research has proceeded in the use of ion-exchange resins for the separation of substances of very high molecular weight, which, although they cannot penetrate the resin particles, may be handled chromatographically, provided conditions for rapidly reversible sorption and desorption can be found. By study of the adsorption of hæmoglobins on carboxylic acid cation resins in various buffer solutions, a procedure capable of separating bovine CO-hæmoglobin from sheep foetal CO-hæmoglobin has been developed, which may prove of great value in the study of enzymes and protein hormones. A new method for the quantitative estimation of amino-acid chromatograms involves the extraction of the 2,4-dinitrophenyl derivatives and their colorimetric estimation in NaHCO_3 solution. Quantities of the order of $6\mu\text{g}$ of alanine may be estimated to within ± 3 per cent.

The Effect of Sugar

The effect has been studied of added sugars on the stability of lipovitellin, the lipoprotein constituent of egg-yolk, during freeze-drying and subsequent storage. Sucrose, lactose and glucose all prevented

the small loss of solubility during freeze-drying; sucrose, and to a lesser extent lactose, also retarded loss of solubility during storage, but glucose accelerated deterioration. At high moisture contents the presence of glucose caused rapid discoloration.

Sterilisation Investigation

In the investigation of sterilisation by ionising radiation, work has shown that the formation of an organic peroxide in butter fat takes place in part after cessation of the irradiation, and shows a surprising maximum rate of reaction in the region of -20° . Reports that the bactericidal activity of X-rays is increased by the proximity of metals have been investigated: it has been confirmed that the short-range radiations produced by the interposition of gold foil in an X-ray beam increase its bactericidal power, but the radiations are absorbed by a few mm. of air or a fraction of a mm. of water.

The copper-catalysed oxidation of components of foods has been investigated by studying the combination of copper with a number of amino acids and measuring the catalytic effect by the complexes on the oxidation of ascorbic acid. In many instances the activity of ionic copper is enhanced when it is combined with an amino acid.

The possibility is being explored of obtaining by simple immersion a satisfactory deposit of tin which could, firstly, be used by itself as a surface finish for aluminium; secondly, form a basis for electroplating aluminium with tin and, thirdly, permit soldering. Tin can be deposited in a coating about 0.0002 in. thick from tin chloride; after addition of a high concentration of Rochelle salt the pH may be raised to about pH 7.5 by adding alkali, without precipitating tin hydroxide. More uniform, thicker and brighter surfaces may be obtained by immersion in potassium stannate, but the adhesion is very poor.

In co-operation with the Ministry of Food and the Brewing Industry Research Foundation, concentrated beer has been prepared by freeze-concentration and by evaporation under reduced pressure. In each instance it has been found possible to

retain, or replace when lost, essential characteristics of beer. The tests are to be extended to the pilot-plant scale, both to obtain information on bulk handling and to provide sufficient material for storage tests.

Quantitative Procedure

As a result of the research on plant tissues and products, a quantitative procedure has been developed for the isolation and determination of L-ascorbic acid and related substances. Enzymes are inactivated by saturating the extract with oxalic acid, and the dienols are stabilised through subsequent operations by maintaining a high concentration of oxalic acid. The dienols are estimated after separation on a chromatogram. Two new solvents, *n*-butanol-water saturated with oxalic acid, and phenol-water saturated with oxalic acid, have been developed; the phenolic solvent will clearly separate L-ascorbic acid from L-arabo-ascorbic acid.

The biochemistry of enzymic browning in potatoes and cut apples is in course of investigation, and the importance of the leuco-anthocyanins as constituents of plants is being studied. The examination of the constitution of the numerous glycosidic forms of polyphenolic compounds has been continued. The phenolic fraction is isolated, using carbon-Celite columns as absorptive filters, and the crude concentrate is applied as a streak to chromatograph paper. The individual compounds are eluted and hydrolysed, the sugars and aglycones produced are identified by R_F values, colour reactions and ultraviolet spectra, and the molar ratio of sugar to aglycone is determined. The spectra, in alcohol and 0.005 N sodium ethoxide, of over 60 naturally occurring phenolic compounds and their methylated derivatives, have been determined, and it has been found that the shift of the peaks in alkaline solution is indicative of the precise position of the free phenolic OH groups. By this means the configuration of the mono-glucosides of apigenin (5, 7, 4'-trihydroxyflavone) and luteolin (5, 7, 3', 4'-tetrahydroxyflavone) have been determined.

Other investigations have shown the presence of a surprisingly large amount of free amino acids in new-laid and stored eggs; the structure of egg-white; and the structure of a considerable number of the peptides and their probable sequences in the lysozyme molecule.

An officer of the Meat Division has gone to Australia to work on a programme of experiments with beef carcasses. Different treatments will be applied and the beef frozen and stored for six months. If it were possible successfully to freeze and store surpluses of home-produced meat, supplies could be evened out over the year. The division has also been collaborating with New Zealand research workers in the examination of the first shipment to this country of chilled beef, which was carried with CO₂ in the hold to check bacterial growth.

Torry Research Station, Aberdeen, have developed a cheap, reliable, portable smoke-meter for industrial measurement of the optical density of smoke, particularly in fish-smoking kilns. Another entirely new instrument has been devised to measure the moisture content of solid substances at any desired point. The instrument is essentially an aluminium wire, anodised at tip, which is then covered with a porous layer of conducting material, so that the wire and the outer layer form the plates of a condenser, the capacitance of which is sensitive to humidity. The smallest element so far constructed occupies a volume of about 0.1 cu. mm.

During the year, Torry did a considerable amount of work on assessing the quality of fish by taste, smell, etc. Results obtained from a trained panel showed that fairly consistent judgment can be maintained over a period of months. It also appears that there is a correlation between the chemical condition of a fish and its scoring by the panel. At present, however, it is not possible to say how far chemical data can be used as indicators of fish quality. Biochemical investigations have included electrophoretic analysis of fish muscle proteins, the alkaline hydrolysis of actomyosin, determination of total lipid content of haddock, and study of intramolecular hydrogen bonding in hydroxyflavones, and there has been some work on the isolation and identification of phenolic bodies in smoked fish.

Volatile Compounds Studied

The Fruit, Vegetables and Plant Products Division has devoted much work to the study of the volatile compounds produced by fruit and vegetables in store. Bramley's Seedlings have been shown to produce ethanol, and small amounts of methanol

and a C₅ alcohol. Analysis of the carbonyl compounds present showed surprisingly little acetaldehyde, but considerable amounts of a C₃ compound, propionaldehyde and/or acetone. Work on the determination of ethylene and other volatiles has continued and the experiments include the removal of ethylene by combination with ozone in an external reaction vessel. Excess ozone may be removed from the atmosphere before recirculating by passing through plugs of iron coated with red lead. It has been found that the sprouting of potatoes may be completely inhibited at 10° by introduction of *n*-amyl alcohol, a natural product of respiration of the potatoes, at a concentration of 1 mg. per litre. The method has been used to reduce considerably the sprouting of 16 tons of potatoes stored under commercial conditions in a straw bale enclosure in a corrugated iron shed, using commercial amyl alcohol, and is now being tested on a larger scale.

'Food Investigation 1952' can be obtained from HMSO, price 2s. 6d.

Terephthalic Acid

continued from page 856

feed. A soluble salt of cobalt (such as oleate or naphthenate) is used and the metal concentration is in the range of .002-.02 weight per cent of the xylene.

The operation is greatly simplified by the fact that most of the intermediate oxidation products are oil-soluble while the desired terephthalic acid (together with some terephthalaldehydic acid) will settle out as a solid. It is therefore possible to recover the product by filtering a side-stream of the reaction mixture. The mother liquor is returned to the converter. Incoming xylene is used to wash the filter cake for the removal of adhering oil-soluble impurities. This process will yield 90 rounds of solids for every 100 pounds of xylene consumed. The crude project assays about 77 per cent terephthalic acid. A primary purification is possible by thorough washing with one of the lower aliphatic alcohols (methanol, ethanol, etc.) at or near its boiling point. By repeating this operation several times, a highly purified grade of terephthalic acid can be obtained. To avoid excessive yield losses, it is necessary to recover the impurities from the solvent alcohol and to return them to the reactor.

An alternate method of purification, which is capable of rendering terephthalic acid in a high degree of purity, involves intermediate esterification. The solid product recovered from the oxidation step is reacted with an excess of a lower aliphatic alcohol. The esterification is carried out at 70° in the presence of sulphuric acid (the use of acid catalyst is usually preferred but can be avoided by operating at higher temperatures and at elevated pressures). If methanol is used, the dimethyl ester of terephthalic acid will crystallise in very pure form upon cooling.

It is also possible to separate the esters quite simply by fractional distillation. Regardless of the method chosen for ester separation, highly purified terephthalic acid can be obtained by the hydrolysis of its isolated ester. As in the case of alcohol washing, the impurities separated by the esterification method should be recycled to the reactor for an increase in yield. In this manner, overall terephthalic acid yield can be boosted to as much as 95 per cent of theory (based on *p*-xylene).

Glass Technology in Scotland

A SCOTTISH section of the Society of Glass Technology was recently instituted at a gathering held in Glasgow representative of technical and scientific personnel engaged in the glass and allied industries in Scotland.

Mr. John Currie, Alloa, was appointed chairman, with Mr. J. F. Turnbull (Alloa Glass Works) and Mr. G. H. Thompson (Scottish Central Glassworks) as joint honorary secretaries. An executive committee, with a representative from each of the Scottish glassmaking centres, was also elected.

The Society of Glass Technology, with its headquarters in Sheffield, has a membership drawn from 42 different countries, a number of local sections under its jurisdiction and also an Indian section. A section is at present being formed in South Africa.

It is the aim of the sections to provide opportunities for closer co-operation between individuals for the study and elucidation of technical problems and generally to promote progress in the industry.

Arrangements will be made for suitable subjects of discussion for the new section at meetings to be held during the ensuing winter session in each of the various glassworks areas in Scotland.

Use of Thiourea

Increasing Applications & Increasing Demands

THIUREA as a reagent in organic synthesis and a substance of industrial importance has acquired increasing significance in recent times. It was first obtained in 1896 by the heating of ammonium thiocyanate and later by the action of H_2S or ammonium sulphide on cyanamide. It has been employed in the synthesis of amino-thiazoles, effected by condensation with α -chloro-aldehydes and ketones.

