THE Chemical Age

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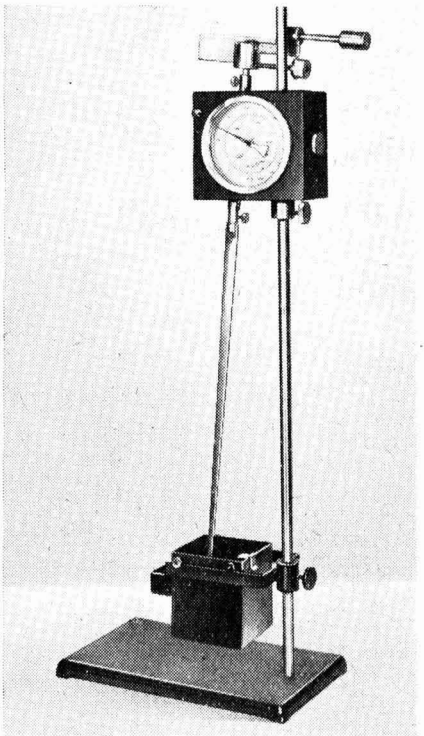

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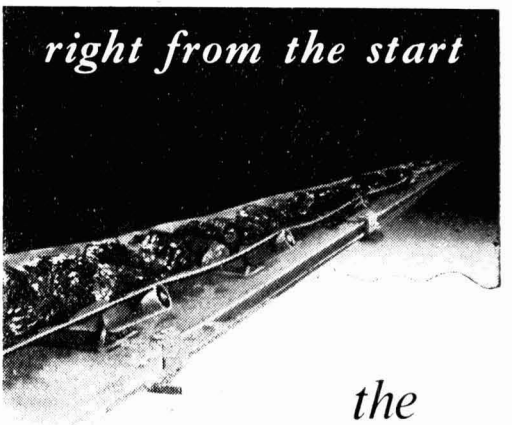

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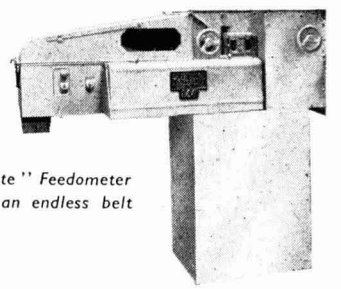

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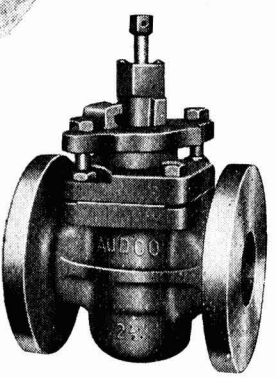

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Public Relations

IN recent issues we drew topical attention to the first Chemical Progress Week at that time being sponsored by the US Manufacturing Chemists' Association (see THE CHEMICAL AGE, 1954, **70,** 1161; 1186). Our comments were necessarily in anticipation of events, but by now we have received some news, direct and indirect, about this open experiment in courting public opinion. Notably there arrived a bulky advance-release of news from just one centre, the State of Maryland. The accompanying note said: 'We believe the information that has been pulled together for Chemical Progress Week in Maryland may be worthwhile for your reference use. Therefore, we will be sending you all releases prepared for Maryland newspapers.' Here, indeed, was faith in publicity for Fleet Street, London, E.C.4 is, by rough and hasty calculation, appreciably more than 3,000 miles distant from the nearest city in Maryland. To include foreign addresses, even those of editorial offices, in the mailing list of a project whose primary target is local American citizenhood is a commendable casting of bread upon the waters.

Operations in publicity are essentially subjective. The outlook of the trained chemist is inevitably objective. This antithesis more than any other influence may well explain why the chemical industry has been slower than others in seeking and stimulating public understanding. Quoting from a Chemical Progress Week preview article in *Chemical Week*: 'The average American knows all about oil, about steel, about aluminium; but the more complex and less obvious achievements of the chemical industry have not been seen in perspective.' However, it is never an American characteristic to remain aloof or retreat into oases of objectivity, and it was a reasonable assumption that the chemists of the US industry would not be prudishly hesitant in giving full-hearted support to the multiplicity of local programmes arranged 'to acquaint Americans with the way in which the science of chemistry is helping them to build an increasingly better society.' Works managers and plant managers are reported to have carried the brunt of the work in most areas. 'They must have been just itching for a chance to talk about just how much chemistry affects the daily life of everyone. . . .'