The production of related compounds such as the aminothiazoles by the action of SO_2Cl_2 on monoaryl thiourea derivatives had patent monopoly in the middle thirties, these compounds being incorporated into paper to facilitate sensitivity to ink eradicating chemicals. The reaction of thiourea as the thiolcarbamate tautomer leads to its use in the preparation of complex thiols and disulphides, such substances as the alk-3-ene thiols being prepared by the action of thiourea on 1-bromo-alk-3-ene, the synthesis being completed by hydrolysis of the thiuronium intermediate (Von Braum, *Ber.*, **67**, 281 [1934]).

Recently it has been used in the synthesis of 1, 2-dithiacyclohexane-3-butyric acid, a substance possessing the biological and physical properties expected for DL- α -lipoic acid. In the plastics industry, thiourea, like urea, affords thermo-setting resins, and textiles are often crease-proofed with thiourea-formaldehyde intermediate condensation products, the complexity of the intermediate products being related to the crease-proofing effects (BP 503.750).

Pest-Proofing Textiles

In the textile industry, wool is protected against attack by pests, by introducing into the fabric a water soluble thiuronium salt prepared by the action of thiourea on either ethylene dibromide, benzyl chloride or the appropriate dihalogen derivative of the latter (BP 346.039). Modern water-proofing techniques involve the use of thiourea and octadecylchloromethyl-ether condensates. The soluble salts in association with capillary active agents are used for impregnation purposes, consequent decomposition of the product on a substratum of textile material

by heat or saponification ultimately imparting the desired impervious properties (BP 526.738). Thioglycollic acid, used in rubber reclamation and permanent wave solutions, may be prepared from thiourea and monochloroacetic acid, the intermediate thiazolidone-2-imino being decomposed by $Ca(OH)_2$ (BP 484.467; *Ber.*, **12**, 1385, 1588).

Therapeutic Applications

In medicine *isopropylisothiourea* derivatives, prepared by the action of *isopropyl* bromide on thiourea, have found applications as respiratory exciters and hypotension agents. On the other hand thiazolidones having narcotic properties, as for example 5,5-diethyl-2-imino-thiazolidone-4 have been prepared using thiourea, acetic and bromodiethylacetic acid (BP 503.478). 5, 5-disubstituted barbituric acids are also obtained using thiourea and disubstituted malonic or cyano-acetic esters (BP 561.105), and the 5, 5-diphenyl thiohydantions may be synthesised, using the appropriate benzoin. Wetting agents useful as softening agents in the textile, paper and leather trades are again prepared by the action of such halogen fatty acids as those of palmitic and stearic acids on thiourea or its derivatives. Satisfactory aqueous dispersions of dyestuff powders are obtained, using S-alkyl or S-aryl *isothioureas* as dispersing agents. In agriculture, thiourea formulations find further applications in pest control where fine compositions containing thiourea-chloropicrin complexes are distributed within the locus of a given pest.

Improved methods for the production of thiourea are very necessary, and American patent literature shows that thiourea may be successfully prepared by the action of H.S and H.S-saturated polar solvents on the active diazomethane, the preparation being effected at 70°C (USP 2,521,778).

Price of Copper Reduced

The Ministry of Materials selling price for electrolytic copper, delivered to consumers works, has been reduced from £253 per ton to £252 per ton, with effect from 29 May. Premiums and discounts remain unchanged.

IN THE EDITOR'S POST

Fenton's 'Notes'

SIR,—As a subscriber to your paper since its foundation I was most pleased when you began to review books and delighted when you changed from the short unsigned notice to the signed and substantial review; and I have much appreciated the careful and just judgment usually given by your distinguished writers. I therefore regret to find what I consider a departure from your high standard and feel compelled to deplore the tone, the substance and the negation of one of your notices. I am referring to Dr. Nutten's account of Fenton's 'Notes on Qualitative Analysis' in your issue of 23 May.

Surely one of the main parts of the reviewer's task is to tell his reader what is in the book in question and in what way a new edition differs from the previous issue. Yet Dr. Nutten fills about one-third of his space informing us of his knowledge of the difficult problem of solubility products and most of the remainder in disclosing his lack of knowledge of school teaching conditions and the elements of reviewing. From his notice a reader could only infer that the contents of Fenton's book consisted of qualitative tables and tests for potassium. A man can but conjecture that Dr. Nutten is a young reviewer and has overlooked the courtesy due to his readers of informing them of the changes in the new edition.

Actually, to make the book more suitable for a school test Dr. Saunders has omitted the whole of the organic analysis, has added a section on semi-micro methods, and one on analysis by paper chromatography and has made a critical selection of the best of the techniques and of the new reagents introduced since Fenton's day. This is just the help teachers need; yet your reviewer makes no mention whatever of these innovations. They include Holness's excellent method of bringing the arsenic group sulphides into solution and his neat device for making the copper group solution of a desirable acidity; neither of these procedures are in American text books known to me.

Again, had Dr. Nutten read more fully the journal he quotes he would have learnt that hydrogen sulphide is more potent as a poison than hydrogen cyanide, which makes

nonsense of his remark on the boldness of teachers using potassium cyanide; and has he not overlooked that part of the worth of school science is the training it gives in using a dangerous material safely?

Fenton was a teacher of chemistry of outstanding ability, and this edition of his book by one of his old pupils is, as it were, a tribute to him. Into this revision, Dr. Saunders, himself a distinguished chemist, author and teacher, has put not only his own experience but has added that of the prominent chemists who are his colleagues at Cambridge. For all that, your reviewer implies that the editor was not aware of an easily available article on analysis. I am encouraged to write because I do not think you would willingly do an injustice to a book of real worth; and from many years' experience as a teacher of chemistry to university scholarship standard in a large London grammar school, I should like to say that I consider Dr. Saunders's able revision a most suitable text for the sixth form.—Yours etc.

G. FOWLES.

Latymer Upper School, London, W.6.

Dr. Nutten's Reply

Sir,—I am very grateful for the opportunity of replying to Mr. Fowles' comments on my review of 'Fenton's Notes on Qualitative Analysis'. The review was not, of course, intended as a monument to Fenton's abilities, but as an evaluation of the worth of the book at the present time.

It is my opinion that the main part of a reviewer's task is to indicate the shortcomings of a book when these are outstanding, rather than to write a catalogue of its contents. I did, however, mention that there was a section on reactions—and most readers would guess the nature of these, because the inclusion of such a section follows established procedure—in addition to the qualitative tables which together account for more than 90 per cent. of the material in the book. There is nothing novel in semimicro methods of analysis which have been standard practice for at least a generation, although not necessarily in this country. The tiny 1½-page section on paper chromatography is quite out of place. Students should be allowed to concentrate

on fundamental reactions and leave specialised topics until later. Even then, only the separation of the Group IIA cations is described, the time wasted on such a separation being at least 15 hours. No mention is made of the advantages of this technique.

The book, which carries a large amount of 'dead' material, should, I feel, be entirely rewritten and not be perpetuated in the original author's name.

It is some years since the paper I referred to appeared, and it is perturbing to note that school examination questions continue to mislead the student on sulphide solubility products. While these questions may be useful from an arithmetical point of view, they bear little relation to chemical fact. The author appears to be unaware of the anomalies existing and I was attempting to pass on my knowledge to those who do not appear to appreciate the above facts.

Hydrogen Sulphide vs. Cyanide

With regard to the poisonous nature of hydrogen sulphide and hydrogen cyanide, Mr. Fowles did not take into account the fact that the amount of potassium cyanide used is very much larger than the amount of hydrogen sulphide likely to be present even in a polluted laboratory atmosphere. Surely Mr. Fowles would rather be in a laboratory where hydrogen sulphide was bubbling than in one where hydrogen cyanide was being passed! I agree that part of the worth of school science is the training it gives in using a dangerous material, but surely potassium cyanide is not an ideal starting material in this respect, especially when the harmless sodium thiosulphate is as suitable a reagent for bringing silver halides into solution.

The Holness method for adjusting the concentration of hydrochloric acid to 0.25-0.3N for the precipitation of the Group II sulphides is quoted in the text, but the final solution prepared according to Dr. Saunders' directions would be distinctly alkaline. Moreover, the method is not given in the qualitative tables. The lithium hydroxide procedure of Holness (and Trewick) appears as a footnote, but the older ammonium sulphide treatment is given in the tables. The nature of the reaction involved is not indicated, and the student is left to guess the reason for the presence of potassium nitrate in the reagent. In my review, space limitations permitted only a selection of

criticisms. For Mr. Fowles' benefit here are a few more:—

(1) The test for copper and zinc (pp. 5, 16) based on the reaction with ammonium mercurithiocyanate, will almost certainly not be given with the reagents described. The copper solution should be diluted so that it does not itself give a precipitate with the ammonium mercurithiocyanate, otherwise a yellow, not violet, precipitate will be obtained.

(2) There is no mention of the elegant dithionite procedure for the separation of copper and cadmium, thus dispensing with the use of the older potassium cyanide method.

(3) Dr. Saunders recommends the use of sulphur dioxide for the reduction of arsenic to the trivalent state (p. 75) and then points out the disadvantages of the method. There are, of course, many more up-to-date and more satisfactory procedures for the reduction. At the acidity described, however, arsenic sulphide *will* be precipitated, so there is no need for the reduction.

With regard to Mr. Fowles' conjecture that I am a young reviewer disclosing a lack of knowledge of school teaching conditions, may I point out that I have had several years' experience teaching analytical chemistry to university students fresh from the Sixth Form. May I also mention that I have run special refresher courses in analytical chemistry for school science masters.

A man is entitled to his opinion as to the suitability of a book, but, just as any religion is always able to find new converts, so any book will always have its adherents.—Yours, etc.,

A. J. NUTTEN, Ph.D., A.R.I.C., C.G.M.

Trace Element Deficiencies

SIR.—We were extremely interested to read in your issue of 16 May an article on trace element deficiencies which referred to the work done at Michigan State College on fritted trace elements.

This work was in fact financed by our American associates, the Ferro Corporation, Cleveland, Ohio, and for a period extending over the past 10 years considerable experimental work and extensive field trials have established that the finely-powdered glass-like substance, known as FTE can effectively correct trace element deficiencies. There is, however, one point which we would like to

clarify. The plants are not actually grown in FTE and its application is not restricted to quartz sand culture. The material is prepared for application to soil deficient in trace elements at an average application rate of 100 lb. per acre. To achieve even dispersion it is usually mixed with the normal N-P-K fertilisers, or with sand or fine soil. It is then worked into two to three inches of top soil so it may readily come in contact with the hair roots of the plant.

We think that it may be of interest to your readers to know that we are now manufacturing FTE in this country and that extensive field trials are being undertaken this year to repeat, under British conditions, the excellent results already obtained by American farmers and horticulturists.

Yours faithfully,

W. R. TODD,

Ferro Enamels Limited.

Aluminium Production Record

WORLD production of primary aluminium in 1952 reached a record figure of 2,250,000 short tons, exceeding the peak year of 1943 by about 100,000 short tons.

Production and consumption in the United States increased, according to the

US Department of the Interior, but imports and exports declined. Prices for primary aluminium and prime aluminium products increased by about 5 per cent. A 'third round' of primary aluminium production capacity was initiated and a programme formulated for increasing the forging, extrusion and rolling capacity for aluminium products.

Despite an acute power shortage that occurred during the last four months of the year in the Pacific Northwest and the Tennessee Valley, the domestic production of primary aluminium increased by 100,000 tons over 1951 to 937,330 short tons. The maximum monthly production of 85,175 tons was reached in August. There was a record low production of 74,639 tons in November, when the power shortage was at its worst.

U.S. Domestic Sulphur

THE US domestic sulphur industry produced 471,615 long tons of native sulphur and 28,581 tons of recovered sulphur (of a purity of 97 per cent or greater) during the month of March, according to reports of producers to the Bureau of Mines, US Department of the Interior. Producers' stocks of native sulphur decreased and at the end of March stood at 3,042,952 tons.

PRODUCTION, MINE OR PLANT SHIPMENTS, APPARENT SALES, AND PRODUCERS' STOCKS OF NATIVE AND RECOVERED ELEMENTAL SULPHUR IN THE UNITED STATES, IN SPECIFIED PERIODS OF 1952-53
(in long tons)

Period	Production	Mine or plant shipments	Apparent sales	Producers' stocks
<i>Native Sulphur (Frasch)</i>				
First Quarter, 1953 :				
January	418,568	362,992	357,044	3,130,379
February	381,532	437,749	422,779	3,089,132
March	471,615	516,780	517,795	3,042,952
Total	1,271,715	1,317,521	1,297,618	3,042,952
First Quarter, 1952 :				
January	433,871	382,497	420,089	2,851,214
February	412,481	406,995	380,124	2,883,571
March	445,014	472,717	477,919	2,850,666
Total	1,291,366	1,262,209	1,278,132	2,850,666
<i>Recovered Sulphur</i>				
First Quarter, 1953 :				
January	28,239	19,998	19,542	103,359
February	25,758	18,356	15,206	113,911
March	28,581	18,806	15,476	127,016
Total	82,578	57,160	50,224	127,016
First Quarter, 1952 :				
January	18,233	7,880	7,880	79,565
February	17,907	9,253	9,031	88,441
March	19,371	9,849	9,678	98,134
Total	55,511	26,982	26,589	98,134

'At the Mercy of the State'

Directors Describe Year of Considerable Difficulty for BDH

COMMENTING on the disappointing results experienced by The British Drug Houses Limited during the trading year to 31 December 1952 the directors point out in their annual report that a large part of of company's home sales of medicinal products are paid for directly or indirectly through the National Health Service and they go on to state:—

'In these circumstances we are—like the rest of our industry—to an exceptional and peculiar degree at the mercy of the State and of the policy that may be followed by the Ministry of Health. Margins, as this year's results show, are narrow.

'If the margins are narrowed further our ability to continue our present rate of expenditure on research and development will be threatened; yet that expenditure, considerable although it is by British standards, is quite inadequate if compared with that which the large American pharmaceutical companies devote to similar ends.

'The Ministry of Health is now engaged in investigating the costs of a number of the main products being bought from our industry through the National Health Service. We appreciate the inevitability of inquiries into prices and the duty the State has to satisfy itself that it is receiving value for money. We can only hope that in the performance of that duty it will not take any narrow or short-term view of what is in the best interests of the community.'

The Outlook

Later in the report the directors state:—
'So far in the current year the company's sales have been maintained. Our prospects for 1953 depend, however, on many factors outside our control, including the trend of prices, the import and currency policies of overseas countries and the attitude of the British Government as our main customer.'

The directors' report, which has been issued in connection with the annual meeting to be held on 16 June, describes the trading year to 31 December last as one of 'considerable difficulty' for the company.

Profits dropped sharply, although the consolidated sales of the parent company fell by only about 5½ per cent. The consolidated

profit, before taxation, amounted to £347,319, which was £297,719 less than the 1951 figure. Net profits of the parent company, after allowing for taxation, came to £141,659, which was £85,658 less than the total for 1951.

The decline in sales was confined to medicinal chemicals and preparations. Sales of laboratory and industrial fine chemicals increased slightly.

Narrower Profit Margins

Sales of medicinal products dropped for the first time since the war. The period concerned was one of narrowing profit margins due to a further rise in wages and salaries and to price reductions.

Profits were further affected by the fact that, after a long period of rising prices and shortages, there was a sudden change in 1952 both in trend of prices and availability of supplies. Indeed, the prices of most of the raw materials fell sharply during the year and the fall continued into 1953. In addition—as anticipated—sales in a number of overseas markets were severely curtailed by import and currency restrictions.

The slight increase in sales of laboratory and industrial fine chemicals—products of the Poole factory—was achieved in the face of many difficulties, especially in export markets, and was accompanied, although less severely, by similar narrowings in profit margins. Consequently, despite improved sales, the profits from that side of the business also suffered a decline.

The company's overseas subsidiaries—in Australia, Canada, India, New Zealand and South Africa—achieved very much the same sales *in toto* in 1952 as in the previous year but there were considerable variations between the different companies. In particular, while sales and profits increased in Canada, trading conditions in India were adverse.

In view of the disappointing results for the year and having regard to the many uncertainties in any period of falling prices and fierce competition, the directors thought it prudent to recommend a smaller dividend than that for the previous year—10 per cent as against 12½ per cent.

Nuclear Power

Possible Application to Gas Turbines

PARTICIPANTS in a nuclear technology institute held at the University of Wisconsin last month heard Prof. Farrington Daniels describe the essentials and possibilities of a nuclear power reactor. Conducted by the UW Extension Division and the UW College of Engineering, the institute was designed to present to engineering, managerial, research, and technical personnel a summary of current developments in the possibilities of using atomic energy for constructive purposes.

'Although progress is being made,' Dr. Daniels said, 'particularly in the development of an atomic engine for a submarine, I believe that a bolder approach should be followed also, and that another line of attack should be made, emphasising a gas turbine. The gas turbines are efficient only at very high temperatures, but the atomic furnace is peculiarly suited to high temperatures. Nuclear fission is capable of operating at indefinitely high temperatures, but these temperatures are limited by the properties of the available materials of construction. Ordinary gas turbines, operated by the burning of fuel, have to be resistant to the oxygen used for chemical combustion of the fuel. An inert gas, such as nitrogen or helium, can be circulated through an atomic furnace and gas turbines using a closed cycle. Theoretically, it may be possible to find materials of construction which can go to higher temperatures than are now possible in gas turbines, providing that these materials do not have to come in contact with oxygen.'

In order to use very high temperatures, Dr. Daniels said 'it will probably be necessary to eliminate the metallic enclosures of the atomic fuel which are now used to prevent radioactive materials from leaving the atomic furnace'. This would mean that to take advantage of very high temperatures it would be necessary 'to take a calculated risk'. Contamination of the turbine must be accepted, he said, so that repairs would have to be made by remote control and the turbine would have to be capable of operating for a long time without any attention or repairs.

The contamination problem 'can be determined best by operating small pilot plants.

Furthermore, the limiting economical factor in atomic power is the frequency with which the atomic fuel must be purified through chemical operations and, again, the frequency of chemical processing can be determined best through pilot plant operation'. Dr. Daniels said it should be possible to build, without excessive cost, an experimental unit 'operating in an isolated concrete pit which could be abandoned after operating data had been obtained and the machinery had become contaminated'.

Safety Against Explosives

A DEVELOPMENT of considerable value in improving safety in working is now operating in the Ardeer explosive works of Imperial Chemical Industries, Ltd. Radioactive isotopes are being used in buildings where the more sensitive initiating explosives are being handled. These materials emit radiations which, by rising the atmosphere in the building, prevent the building-up of static electricity to which some explosives are especially sensitive.

It has been found that explosions which have occurred in similar establishments, completely without warning, despite such precautions as the wearing of rubber boots and other protective clothing, have been caused by static electricity generated in the atmosphere around work benches. The use of radio-active isotopes develops a conductor for this potential explosion danger and the static electricity is dissipated.

Export Licensing Changes

CHANGES in export licensing control were made by a Board of Trade Order which came into force on 1 June.

Goods for which licences are not now required, except for exports to China, Hong Kong, Macao or Tibet, include titanium (rutile only), antimony compounds, cadmium compounds and cadmium mass.

Licences are now required for manganese (electrolytic), but not for manganese; for carbon blacks, but not for mixtures containing carbon blacks; for hydrogen peroxide containing over 50 per cent by weight of hydrogen peroxide but not for hydrogen peroxide of 50 volumes strength.

North American Prices

US Changes Affect Canadian Costs

A NUMBER of price increases of chemicals in the United States became effective on 1 May. These increases may be reflected in Canadian prices later, reports the Toronto Purchasing Agents Association. The most prominent was a 10 per cent increase in soda ash, along with varying increases in industrial alcohol, oxalic acid, phosphoric acid, phosphates and potassium, sodium and calcium iodides.

Raw Materials Cost More

Prices of alkyd resins, ester gums, penta resins and phenolics were increased in Canada in April by most manufacturers due to higher raw material costs. During April there were three price lists issued by Canadian producers of lead carbonate, lead sulphate, red lead and litharge. These occurred on 8 April, 15 April and 21 April. Each showed a decline because of lower lead-metal prices. Canadian produced zinc oxides dropped 50 cents per cwt. on 20 April from the previous price list of 4 March. All of the above remain in good supply.

New higher prices were put into effect during the first week of May on CP iron blues, CP chrome greens, reduced chrome greens, CP toluidine reds, CP para reds and a number of other special dry colours by American dry-colour manufacturers. CP iron blues advanced three cents per pound; CP chrome greens from one cent to two cents a lb; 25 per cent reduced chrome greens from three quarters of a cent to one cent per pound; CP toluidine red 10 cents per lb. and CP para reds 10 cents a pound. American manufacturers of carbon blacks advanced prices by 10 per cent, effective from 1 May. Various iron oxides of American manufacture also rose as much as one cent per pound.