Far removed from the excitement and fresh impact of America's Chemical Progress Week, we can without unkindness apply a discounting process to early and enthusiastic reporting from the chemical industry itself. But even the heaviest discounting still leaves behind a solid residue of eagerness that is itself an objective fact. The demand for publicity material of all kinds, expressed through the various local committees and sub-groups and even in the smallest of centres, staggered MCA headquarters. The desire to take part in committee or sub-committee work was so widespread that the main problem was not in obtaining volunteers but in sorting out responsibilities so that confusion and broth-spoilage was avoided.

Here is clear-cut demonstration that those who work in the industry have long been conscious that the industry's importance is under-appreciated by the rest of the community; and some evidence, too, that this is felt more deeply by works staff than by chemists in laboratories, research, and other branches. Vanity this may be, but human nature in the twentieth century has not improved so fast that its weaknesses can be loftily ignored. Wage-packets and isolated self-respect are not quite enough; the respect of other people for the real value of work done is a third ingredient of indus-

trial contentment. Admittedly these are direct deductions from the American scene and Americans represent a younger industrial nation. Industrial achievement in America wins admiration more easily than in our older world; a sense of under-appreciation will therefore penetrate farther below the skin and perhaps more malignantly. But this does not mean that similar sensitivity is non-existent in Britain.

Here, possibly, an equivalent campaign of showmanship would run greater risk of ridicule, for British reactions are more complex. Buses, hoardings, shops, and banks were liberally adorned with Progress Week posters. In many areas there were quiz and essay contests. Conferences, public meetings, works tours, display-exhibitions in well-known local stores, TV programmes, all these methods of 'going to the public' were vigorously employed. In one area thousands of souvenir buttons were issued to children. With all this effort time-tabled for the same week, the lowest-level reaction of the man or woman in the street was curiosity. The same simple token welded all the local efforts into unison, a retort-shaped picture containing the words 'Chemistry Makes It Better'. The band-wagon might need to be decked with rather more restraint here, but that is only the reflection of regional difference; in the United States each local area was left to plan its own programme to suit the taste of its own population.

The initial 'fact sheet' issued by the Chemical Progress Week Committee for the State of Maryland and for use 'by writers, speakers, and others' provided an abundance of information about the industry *in Maryland,* wasting no effort in providing information about the US industry as a whole. It pointed out that one out of every 22 people employed in Baltimore's factories worked in a chemical plant; that the high investment per worker needed in the industry meant that chemical factories were large purchasers of materials and services, e.g. Baltimore's chemical factories were consuming in 1954 three and one-third times as much electric power as in 1944. The types of chemical manufacture were classified, the total sums spent on new plant since the war were given, the *per capita* consumption, direct and indirect, of chemicals in Maryland was calculated. The history of Maryland's chemical industry was outlined. Educational facilities available in the State for chemistry were listed and described. Works safety progress was stressed—e.g. 'one Baltimore company won 35 awards in a single year from four national safety organisations . . . employees at work in chemical plants are actually safer than at home.' Research and development, as exemplified by entirely new products now being made in Maryland chemical factories, laid the final emphasis. Together this formed a basic issue of factual information for the press, an operation in publicity that might seem obvious enough, but one that is rarely attempted by the industry on a local basis. In Britain it is more often than not the provincial morning or evening newspaper that tries to foster local interest in local industry, and journalists are obliged to ferret out their own information; the chemical industry being more complex than most, its contributions are either under-described or presented with high risk of error. If all the major States issued fact sheets of the same quality and informative value as that which was issued in Maryland, at least one beneficial effect of Chemical Progress Week will be lastingly felt in America.

In praising this notable venture of the US industry, we do not seek to imply that an identical venture should be embarked upon by the British industry. The one-week 'punch' technique might well be less fruitful here than a smaller but steadier effort in publicity. The most important conclusion that can yet be drawn is that bold efforts in gaining greater public understanding and esteem have an immediately beneficial internal effect upon the industry. The most important lesson to be learnt from the American industry's first large-scale effort is that regional and local associations with the industry should be predominantly stressed, that public relations work is not a head office or headquarters task. The need to secure better public understanding is more urgent here than in the United States, where industrial enterprise and its aims are generally given a greater and readier respect.