European Competition

In Canada a reduction in phosphates was announced recently in face of the American increase. This reduction was brought about by European competition. With increased freight costs and continued labour pressure, industrial chemicals in Canada may well follow the American trend soon.

New High Octane Process

AS a result of an agreement recently made between three USA concerns—the Sinclair Refining Company, Baker & Company, Inc. (manufacturers of precious metal catalysts) and the M. W. Kellogg Company (engineering-contracting subsidiary of Pullman Incorporated), the recently developed Baker platinum catalyst will be used by the M. W. Kellogg Company in a new process for the reforming of naphthas into high octane gasoline.

Known as the RD-150, the new catalyst, which was developed through co-operative research by the Sinclair Refining Company and Baker & Company, is of the regenerative type.

It is claimed to have two major advantages over existing commercial catalysts: (1) it maintains high activity over considerably longer periods of time, and (2) it has a greater ability to convert low octane paraffin components to high octane aromatic gasoline.

The new Kellogg process for employing the catalyst will be of the fixed bed type of a new design especially developed for the catalyst, which is now being produced by Baker & Company in its plant at Newark, N.J.

Chemists Golf Meeting

THE annual golf meeting of the Society of Cosmetic Chemists of Great Britain was played at Walton Heath recently.

The morning round for the Firmenich Cups was a Stapleford against bogey and was won by Mr. A. W. E. Chismon (County Perfumery Company, Ltd.), with a score of 37; runner-up was Mr. D. N. Davies (Antoine Chiris, Ltd.) with a score of 30½. The winner also received 12 golf balls and the runner-up six golf balls, given by Evans Chemicals, Ltd., and presented by Mr. T. G. C. Hendy.

The afternoon match, two-ball foursomes against bogey, was won by Mr. K. E. Woodward (Sandoz Products, Ltd.), and Dr. R. H. Marriott (County Perfumery Company, Ltd.). The winners each received an engraved calf leather wallet given by Marchon Products, Ltd., and presented on their behalf by Mr. R. H. MacIntyre.



The Chemist's Bookshelf

WEED CONTROL. By W. W. Robbins, A. S. Crafts and R. N. Raynor. Second Edition. McGraw-Hill Publishing Co., Ltd., London, 1953. Pp. x + 503. 15s. 57s. 6d.

In the decade which has elapsed since the appearance of the first edition of this book, the whole approach to the chemical control of weeds has changed. This has partly been due to the results of practical experience in the use of the classical weed-killers, but largely to the introduction of many new types, especially phenoxyacetic acid derivatives, *isopropyl phenylcarbamate* and *maleic hydrazide*. The new edition of the book fully reflects these important developments, for whereas the seven chapters dealing with introductory subjects, control by tillage and by biological methods, have in general received only minor additions and deletions, the twelve chapters dealing with chemical control have been largely re-written. The increased choice of chemical weed-killers is also responsible for many of the changes in the last five chapters on spray machinery and special weed problems.

Since the efficacy of weed-killers often depends on the method of their application, it is possible to approach the subject of chemical weed control in two ways. The substances may be grouped according to their chemical constitution, and methods of application then discussed for each. Alternatively, as in the new edition of this book, the practical importance of the different routes of entry may be emphasised by having sections discussing each of these, and then further subdividing to deal with chemical groups and individual substances. Neither method is ideal, but the authors have adopted their system of classification with the minimum of inconvenience to the reader.

The problems of weed control vary to some extent in different countries, and hence many of the weeds whose control is described by these American authors are not

of major importance here. This disadvantage is largely offset by the fact that the fundamental principles underlying the uses of herbicides are stated clearly in most cases. A related criticism is that, except for an occasional reference to *Nature* there are rather few references to publications outside the New World.

The book is well produced and bound, and is clearly and attractively printed. There are, however, rather more errors than might have been expected in a second edition; both °F. and °C. are used in the text, and in two places the rather confusing error is apparently made of using the wrong scale. The book is a most useful reference book for the agricultural chemist and the scientifically trained grower.—K. A. HASSALL.

THE TIME FOR DECISION. By Francis B. Willmott. The St. Catherine Press, Ltd., London, 1953. Pp. 202. 15s.

Mr. Willmott's faith in industry and business as a way of both individual and community life has a religious fervour. Private enterprise with sound human relations throughout each unit is his basic text. The book undeniably has high and sincere aims, which makes it all the more regrettable that it is unevenly written. Long sentences abound and too often the simple meaning of an over-complex adhesion of clauses and phrases has to be arduously extracted by the reader. By far the best part of the book is the longest chapter—it occupies more than 80 pages—'Human Relations.' However, it seems highly improbable that the author's attitude to Trade Unions would promote happy relations in very large factories. His own experience, though certainly not small, is largely of the smaller and medium-sized industrial unit, where the closeness of contact between labour and management can create internal influences of greater strength than external persuasions. But no message, however sincere, can spread very far unless it is expounded with clarity.—D.P.H.

RAYON TECHNOLOGY. Prepared by the Textile Research Department of the American Viscose Corporation. Second edition. McGraw-Hill Publishing Co., Ltd., London. 1953. Pp. vii + 344. 59s. 6d.

During the past few years ever increasing use has been made of viscose and acetate rayons, alone and in mixtures with natural and other man-made fibres. Concurrently, new machinery and processing techniques have been developed. The field of rayon technology has become so wide that it is doubtful if any one person, in a book, could deal adequately with all its ramifications. This book, each section of which is written by one or more members of the research staff of the American Viscose Corporation, is a second edition of an already well known manual. The first edition has been completely revised and two new chapters added.

The first three sections are concerned with viscose and acetate rayons on the cotton, worsted and woollen systems. Suitable types, deniers and lengths of staple fibres are given and details of blending with other fibres. Processes such as carding, drawing and spinning are considered in detail and the machinery involved is critically discussed at some length, including such details as machine settings, lubrication and humidification. A section on viscose and acetate rayons from yarn to fabric deals mainly with the more difficult aspects of handling and weaving viscose and acetate continuous filament and spun rayon fibre. A feature of this section is a survey of the principal defects in weaving and their probable causes.

A further section on standard fabric construction deals first with the choice of type of rayon for a particular fabric and then outlines the production of fabrics ranging from light georgettes to heavy blankets and tyre cord fabrics. The knitting of viscose and acetate rayons is dealt with at some length, including details of knitting machines and stitch formation. This section contains many useful photographs and diagrams.

A section on the dyeing and finishing of viscose and acetate includes outlines of methods of dyeing different viscose rayon fabrics with direct and vat dyes and acetate rayons with dispersed and soluble vat dyes. Methods of determining characteristics of dyes for rayon are also given, together with details of printing methods, crease and shrink

resistance treatments and cake, top and yarn dyeing.

The two new sections deal with industrial applications and textile chemicals. The former outlines some uses of viscose rayon and acetate in the production of asbestos yarns, bonded fabrics, flock, felt and in the reinforcement of mechanical rubber materials and paper. The textile chemicals section is a short one giving some account of lubricants, sizes, softeners and anti-static agents. Unfortunately, the only assistants cited are those of the American Viscose Corporation. This is in contrast to the rest of the book where generally not only American but also British and other processes are treated adequately. The book includes a short appendix which contains information such as the meaning of the term 'denier,' outlines of the viscose rayon and acetate processes and some characteristics of viscose rayon yarn and staple and acetate yarn.

The material in the appendix is of a rather more elementary nature than that found generally in the book which presupposes a fair knowledge of textile processing. The book is essentially a practical one and to those engaged in rayon or allied technologies it provides a good deal of up-to-date information. There are over a hundred clear diagrams and about 60 tables. It is well produced and for the amount of information it contains the price is not excessive. —W.R.M.

CELLULOSE: THE CHEMICAL THAT GROWS.
By Williams Haynes. Doubleday & Co., Inc., New York. 1953. Pp. 386. \$4.00.

Very much a 'popular' book, racy, at times too heavily facetious but always readable, this volume is worth noting for its authenticity. The author is clearly very familiar with the history of cellulose and its many derivatives, and has been especially fortunate in his personal acquaintance with many of the pioneers of the industry in America. Here and there, in his attempts to freshen some of the well-known anecdotes of chemistry, Mr. Haynes has descended to an exceedingly painful style, but the majority of the book is adequately written. Its principal value lies in the 'Cellulose Chronology' and in the appendices of production figures and physical properties; altogether it is an amusing and up-to-date work.—B.I.

Coronation Honours

Awards Made for Research

SERVICES to science and industry were recognised in the Coronation Honours List published as a supplement to *The London Gazette* on the eve of Her Majesty's Coronation, on Monday, 1 June, 1953.

LORD WOOLTON, Chancellor of the Duchy of Lancaster since 1952, and Lord President of the Council 1945 and 1951-52, becomes a Viscount, and among the Knights Bachelor is EDWARD CRISP BULLARD, director of the National Physical Laboratory, Department of Scientific and Industrial Research.

Other awards and promotions included the following:—

Knight Commander of the Bath

SIR JOHN DOUGLAS COCKCROFT, C.B.E., chairman, Defence Research Policy Committee and Scientific Adviser to the Minister of Defence; director, Atomic Energy Research Establishment.

Companions of the Bath

ROBERT COCKBURN, O.B.E., scientific adviser to the Air Ministry; ERNEST TURNER JONES, O.B.E., principal director of Scientific Research (Air), Ministry of Supply.

Commanders of the Order of the British Empire

JAMES EDGAR HURST, president, British Cast Iron Research Association; LOUIS LE COUTEUR, deputy Chief Inspector of Factories, Ministry of Labour and National Service; REGINALD BRADBURY SOUTHALL, director and general manager, National Oil Refineries, Ltd.

Officers of the Order of the British Empire

JOHN GILBEY BULLEN, general manager, Highland Reduction Works, British Aluminium Co., Ltd.; WILLIAM JOHN HUGHES BUTTERFIELD, B.M., M.R.C.P., member of the scientific staff, Medical Research Council; CHARLES STEWART CAMPBELL, director of sulphur and sulphuric acid supplies, Ministry of Materials; ERNEST FLEMING, lately chief executive officer, Agricultural Research Council; HERBERT WASHINGTON GAMBLE, lately president of the Pharmaceutical Society of Northern Ireland; JOHN CHARLES GLOVER, deputy director, Oils and Fats Division, Ministry of Food; HAROLD CHARLESWORTH GRIMSHAW, principal scientific officer, Safety in Mines Research Estab-

lishment, Ministry of Fuel and Power; GEOFFREY CHARLES LOWRY, T.D., clerk to the governors, Imperial College of Science and Technology, University of London; JOHN CUTHBERT NEEDHAM, chairman, Evershed and Vignoles, Ltd., London; CLAUDE MEYER SPIELMAN, managing director, Whessoe, Ltd., Darlington.