Notes & Comments

Smoke Abatement

IN a memorandum presented by the National Smoke Abatement Society to the Committee on Air Pollution, the Society draws attention to its meagre financial resources. The Society has come to be recognised as the national centre for general information on air pollution, complaints, publicity material, etc. Yet all this work—now much intensified owing to the stimulus to public opinion given by the London 'smog' of late 1952—is 'at present being conducted on an income of about £5,000 a year'. On this the budget of the Society's activities, not only those of the London headquarters but of the provincial activities as well, must be based. No one today would regard £5,000 per annum as an appreciable sum. It might make a comfortable private income, equivalent to about £1,750 before the war; but it can hardly support an organisation of national status. It can buy only a most limited amount of professional services, and it can hardly meet the out-of-pocket expenses of a substantial volume of voluntary work.

Government Aid Unwise

THE Society therefore suggests that the Government Committee should consider these difficulties and discuss whether a recommendation could be made for the Society to receive financial support from the Government. But this would represent a most retrograde step. The reforming spirit should never be nationalised or subsidised. It must at all costs retain a position of scrupulous independence. In our view, any methods by which the Society can augment its grossly inadequate £5,000 a year income should be preferred to direct Government assistance. All owners of property, especially substantial owners, stand to benefit from the progress that the Society makes in publicising the need for better control of air pollution; local authorities can be classed among these beneficiaries. If the financial needs of the Society were more fully appreciated, additional income for its work would surely not be difficult to obtain? The history of reform in this country is a history of stimulus by voluntary and independent effort. Admittedly we have entered an age when the springs of private endeavour are sadly tapped by taxation and death duties, and the reduced value of the £ has slashed the practical worth of former income; but it will be a poor day for social progress when the work of reform is automatically regarded as a task for the Government to finance.

Quicksilver

A CURRENT British advertisement is offering 14s. 6d. a pound for waste mercury. Will the petty crime wave that not so long ago expressed itself on countless rooftops now turn from lead to the metallic contents of barometers and thermometers? Fortunately mercury is not a suitable metal for surreptitious handling. Though it has no shape to help specific identification, it is spillable and what happened to get spilt would be difficult to pick up again. A 'get-away' with a worthwhile haul of mercury might be a somewhat precarious adventure for the unskilled. However, there is nothing fantastic about the price of 14s. 6d. a pound. The price for a 76-lb. flask of mercury on the New York import market reached $240 in early May, more than $30 higher than at any time during World War II. This is equivalent to a price of about 22s. 6d. per lb. At the end of the war the price of a flask was round about $100 and in the post-war period it fell as low as $70. More than a threefold advance in price during the post-war period is remarkable even in an age of commodity price fluctuations. The principal price-driving influence seems to be heavy buying by the US Government, and there is some speculation that a new military and classified use for mercury has turned up. It is reported (*Chemical and Engineering News*, 1954, **32**, 2062) that current US Government buying is equivalent to the total output from Spanish mines; the

amount left for industrial use and for other countries is therefore very small. Today, of course, electrical industries are large users of mercury. It may well be that the US demand is no more than an expression of this increasing demand coupled with the desire to form a stockpile. If this is a correct interpretation, the price must be expected to fall, and perhaps sharply, when the stockpiling aim has been satisfied.

Another OEEC Contribution

'MANURES and Fertilisers—Potential Progress in Europe' (1954, 117 pp., from HMSO) is a new and stimulating publication from OEEC based upon a working party's study of methods to improve the conservation and use of animal manures and to improve methods of applying fertilisers. For many chemists in agriculture the principal value of the publication will be found not so much in the summary of recommendations as in the data from varied experimental work presented in the appendices, which themselves occupy rather more than half the space of the book. The best work of the experimental stations of Europe has been selected, especially on the vexed subject of organic matter's contributions to soil fertility. The fact that there are marked differences in practical policy with fertilisers in different countries of Western Europe can easily be confusing, but it also provides a promising foundation for discussion, as in this country papers read to The Fertiliser Society by visiting scientists have already shown.

Admirable Progress

SOME doubt is cast upon the long-term virtues of modern placement. While it is admitted that good responses are given when smaller amounts of fertiliser, especially phosphatic types, are drilled in the same row as seeds, the suggestion is put forward that eventually larger amounts of fertiliser will be required to maintain the same standard of responses. The gradual enrichment due to unused residues is lost by placement so that in the course of years the basic level of nutrient reserve will fall. It is a critical point deserving more consideration. Attention is drawn to the influence of nutrient elements other than nitrogen, phosphorus, and potassium, the 'big three' of the fertiliser industry. Although at present deficiencies of trace elements occur infrequently in Western Europe, it is felt that this relative freedom from micro-factors in plant nutrition may not last indefinitely, or, indeed, may already be somewhat illusory as a result of incomplete diagnoses. As crop yields continue to increase, and particularly if animal manure supplies are not better conserved and utilised, soil reserves of trace and secondary nutrients are likely to decline. There is a tendency to look upon the documentary literature of post-war international organisations as forms of extravagance or as efforts in redundancy. This is regrettable in principle and outrageously inaccurate in fact. In all the common technologies of Europe there is a wealth of information to be shared and OEEC is making admirable progress in that not altogether easy direction.

Applying Science to Industry

A JOINT Science and Industry Committee to investigate the possibility of speeding up the application to industry of the results of scientific research has been established by the Royal Society of Arts, the British Association and the Nuffield Foundation. The Board of Trade have made a grant to help the committee begin work. The committee's terms of reference include the making of a scientific appraisal of the whole problem, to discover what further research is needed; the identification of those factors which determined the speed of application of new scientific and technical knowledge in different industries and firms; the examination of their relative importance; the collection of evidence of the effectiveness of measures already taken; and the examination of the possible results of other proposed measures. The chairman of the committee is Professor C. F. Carter. Some work is already in progress: at University College of North Staffordshire under Professor B. R. Williams, and at the Queen's University of Belfast under Professor Carter.

Bulk Delivery of Liquid Sulphur

First Outside the USA

THE first regular bulk delivery of liquid sulphur outside the USA has recently been initiated between Shell's Stanlow chemical plant and Brotherton & Co. Ltd., of Bromborough, Cheshire.

When sulphur became available in liquid form at Stanlow it was realised that it would be advantageous if it could be delivered in this form instead of being allowed to cool to rock sulphur which has frequently to be melted again before processing. Stanlow sulphur is produced at a purity of over 99.9 per cent and no matter how carefully the operation of solidifying, digging out and transporting the solid sulphur in lorries and rail wagons to customers' premises is carried out, there is always the danger of contamination.

The bulk liquid sulphur storage installation at Stanlow consists of two 180-ton mild steel storage tanks lagged and provided with steam coils. To allow trouble-free discharge of these tanks, it is essential to maintain the liquid sulphur in them at a temperature within the range of 140°-150°. At this relatively high temperature vehicle loading by pump presented many problems and therefore the tanks are elevated to allow the vehicle to be loaded by gravity.

Narrow Working Range

The melting point of sulphur is approximately 113° and it can be seen, therefore, that the working range of temperature for bulk handling is not more than 40°.

In considering the design of a suitable road tank vehicle the factors mentioned above had to be taken into account, and three possible methods considered, namely:

(1) The use of a mild steel tanker under a nitrogen blanket and discharge by compressed nitrogen.

(2) The aluminium metallising of a mild steel tank so that pyrophoric iron could not be formed, and the use of compressed air to discharge the load.

(3) Mechanical pumping, which was ruled out due to the possibility of the sulphur cooling and blocking the pumps.

The method adopted was as outlined in (2) above, and is giving every satisfaction.

Harold Wood & Sons Ltd., the transport contractors who undertook the task, decided that the most practical way of tackling the problem was to use a heavily insulated steam coiled tanker which would be unloaded by compressed air supplied by the air compressor mounted in the chassis and driven off the engine. As Brothertons, in particular, required discharge into an overhead storage tank it was decided that there should be discharge outlets both at the top and the bottom of the tanker.

The bulk liquid sulphur installation

In the original steam heating system the jacket of the top delivery cock, the jacket round the stack pipe, the steam coils in the tank and gravity outlet, and the jacket of the bottom outlet cock were all linked in series. Due to its considerable length, vibration and temperature variations caused fractures in this pipe, and it was therefore decided to supply steam to each unit of the heating system separately. This method has worked extremely successfully in practice, connection being made to steam supply immediately prior to loading and again before unloading to ensure that the internal outlet stack pipe is free of solid sulphur.

The loaded road tanker is driven into Brotherton's process building, where overhead bulk storage of liquid sulphur is arranged in a horizontal cylindrical storage tank which is carried on a steel supporting structure and is of about 70 tons capacity. The vessel is heavily insulated and fitted with internal steam coils which serve to maintain the sulphur in liquid form.

The actual discharge of the liquid from the tanker is through a steam jacketed overhead pipeline specially designed and spring loaded in order to give the maximum flexibility. Pressure (15 psi.) is provided by the pump mounted on the tanker chassis.