Members of the Order of the British Empire

EGON BENEDICT BABLER, chief of the metallurgic and general research laboratory, Allen West and Company, Ltd., Brighton; ROBERT NOEL LIGHTFOOT CLARKE, plant manager, Imperial Chemical Industries, Ltd., Alkali Division; ALEC ALFRED GREEN, senior experimental officer, Pest Infestation Laboratory, Department of Scientific and Industrial Research; WILFRED JOHN HOBBS, works manager, Drayton Regulator and Instrument Company, Ltd., West Drayton, Middlesex; GEORGE KING, senior research chemist, Albright and Wilson, Ltd., London; GEORGE TILGHMAN RICHARDS, senior research assistant, Science Museum; GEORGE ALEXANDER STEWART, assistant secretary and librarian, the Royal Society of Edinburgh; JOHN WILLIAM STRYDOM, cashier, The Vacuum Oil Company, Ltd., Coryton Refinery (for services during the recent floods in the Eastern counties); JOHN SEYMOUR THOMPSON, chief metallurgist and production manager, Durham Chemicals, Ltd., Birtley; CHARLES THOMAS WEBSTER, senior experimental officer, Joint Fire Research Organisation, Department of Scientific and Industrial Research; FRANK BAXTER WILSON, technical adviser, Guest, Keen and Nettlefolds (Midlands), Ltd., Darlston.

New Celanese Process

LARGE-SCALE production of both propionic acid and butyric acid for sale to general industry has been started by Celanese Corporation of America, according to an announcement by Mr. Richard W. Kix Miller, general manager of the Chemical Division of the company.

Celanese production of these chemicals is the result of an entirely new process developed by the Chemical Division's research laboratories. The process involves a one-step oxidation of natural gas components to acetic, propionic and butyric acids and other chemicals yet to be announced, and is the first of its kind.

HOME

Fertiliser Society Meeting

The next meeting of The Fertiliser Society will consist of a visit to the Research Station of Imperial Chemical Industries, Ltd., at Jealott's Hill, Bracknell, Berks, on Thursday, 25 June, at the invitation of the director, Dr. A. H. Lewis, F.R.I.C. The programme will occupy the whole day and will include a tour of the field experiments as well as the annual general meeting of the Society. Guests will be welcome if introduced by a member.

Training Young Chemists

A training scheme for young chemists in the electricity supply industry has been prepared by the National Joint Council for the industry. Trainees will be selected from suitable persons employed in a power station laboratory or recruited direct from school between the ages of 16 and 18. Particulars are given in the May issue of the *Ministry of Labour Gazette*, or may be obtained on application to the National Joint Council, c/o British Electricity Authority, Winsley Street, London, W.1.

Sir John Cass Prospectus

The prospectus for the 1953-54 session of the Sir John Cass College, Jewry Street, Aldgate, London, E.C.3, has just been issued and contains details of full-time and part-time courses for students in chemistry. The first term of the new session begins on 28 September. Subjects covered in evening courses of lectures with practical work are microchemical analysis, radiochemical analysis, spectrochemical analysis, absorption spectroscopy and microbiology. There will also be an evening course of lectures on the theory and practice of distillation.

The Work of Sir William Ramsay

Present-day aspects of the work of Sir William Ramsay were commemorated at a meeting which the Chemical Society—of which Sir William was president in 1907-09—held in their rooms at Burlington House, Piccadilly, on Thursday. Contributions were made by J. S. Anderson, F. A. Paneth, H. G. Jenkins, L. C. Bannister and H. J. Taylor.

New Heriot-Watt College Laboratories

As part of an extension scheme for the Heriot-Watt College, Edinburgh, costing £350,000, additional laboratories will be provided for physics and applied physics, organic and physical chemistry, and chemical engineering. Work on the foundations of the new building is now complete.

First 'Platformer' in UK

The first 'platformer' unit ever to be erected in the United Kingdom is now under construction at the Stanlow oil refinery of the Shell Petroleum Company near Ellesmere Port, Cheshire. Estimated to cost £3,500,000 it is scheduled for completion by the end of this year. The unit is called a 'platformer' because it uses a platinum catalyst to reform low-grade petrol into high-grade petrol.

New Printing Ink Factory

A. B. Fleming & Company Ltd., printing ink manufacturers, have acquired a new factory at Corstorphine on the main Glasgow Road. A modern single storey building of 40,000 sq. ft., it includes office and staff accommodation. Production of high grade letterpress and lithographic inks, at present concentrated at the Granton factory, will be transferred to the new factory by stages. The company's main research laboratories will be at Granton.

Testing Works

Premises now being erected in Scotland Street, Sheffield, will house Yorkshire Testing Works Ltd., and Beecroft & Partners (Metallurgists) Ltd., subsidiaries of J. & J. Dyson Ltd., refractories manufacturers, Stannington, Sheffield. Testing and analyses will be carried out on ferrous and non-ferrous metals and ceramic materials.

Saw Coronation Procession

The Coronation decorations of Dunlop's headquarters in St. James's Street, floodlit during June, are on the lines of the draped stands from which spectators once watched knights unhorse one another in the jousting lists at St. James's Palace nearby. One hundred Dunlop employees from England, Scotland and Wales saw the Coronation procession at eye level as the company's guests.

OVERSEAS

Norwegian Niobium Mine

Extraction of ore containing niobium is expected to start next month at Sove, near Ulefoss, S. Norway. The Sove mine, constructed by the Norwegian Government mining company, Norsk Bergverk A/S, at a cost of £100,000, will operate on a trial basis until July, when full production will be started. It is hoped then to extract about 40,000 tons of raw ore a year, containing an average of 0.3 per cent niobium.

USA Rubber Consumption Down

Estimated new rubber consumption in the USA during April was slightly lower than the all-time record of March, according to the Rubber Manufacturers' Association. Total new rubber consumed amounted to 126,406 long tons, of which 48,993 tons were natural and 77,413 synthetic, including 61,969 tons of GR-S (Government Rubber-Styrene).

Lead & Zinc Problem

Considerable worry to the proprietors of lead and zinc mines in Western Germany has been caused by declining prices. Zinc production in 1952 increased only slightly to a total of 140,000 tons, while lead production decreased from 147,200 tons to 128,600 tons. A reduction in orders is said to have followed the opening of the London zinc and lead market. Many metal ore mining companies have been forced to sell below production costs for some time. Producers are hoping to find some solution to their difficulties through negotiations with the Federal Ministry of Economics.

Football Pool Helps Science

From the profits made last year by the Norwegian State Football Pool, £700,000 has been allocated to scientific research. The Atomic Energy Institute is to receive £31,500, the Central Institute for Industrial Research £125,000, the Technical and Agricultural Research Councils £29,250 for special purchases of scientific instruments, the Marine-Biological Station at Bergen £12,500 for a research vessel. The three Councils for technical, agricultural, and general research are to receive grants totalling almost £500,000 to finance a great variety of research projects.

Monsanto Expansion

Expansion of phenolic resin production at the Port Plastics (US) plant of Monsanto Chemical Co. is to begin immediately and is expected to increase output by 30 per cent.

5,500,000 Dollar Expenditure

Goodyear Tyre and Rubber Co. is to spend \$4,000,000 on a plant at Niagara Falls to produce vinyl plastic resins, antioxidants and accelerators, and \$1,500,000 to enlarge the 'Chemigum' plant at Akron.

India and Atomic Energy

The Indian Government has announced new controls over five substances used to produce atomic energy—radium, zirconium, graphite, lithium and deuterium.

Icelandic Fertiliser Factory

Iceland has been granted a loan by the International Bank for Reconstruction and Development to help finance the construction of a nitrogen fertiliser factory. At full capacity the plant will produce about 18,000 tons of ammonium nitrate a year—sufficient to meet the country's needs. This amount is well above current consumption, but the use of fertilisers is expected to increase. In the meantime the surplus will be exported.

New Zealand Atomic Plant

The construction of a £5,000,000 combined plant to produce electricity and heavy water by using geothermal steam in the Wairakei area of North Island has been approved in principle by the New Zealand Government. Announcing this, the Minister of Works, Mr. W. S. Goosman, said Government departments would work in co-operation with the British atomic establishment at Harwell.

Daggafontein Uranium Plant

A big uranium plant at Daggafontein Mines, on the Eastern Rand in the Transvaal, was officially started up on 22 May by Sir Ernest Oppenheimer, chairman of the Anglo American Corporation of South Africa, in which group the Daggafontein company comes. He said the South African gold-mining industry has now become the largest source of the world's two most precious metals—gold and uranium.

PERSONAL

LORD BAILLIEU, chairman of the Central Mining and Investment Corporation and of Dunlop, has been elected an honorary member of the Institution of Mining and Metallurgy in recognition of his services to the mining and metallurgical industries and of his work as chairman of the Empire Council of Mining and Metallurgical Institutions.

MR. R. C. WORSTER, who has been a member of the research staff of the British Hydromechanics Research Association since it was formed, has now been appointed Deputy Director of Research.

MR. E. H. SULLIVAN has resigned his appointment as advertising manager to Fisons Limited in order to join The D. Brook-Hart Company, of 48 Dover Street, London, W.1, as chief executive. After war service in the Royal Armoured Corps from 1939 to 1946, Mr. Sullivan joined John I. Thornycroft & Co., Ltd., where he was responsible for all technical publicity. He left to become deputy director of public relations to Petrochemicals, Ltd., and the Manchester Oil Refinery group of companies, where he worked in close co-operation with Mr. D. Brook-Hart, who was then directing all publicity matters for those companies. From there he went to Fisons.

The Council of the Textile Institute has elected as hon. secretary MR. JOHN BOULTON, F.T.I., chairman of the Institute's Conference Committee and of its International Relations Committee and a member of Council since 1947. Mr. Boulton, a graduate of Manchester University and a Fellow of the Royal Institute of Chemistry, holds the Gold Medal of the Worshipful Company of Dyers. He is a member of the Council of the Society of Dyers and Colourists. Research manager of the Droylesden (Manchester) laboratories of Courtaulds, Ltd., he is a member of a number of other important committees connected with the textile industry. Re-elected hon. treasurer of the Institute is MR. R. J. SMITH, F.T.I., who has held the position since 1946.

MR. ALBERT MITCHELL, general manager and secretary of the Bede Metal and Chemical Company, has been appointed a director of the company.

MR. P. T. BLISS has been appointed sales director of G. A. Harvey & Co., Ltd., Greenwich Metal Works, London, S.E.7. Mr. Bliss, who is a member of the Incorporated Sales Managers' Association, and the Incorporated Advertising Managers' Association, joined the company in 1909, and has been sales manager for a number of years.

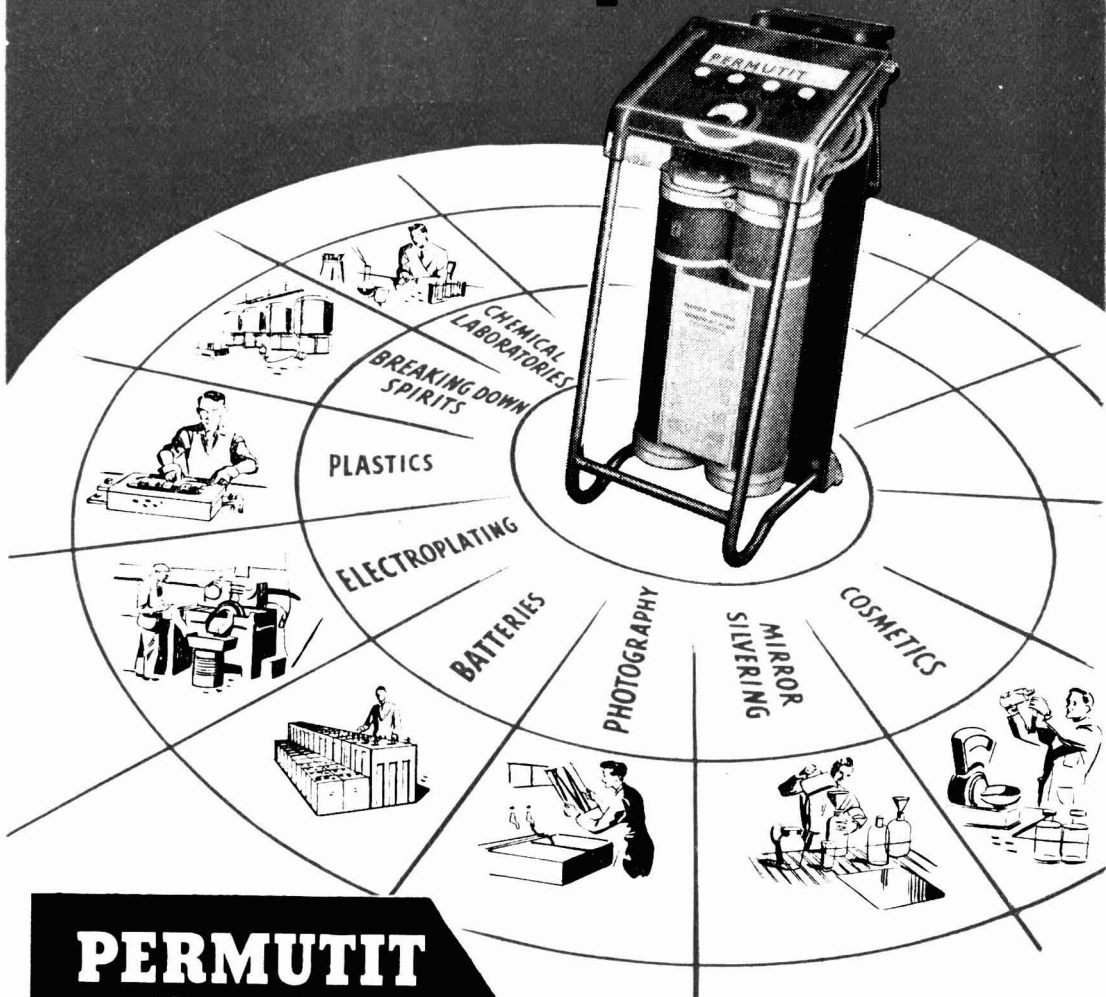
MR. DUNCAN R. LEITCH (Ratsouris Limited) has been elected president of the Industrial Pest Control Association for 1953-54 with MR. K. F. GOODWIN-BAILEY (Cooper MacDougall & Robertson Ltd.) as vice-president. Other elections are: Hon. treasurer, MR. S. F. SPRANGE (The London Fumigation Company, Ltd.); hon. auditors, MR. S. BREMER (The Ideal Insecticide Company) and MR. R. A. H. FREEMANTLE (Stemco Ltd.); executive committee, MR. D. J. S. HART (May & Baker Ltd.); DR. N. E. HICKIN (Rentokil Limited); MR. A. FRASER MCINTOSH (Thomas Harley Ltd.); MR. I. A. MACKAY (Imperial Chemical Industries Ltd.); MR. G. POLLARD (Petrochemicals Limited); MR. S. W. HEDGCOCK (Chelsea Insecticides Ltd.—*ex-officio*). The secretary is MR. W. A. WILLIAMS, M.B.E., B.Sc., 166 Piccadilly, W.1.

Obituary

Mr. J. W. McLaughlin

MR. JAMES W. McLAUGHLIN, vice-president of the Union Carbide and Carbon Corporation of New York, whose death has occurred at the age of 62, was also chairman of Bakelite Company and Bakelite Company (Canada) Ltd.; vice-president of Carbide and Carbon Chemicals Company; and president and director of Carbide and Carbon Chemicals Company, Ltd.—all associated with the Union Carbide and Carbon Corporation.

Do you want 5-50 Gallons of Distilled Water per DAY ?



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Here is the modern equivalent of distilled water, produced by 'Deminrolit' at a fraction of the cost of distillation. No heat or steam required. Operated by ion exchange, producing water free from dissolved solids.

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Publications & Announcements

CONTINUING its efforts to achieve uniformity of warning label regulations for hazardous chemicals in the USA, the Manufacturing Chemists' Association has issued a new revised edition of its 'Manual L-1: Warning Labels.' The new edition sets forth the principles of proper warning label preparation and includes illustrative labels for some 250 industrial and agricultural chemicals. It also covers labels and new products for investigational use. Most of the suggested labels present information beyond that required by Federal statutes. They are intended for use in addition to or in combination with any labels required by law. Copies of the 98-page booklet are available from the Manufacturing Chemists' Association, Inc., 246 Woodward Building, Washington 5, D.C. Price \$1.00.

* * *

FACED with making a preliminary capital cost estimate for a new unit process plant or an extension to an existing installation, the engineer or designer seldom has sufficient costing material on which to base his figures and has often to turn to American data. It is, however, difficult to know what conversion factor should be used to translate the sums to British practice. British chemical and chemical plant manufacturers are being circularised by Mactaggart and Evans Ltd., Sondes Place Research Institute, Dorking, Surrey, with the object of ascertaining whether sufficient support is likely to be forthcoming for a scheme whereby current prices of plant are collected by the firm, analysed and tabulated and then either circulated to subscribers in the form of a monthly bulletin or held available against specific enquiries.

* * *

NEW entries in the BDH catalogue for May are 1-fluoro-2,4-dinitrobenzene, a useful intermediate in the synthesis of amino- and alcoholic derivatives; 2-methyl- and 4-methyl-resorcinol; N-acetyl-tryptophane; and two redox indicators, methyl viologen ($E'_{0.1}$ at pH 7.0 and $30^\circ = -0.440$ volts) and sodium diphenylamine sulphonate ($E'_{0.1} = 0.845$ volts). 4-Amino-azobenzene-4'-sulphonic acid is restored to stock.

ONE of the outstanding trends in post-war engineering in Great Britain has been the development of heavy industry devoted to the production of fabricated equipment for oil refineries and the associated chemical industry. This development was foreseen by G. A. Harvey and Company (London) Ltd., Woolwich Road, S.E.7, and they built a large new fusion-welding shop to deal with this class of work. The company's recently issued List No. 880 reviews the plant and layout of the new shop, refers briefly to the older heavy plate shop, and concludes with a section dealing with recent developments in the manufacture and design of pressure vessels and other plant.

* * *

NEW equipment designed for transporting wooden barrels, casks and hooped drums often awkward to handle with trucks of conventional pattern is described and illustrated in List NR.1 issued by Powell and Company, Cambrian Works, Station Road, Barry, S. Wales. The new truck, known as the 'Non-roll' barrel truck, is available in several models. It has two specially reinforced forks or prongs which will slide under the ends of the barrel or drum. Since the forks may be pushed well under, the truck is easily tipped backward, so lifting the barrel from the ground and cradling it in a perfectly balanced position between the wheels and enabling it to be moved with little effort.

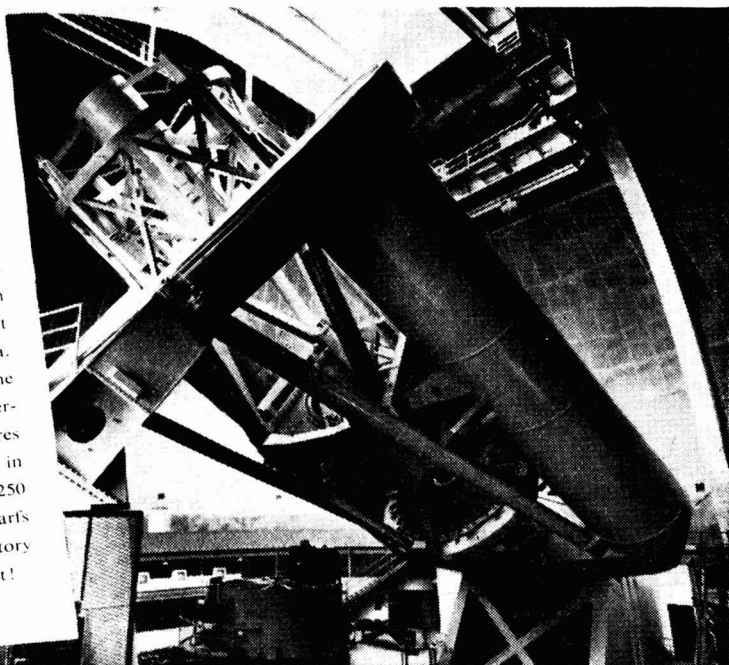
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CONTENTS of the latest issue of the Transactions of the Institution of Chemical Engineers—Vol. 30, No. 4, 1952—are an appreciation of the late Mr. L. O. Newton, hon. secretary, 1945-52; papers on 'Pneumatic Conveying' by D. E. Charles, R. H. Clark, D. M. Newitt and J. F. Richardson, 'Some Aspects of the Handling of Phosphorus' by H. D. Anderson, 'Elimination of Carry-over from Packed Towers' by H. Chilton, 'The Vulcanisation of Thick Sheets of Rubber' by E. C. B. Bott, 'The Use of Sulphuric Acid in a Totally Enclosed Reaction System' by J. L. Edgar, and 'Higher Technological Education' by the Rt. Hon. The Earl of Salisbury; the subject and author index for Vol. 30; and the quarterly bulletin No. 112.