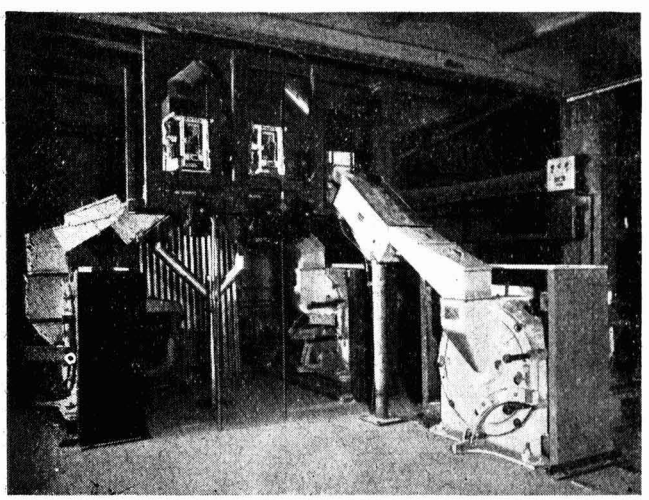
The Simon 'Velofeeder'

THREE grinders or pulverisers fitted with Simon 'Velofeeders' and Automatic Electronic Controllers will, it is claimed, do the work of four grinders not equipped with positive automatic control of this kind. The controllers ensure that the feeders load the grinders steadily, reducing maintenance to one-third of that required in manually set grinders. There is a saving in labour, as little supervision is required. Power drive efficiency is increased by up to 5 per cent as the driving motor works at full load instead of a usual 66 per cent of load. The 'Velofeeder' is a mechanical vibratory feeder, and the amplitude of vibrations can be varied to adjust the rate of feed through a very wide range. It has a small, geared reversing motor, which alters the feed rate adjustment mechanism in either direction as signalled by the automatic controller. The controller receives current directly proportional to that taken by the motor driving the grinder or pulveriser; if this current falls below the full-load current of the motor, the controller regulates the small geared motor gradually and the rate of feed to the machine is increased. If the current exceeds the full-load current of the motor the feed rate is gradually reduced. Usually, the controller is so arranged that there is a dead spot covering plus and minus $2\frac{1}{2}$ per cent of full-load; inside these limits no correction takes place. It is found that this eliminates hunting. Inquiries should be addressed to Henry Simon Ltd., Cheadle Heath, Stockport.

Cracker Plant Completed

LARGEST fluid catalytic cracking plant to be completed to date went on-stream on 27 May at the Girard Point, Philadelphia, refinery of the Gulf Oil Corporation. Designed and erected by the M. W. Kellogg Company, subsidiary of Pullman Incorporated, the unit is designed for a through-put of at least 63,000 barrels of fresh feed daily, making it, it is claimed, the highest capacity plant of its kind ever built.

The cracker is a 'side-by-side' unit, similar to one designed and erected by Kellogg for Gulf of Port Arthur, Texas, in 1951. Erection of the new unit was begun in July, 1952, and more than 500 men worked on the project during the peak construction period. It is one of more than 50 fluid units built by Kellogg since the first one was completed in 1952.



Three grinders with 'Velofeeder' control in a Liverpool mill belonging to J. Bibby & Sons, Ltd.

Newer Reagents for Metals—Part I*

by W. C. JOHNSON, M.B.E., F.R.I.C., and J. T. YARDLEY, B.Sc., F.R.I.C.
(Hopkin & Williams Ltd.)

THIS paper will be published in two parts and the first deals with the general principles governing selection of reagents and some important classes of compounds. New reagents for metals and new applications for older reagents appear in the literature at a prodigious and increasing rate and a more descriptive catalogue of these would make rather wearisome reading. With this in mind, therefore, and in order to keep this survey within reasonable bounds we have selected a few of those reagents likely to be of special interest and we have introduced certain discursive themes that may broaden this interest.

In the first place it may be helpful to summarise the rather exacting requirements of a good reagent. For a gravimetric precipitant:—

(1) The precipitate formed should be completely insoluble; (2) its composition must not be subject to variations; (3) the reagent should contain a small proportion of the metal being determined—so that the stoichiometric conversion factor is favourably high; (4) the precipitate should be thermally stable so as to permit drying and subsequent weighing; (5) it should be highly crystalline to facilitate filtration and minimise occlusion of foreign substances; (6) the reagent should be soluble in water—since most estimations are carried out in aqueous solution and precipitation of the reagent must be avoided; and (7) it should be specific for the metal in question or at least highly selective.

Misuse of 'Specific'

In passing it might be observed that few words in the chemists' vocabulary have been so misused as the term 'specific.' As far as we are aware, no reagent literally merits this description without qualification except over an extremely narrow range of conditions, and certainly no reagent possesses all the qualities enumerated above.

For reagents intended for colorimetric use the requirements are similarly exacting. A high degree of selectivity must be combined with stability of the coloured product in solution and these coloured solutions must obey Beer's law. In addition, the colour intensity resulting from a minute amount of cation must be very high if a sensitive reaction is to be achieved. This sensitivity can be further enhanced if the coloured product is selectively soluble in some water-immiscible organic solvent. Once again, there is no known member of this class which embodies all these qualities to anything like perfection.

It is interesting also to consider the general lines along which organic reagents have developed and are developing, although that will involve introducing some of the older and better known reagents into our discussion.

Accidental Discoveries

There is no doubt that the discoveries of many of the earlier reagents were made under more or less accidental circumstances. The deep red colour produced by the combination of the aromatic *o*-dithiols, for example, made itself evident when an organic research chemist was investigating the preparation of benzene *o*-dithiol. He adopted the procedure already well known for monothiols which consists in reducing the corresponding sulphonyl chloride, using tin and acid for the reduction. The product immediately showed itself as a sensitive colour reagent for stannous tin. Similarly, one can easily imagine how a substance like 8-hydroxyquinoline, which is manufactured in considerable quantities for medical purposes, soon gave evidence of its ability to combine with almost any metal used in plant construction.

Although so many of the early discoveries were not made as a result of a deliberate search for substances with the characteristics of a reagent, many later researches have been pursued with precisely that object in view and some impressive examples will be quoted.

From a theoretical standpoint the metal-organic compounds which form the basis of our survey fall into three rather ill-defined categories:—

* Based on a lecture delivered to the Sheffield Section of the National Trades Technical Societies, at Sheffield on 30 March, 1954.

1. Salts derived from acidic compounds by replacement of hydrogen atoms.
2. Inner complexes formed by the exercise of co-ordination valencies.
3. Dye-lakes of incompletely understood constitution.

Fundamentally, the members of the first class stand out as being ionised and largely insoluble in organic solvents.

Most Useful Reagents

The complexes on the other hand are essentially non-polar in character, insoluble in water and soluble in organic liquids. As might be expected, it is in this class that the most useful analytical reagents have been found. The commonest functional co-ordinating groups giving rise to complexes with metals are: amino ($-NH_2$), cyclic amino ($=N-$), carbonyl ($C=O$) and the oxime grouping ($=NOH$).

Where two such groups occur in an organic molecule, a metal may become attached to both and this arrangement is common in cases where the disposition of the functional groups is such as to lead to the production of a chelate structure involving a ring of five or six members. Rings of this size have a high intrinsic stability and are frequently encountered in this field just as they are in organic chemistry as a whole. Dimethylglyoxime, which is, by the way, one of the oldest organic reagents, having been discovered by Tschugaeff in 1905, gives rise to two such rings.

Not unnaturally, later workers devoted much attention to the possibilities implied by other dioxime structures and, as might be expected, only those molecules having adjacent oxime groups showed selective sensitivity to nickel. The more distinguished members of this series were α-benzil dioxime, α-furil dioxime, and cyclohexanedione dioxime, the latter being developed largely in the authors' laboratories[1].

Both the benzil and furil compounds are more sensitive to nickel than dimethylglyoxime but α-benzildioxime has an embarassingly low solubility in water. Furildioxime is more soluble in water but in this respect shows no advantage over cyclohexanedione dioxime, also called Nioxime, which has the attraction of high sensitivity and adequate water solubility.

The most important application for Nioxime is in the detection of minute traces of nickel and in colorimetric micro estimations. The precipitate is of a colloidal nature and can easily be stabilised by a protective colloid such as gum arabic. This provides a highly satisfactory colorimetric technique without the necessity of oxidising the nickel with bromine or iodine as in the older colorimetric methods using dimethylglyoxime. The method is readily applicable to the determination of nickel in steel and the reagent has the further advantage that the nickel complex forms quantitatively in relatively acid solution, down to *p*H 3.4, whereas the limit for dimethylglyoxime, for example, is *p*H 5.1. This means that the nickel reaction can be obtained in solutions containing manganese, aluminium and other metals whose hydroxides might be precipitated from less acid solutions. As a joint consequence of these properties and a distinct price advantage over furildioxime, Ni-oxime is becoming widely used.