A GREAT RANGE

In Astronomy it's Mount Palomar of California

Scientific advances yet undreamed of are expected from the new 200 inch telescope at Mount Palomar, California. Largest of its kind in the world, this giant aid to interstellar exploration measures 55 feet in length, 20 feet in diameter and weighs 250 tons. No wonder it dwarfs members of the observatory staff who stand beside it!

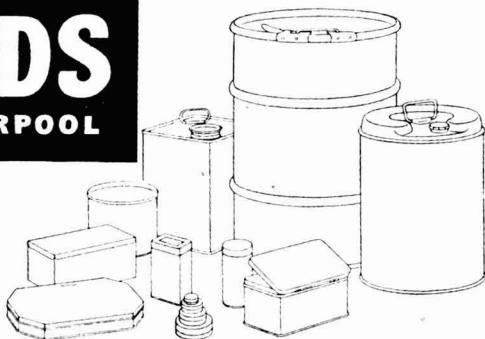


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Famous in their own field for over 80 years, Reads of Liverpool have developed a standard range of containers so extensive that it comprises nearly every type now in common use. And this range is constantly increasing as new designs, new finishes, new methods of closure are added. If you have a problem connected with containers, our design and research staff is at your service—quite without obligation.

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Company News

Changes of Name

The following changes of name have been announced:

Vermin Control Ltd., to Totem Chemicals Ltd., on 21 April, 1953. Emblem Laboratories Ltd., to William Edge & Sons Ltd., on 31 March, 1953.

Greeff-Chemical Holdings

A final ordinary dividend of $11\frac{1}{2}$ per cent, plus a bonus of $2\frac{1}{2}$ per cent, is recommended by Greeff-Chemical Holdings. This makes a total of $17\frac{1}{2}$ per cent, less tax, for the year ended 31 December, 1952, as against 20 per cent, less tax, for the previous year.

Swedish Match Company

Net profit of Kr. 10,800,000 for the year ended 31 December, 1952 is announced by the Swedish Match Company. This is after allowing for taxes and compares with Kr. 11,600,000 for 1951. An unchanged dividend of Kr.2 per share (or 4 per cent) is recommended by the board.

F. W. Berk & Co. Ltd.

After achieving exceptional results in 1951, F. W. Berk & Company Ltd. experienced a setback in 1952. In an address issued in advance of the annual meeting on 15 June the chairman, Mr. A. D. Berk, states that conditions became increasingly difficult as the year progressed. Although turnover fell by only 25 per cent, costs rose throughout the period, while profit margins decreased and inevitable stock losses were incurred. Group profits, before charging taxation, were £139,988, as against the exceptional figure of £555,213 for 1951, and £278,408 for 1950. The current year showed a more regular pattern, but competition was very keen; the directors hoped for improved results, which should be helped by new projects in hand, but cautioned shareholders against undue optimism in view of the continuing rise in the cost of labour, raw materials and services and the excessive burden of indirect taxation. Because of their confidence in the future of the company, however, the directors recommended that the final dividend be maintained at $2\frac{1}{2}$ d. per share, making $4\frac{1}{2}$ d. per share for the year.

Stevenson & Howell Ltd.

A final dividend of 13 per cent for the year ended 31 December, 1952, is being paid by Stevenson & Howell, Ltd., making a total for the year of 22 per cent compared with 29 per cent in the previous year. Trading profit was £82,107 compared with £155,558 in 1951.

W. J. Bush & Co. Ltd.

Consolidated profit of W. J. Bush & Co. Ltd., for the year ended 31 December, 1952, at £504,787 was £316,257 less than the previous 12 months. After deductions for interest £22,467 (nil), depreciation £113,049 (£104,566), taxation £208,876 (£411,756), net profit was £196,395 (£340,722). Annual dividend 10 per cent (same). In his statement Mr. P. C. C. Isherwood, the chairman, states that turnover for the first quarter of 1953 was lower than for the corresponding period of 1952, but indications were that there was a trend to improved conditions.

Laporte Industries Ltd.

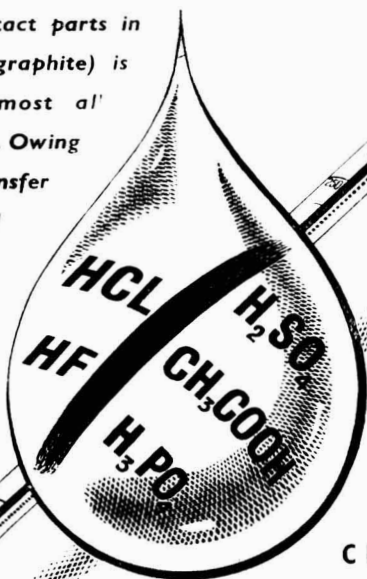
Group trading profit of Laporte Industries, Ltd., for the year ended 31 March, 1953, was £352,646 (£825,295). After adding an exceptional credit, as in 1952, and setting aside for tax only £212,015 as against £427,188 in the previous year, the net profit at £317,666 shows a decrease of £142,948. A final dividend is recommended of $9\frac{1}{4}$ per cent making $12\frac{1}{2}$ per cent (same) for the year. The final is payable on £14,750 more capital at £1,486,950. The group was reorganised in March, when the company became a holding concern and changed its name from Laporte Chemicals Ltd. The meeting will be held in London on 9 July.

New Factory at Haifa

Following the establishment of a new factory at Haifa by Electro Chlorine Chemical Industries, Israel's output of sodium chloride will be increased by 800 tons a year. This will relieve the current drain on foreign currency reserves to meet the requirements of the local textile and paper industries.

do you HEAT ←

The Powell Duffryn cubic heat exchanger (constructed with all contact parts in Delanium carbon and graphite) is designed to handle almost all industrial corrosive liquors. Owing to its very superior heat transfer performance, combined with flexibility, compactness and robustness, it is being used increasingly in such unit processes as...



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In the U.S.A. — Delanium Carbon Corporation

Market Reports

LONDON.—There have been no important changes in industrial chemicals, and business has been quiet during the short week following the Coronation holiday. Movements to the home consuming industries are expected to return quickly to full scale, and the volume of inquiry for export now in circulation is reasonably good despite keen competition from foreign producers.

The chemical compounds of lead are slightly firmer and there is a good seasonal demand for tartaric acid. There has been no feature in the coal-tar products market.

MANCHESTER.—Business in most descriptions of chemicals on the Manchester market during the past week, largely in consequence of the Coronation, has continued on relatively quiet lines and only moderate new bookings have been reported on both home and export accounts. The by-products section has similarly been affected. In the fertiliser market one or two products are still moving into consumption in fair quantities, but for the most part the usual

seasonal contraction in business is becoming increasingly in evidence.

GLASGOW.—The volume of business from the paint, rubber and textile trades has maintained an upward trend and this, combined with the continued demand for the usual wide range of agricultural chemicals, has kept merchants and manufacturers in some instances extremely busy.

Chemical Price Changes

The price of dark chemical quality lactic acid, 44 per cent by weight, is now £109 per ton, ex-works, in 1-ton lots, usual container terms. Magnesium carbonate, light, commercial d/d, is now £92 per ton, cwt. lots, and £84 10s. per ton d/d in 2-ton lots.

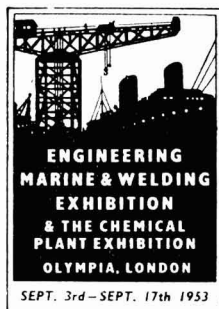
USA Insecticides for Turkey

From Istanbul it is reported that the USA Office of Mutual Security has opened a credit of \$600,000 for Turkey for the purchase of insecticides in the USA.

ACID-RESISTING METALS

for use in pickling tanks

Meldrums manufacture any item to meet individual requirements. Sample pieces and test reports verifying the outstanding resistant properties against corrosive attack by hot or cold acids are available on request.



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features : **ECONOMY
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ADAPTABILITY**

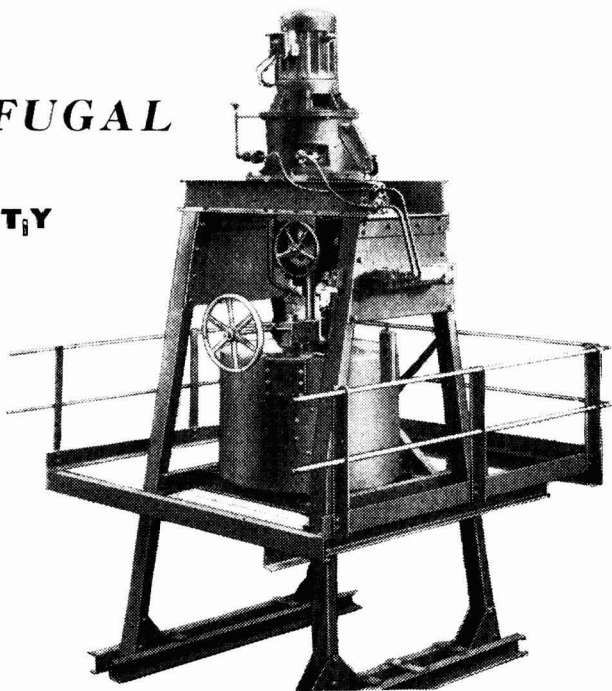
A "Vulcan-Sinclair" scoop tube controlled type hydraulic coupling is interposed between electric motor and centrifugal spindle, giving these advantages :

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

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

One handwheel controls acceleration, speed variation and braking.