It might be mentioned that none of these substances rivals dimethylglyoxime as a gravimetric reagent. We were unable to devise wholly satisfactory conditions for the quantitative gravimetric use of Nioxime, results being invariably high, and although furildioxime has been recommended for this purpose we have found this reagent to suffer from a precisely similar disadvantage. More recently, Banks[2] has described the use of cycloheptanedione dioxime (Heptoxime), both as a gravimetric and colorimetric reagent for nickel. In this last respect it is claimed to be slightly more sensitive than Nioxime.

Other Hydroxylamine Derivatives

In addition to the 1,2-dioximes, a large number of other organic derivatives of hydroxylamine have found use as reagents. α-Benzoin oxime and salicylaldoxime both contain oxime and hydroxyl groups in adjacent positions in their molecules and both form insoluble complexes with copper and a number of other metals. The former will separate copper from Cd, Pb, Ni, Co, Zn, Al, and moderate amounts of iron in faintly ammoniacal tartrate solution. In strongly acid solution molybdate and tungstate are quantitatively precipitated.

Salicylaldoxime is also an effective reagent for copper but suffers rather severely from interference due to iron. α-Isatin oxime has been recommended as a precipitant for lead[3] and the methyl ether of 2-isatinoxime has very recently been used as a colorimetric

reagent for copper[4], while formaldoxime is an established reagent for manganese.

Further derivatives of hydroxylamine that have achieved considerable prominence are to be found among the aryl nitroso hydroxylamines. Cupferron, the ammonium salt of the phenyl compound, is almost as old a reagent as dimethylglyoxime but is nevertheless still widely employed for the separation of iron, titanium and certain other metals from aluminium, and the metals of the ammonium sulphide group. The name cupferron is a rather unfortunate choice and is apt to be misleading since this compound will neither completely separate iron from copper nor quantitatively precipitate both under similar conditions. Very faintly acid conditions are essential for the complete precipitation of copper and, unfortunately, general interference is most marked in these circumstances.

Neo-cupferron, the naphthyl analogue, on the other hand, yields less soluble derivatives and makes possible the direct separation of small amounts of iron from copper, a feature that has found application more particularly in the analysis of mineral waters. Neither reagent, unfortunately, is very stable and more recently N-benzoylphenylhydroxylamine has been shown to possess the dual advantages of greater stability and solubility in water. Copper, iron, aluminium and titanium may be quantitatively precipitated with this reagent[5].

Another series of compounds which has furnished some time honoured analytical reagents is the group of nitroso phenols of which the oldest, α-nitroso-β-naphthol, actually preceded dimethylglyoxime by a number of years and is still used for separating cobalt from large amounts of nickel. The isomeric β-nitroso-α-naphthol behaves somewhat similarly and has been fairly widely employed as a colorimetric reagent for cobalt.

An Interesting Failing

The insoluble precipitates produced by these compounds in the presence of cobalt illustrate a rather interesting failing to which reagents of this type are prone. The cobalt complexes are of the cobaltic type and since the only stable simple salts of cobalt are cobaltous compounds this means that the complexes are formed at the expense of some reduction of excess reagent, causing heavy contamination of the precipitate and making direct weighing impossible. Methods involving prior precipitation of cobaltic hydroxide are not satisfactory because of the extremely slow rate of dissolution of this precipitate in a suitable acid medium.

Erroneous Claims

Similarly, claims that α-nitro-β-naphthol is a more effective precipitant than the nitroso compound are quite erroneous and the authors of certain text books who were unlucky enough to have included this recommendation in their text have remedied this state of affairs in later editions. The error seems to have been due to an abortive attempt to prepare the nitro compound from the nitroso-naphthol. The product was presumably impure nitroso-naphthol and over enthusiasm for the project must be held responsible for the rest. The present authors, as representatives of a chemical supply house, were embarrassed on a number of occasions by orders for this chemical —knowing full well that the genuine article, prepared in a different manner, was quite incapable of satisfying the customer's presumed requirements.

Another distinguished member of this series is commonly known as nitroso-R-salt. It is the disodium salt of 1-nitroso-2-naphthol-3,6-disulphonic acid and, as a colorimetric reagent for cobalt, it has probably accounted for more space in the literature during the last ten years than any other substance of similar application. Under favourable conditions the sensitivity to cobalt exceeds one in 30,000,000. It is frequently used in the authors' laboratories for the estimation of sub-micro amounts of this metal in pure zinc and cadmium salts, using specially constructed Nessler glasses of considerable length. In these days of intensive instrumentation it is refreshing to be able to observe that such a visual assessment, when possible, provides a more sensitive method than the use of spectrophotometers; entirely as a consequence of the path length involved.