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



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ORTHOTOLUIDINE
PARA FORMALDEHYDE
FORMAMIDE
ADIPIC ACID

BLANC FIXE
ANHYD. SOD. SULPHATE
POTASSIUM CHLORATE
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CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

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

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

GRADUATE CHEMICAL ENGINEER required by leading manufacturers of instrumentation and automatic controls, to be responsible for chemical plant sales. Experience of chemical or petroleum plants and an aptitude for developing projects and outside contacts, an advantage. Good prospects and salary. Pension Scheme on establishment. Write details to **ELECTROFLO METERS CO., LTD., ABBEY ROAD, LONDON, N.W.10**

**NORTHERN GAS BOARD
WORKS MANAGER, TAR AND BENZOLE WORKS AT
NEWCASTLE UPON TYNE**

APPLICATIONS are invited for the above position. The selected candidate will be responsible for the operation and upkeep of plant at present distilling about 45,000 tons tar and refining approximately 750,000 gallons of benzole per year, and for the control of labour employed.

Experience, qualifications, age and present employer, should be stated and reference given by applicants.

Commencing salary not less than £1,000 per annum. A satisfactory report by the Medical Officer to the Board and participation in the Area Board's Superannuation Scheme will be conditions of engagement.

Applications to be sent to **THE SECRETARY, 30, GRAINGER STREET, NEWCASTLE UPON TYNE, 1,** not later than June 30, 1953.

PHYSICAL CHEMIST required by Ministry of Supply Research Establishment, near Sevenoaks, Kent. Qualifications: Minimum of Higher School Certificate (Science) or equivalent, but Degree or H.N.C. in Chemistry may be an advantage. Experience in Rheology, preferably with plastic and highly viscous dispersions, desirable. Salary within range, **EXPERIMENTAL OFFICER** (min. age 26), £649-£799, or, **ASSISTANT E.O.**, £264 (age 18)-£576. Women somewhat less. Post unestablished. Application forms from **M.L.N.S., TECHNICAL & SCIENTIFIC REGISTER (K), 26, KING STREET, LONDON, S.W.1,** quoting F.246/53A. Closing date 4 July, 1953.

SALES AND TECHNICAL REPRESENTATIVE required in Chemicals by old-established Glasgow Company. State full particulars and qualifications; preference given to man with sound connection and certificated qualifications. Good commencing salary and sound prospects for progressive individual. Pension Scheme. Apply **BOX No. C.A. 3227, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

BUSINESS OPPORTUNITY

AN EXCEPTIONAL OPPORTUNITY. For disposal through client's ill-health, the whole of the Issued Share Capital in young Company recently making highest-class English Graded Hard Wood Charcoal. There are no debentures or charges on the Company, but considerable trading losses are available for taxation purposes. Large stocks of wood are assured and complete plant includes Steel Kilns, Graders, etc. **BOX No. C.A. 3223, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

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

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

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MIXERS

ALL types of **MIXERS** made to requirements—Horizontal, or Vertical, Jacketed or Unjacketed. **"MORWARD"** **"U"**-**SHAPED TROUGH MIXERS,** in any size up to 3 tons.

TROUGH MIXER by **CHALMERS,** 3 cwt., stainless steel tilting trough; motorised.

TWO TROUGH MIXERS by **GARDNER,** 3 cwt., stainless steel lined troughs; one motorised; one fast and loose pulley.

ONE 350g. Homogeneous Lead-lined **JACKETED PAN** with lead-lined anchor-type stirring gear. Arranged fast and loose pulley drive.

ONE CHANGE PAN MIXING UNIT with stainless steel agitators; fast and loose pulley.

HYDRO EXTRACTORS

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

LEAD-LINED VESSELS

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

PUMPS

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

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**MORTON, SON AND WARD LIMITED,
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FOR SALE

FOR SALE

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

1—Baker Perkins MIXER as above, not steam jacketed, single geared, complete with 25 h.p. A.C. motor.

3—Baker Perkins and Werner Jacketed MIXERS screw tipping pattern, friction pulley drive, single geared, with double-fin type agitators.

4—Gardner RAPID SIFTER MIXERS and MIXERS only, various sizes, one with brass fitted interior and glass-lined end plates.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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DRYING PLANT

ROTARY DRUM DRIER by BUELL, 24 ft. 6 in. by 4 ft. 3 in. diam., on two roller rings, driven through girth wheel and pinion. Arranged for solid fuel firing with brick-lined furnace box. Complete with ducting, Buell high efficiency cyclone and rotary air-lock discharger. Certain spares available.

ROTARY DRYING INSTALLATION by DUNFORD & ELLIOTT, comprising approximately 23 ft. centres, totally enclosed inclined continuous 8 in. BUCKET ELEVATOR, with feed boot and discharge chute driven by 1½ h.p. motor, 940 r.p.m. ROTARY LOUVRE DRIER, 21 ft. 6 in. long by 3 ft. 11 in. diam., with feed hopper and discharge chute, driven through girth gear and pinion by 5 h.p. motor with reduction gear, two oil burners and small blower, Sturtevant hot-air fan with 4 h.p. driving motor, exhaust fan with belt drive and motor. Electrical gear for 400/3/50.

COMBINED ROTARY LOUVRE ROASTER AND COOLER by DUNFORD & ELLIOTT. Roaster section approximately 22 ft. long by 3 ft. 10 in. diam., and Cooling section 8 ft. long, running on two roller paths; drive to electric motor through reduction gear to spur driving gear. Complete with Towns Gas-fired combustion chamber, lined firebrick, roaster inlet fan, roaster exhaust fan, cooler exhaust fan, dry and wet cyclone collector, ducting, all electrical equipment and control panel.

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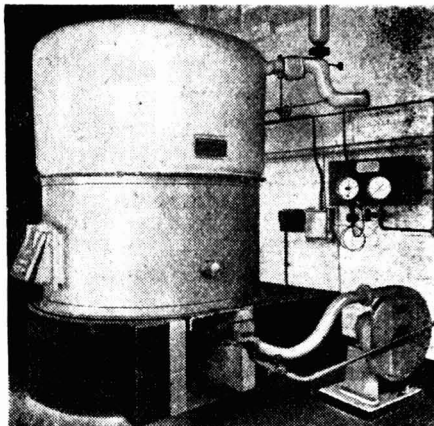
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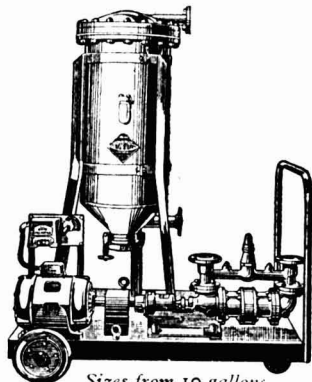
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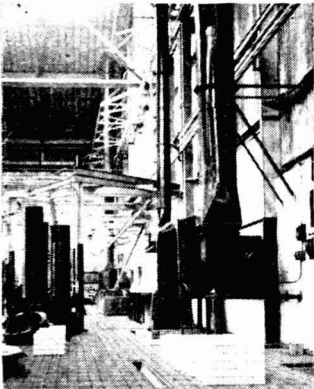
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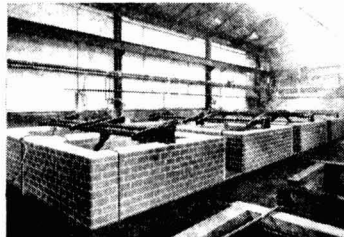
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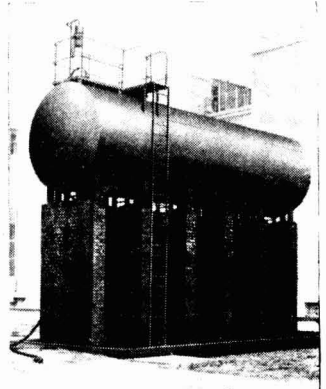
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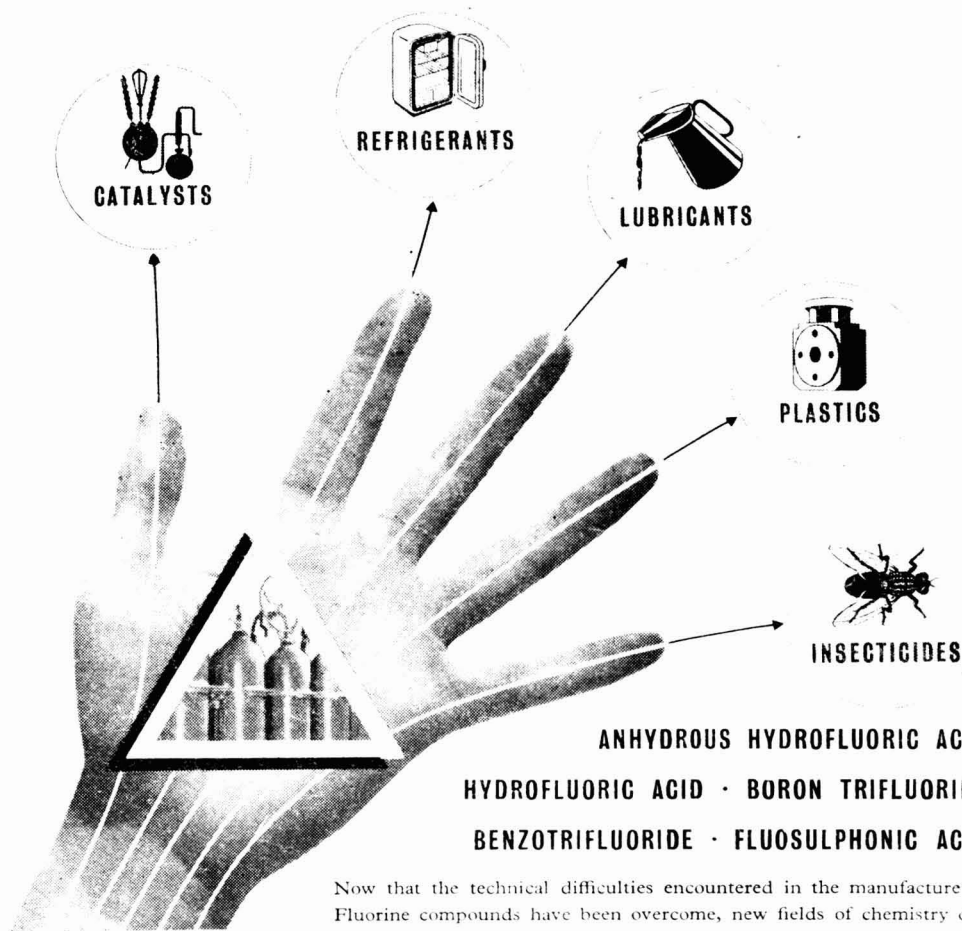
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