Two rather more distant relatives of much more recent development are 3-nitroso-salicylic acid[6] and *iso*-nitroso-dimethyl-dihydroresorcinol[7]. These are both colorimetric reagents, the former being employed for the determination of cobalt and nickel and the latter for cobalt more specifically.

The derivatives of 2,2′-dipyridyl and 1,10-phenanthroline provide excellent examples of the way in which a range of closely re-

lated substances has been explored. 2,2′-Dipyridyl was the precursor of 1,10-phenanthroline and was made by the oxidation of pyridine in an autoclave with a ferric salt. The product of this reaction, rather surprisingly perhaps, was a deep red coloured mixture, and was found to contain the 2,2′-dipyridyl and a large variety of related by-products, including terpyridyl, combined with the ferrous iron resulting from the reaction. It has been widely used in the colorimetric determination of iron.

Related Structures

The relationship between 2,2′-dipyridyl and 1,10-phenanthroline may not be immediately obvious but is in fact a very simple matter, on paper at least, of completing a third aromatic ring in the former to produce the latter. Phenanthroline is not, in actual practice, produced from dipyridyl. There are more direct and more economical syntheses available and, in fact, phenanthroline is now a much cheaper reagent than dipyridyl and has to a large extent displaced it as a colorimetric reagent for iron. The colours produced with ferrous iron are rather similar, though dipyridyl gives a rather brighter shade of red, but phenanthroline is the more sensitive of the two reagents, the ferrous complex having a molecular extinction coefficient of 11,100 as against 8,650 for the corresponding dipyridyl complex.

The grouping common to these two reagents is the =N—C—C—N= chain and it is by virtue of this arrangement that they and many other similarly constituted substances yield ferroin type complexes. Realisation of this fact encouraged a number of workers to synthesise derivatives of dipyridyl and phenanthroline in the hope of finding even better reagents than the parent substances. This hope was realised up to a point, and reagents better suited to rather special applications were discovered, but, as might be expected in such circumstances, the new reagents are sometimes very much more expensive than their precursors.

Among the phenanthroline derivatives the bromo, chloro, nitro, methyl and phenyl substitution products have been synthesised and their characteristics determined as potential reagents for analytical purposes. Their study provides an excellent example of the more systematic type of research that has been applied to the quest for new reagents.

G. F. Smith, in the University of Illinois[8], has prepared as many as 28 mono-, di-, tri-, and tetra-methyl substituted derivatives and has determined their characteristics as reagents for both iron and copper. In the course of this research he reached a point where he was able to predict quite closely the wave lengths of maximum absorption of any of these complexes and to make a rough estimate of their anticipated molecular extinction coefficients. The redox potentials of the iron complexes were also predicted with remarkable accuracy.

Perhaps the most interesting outcome of researches in this field is the influence of substitution on the ability of compounds of this type to react selectively with cuprous ions. The parent substances yield cuprous complexes similar to the ferrous compounds but containing only two molecules of the organic substance to one atom of copper. These copper complexes are formed in rather more alkaline conditions than the ferrous complexes. They are almost insoluble in water, and, as distinct from the ferrous complexes, soluble in organic liquids. Nevertheless, so far as concerns the parent compounds, little was found to recommend them as copper reagents under any ordinary circumstances.

2,2-Dipyridyl Derivatives

Then in 1950 Hoste[9] prepared and investigated a number of derivatives of 2,2-dipyridyl including diquinolyl, and similar compounds such as 2,2-pyridylquinoline. He found that dipyridyl and phenanthroline themselves each reacted with both iron and copper, the molecular extinction coefficients being as shown in Table I.

6,6′Dimethyl-2,2′-dipyridyl differed in quite a remarkable way in that it reacted only with copper, giving no colour with ferrous iron. 2,2′-Diquinolyl had already been investigated and found to give the copper reaction and no iron reaction, and although less sensitive than 6,6′-dimethyl-2,2′-dipyridyl it is a far more accessible compound and has found considerable use as a selective copper reagent under the name Cuproine.

A further improvement was realised by G. F. Smith[10] when he introduced 2,9-dimethyl-1,10-phenanthroline (Neocuproine), another copper selective reagent with a greater sensitivity than its precursors, as may be seen by reference to the molecular extinctions in Table I.

A very interesting fact emerged from these data and, as Hoste pointed out, substitution by methyl groups in the positions next to the N atom in these reagents conferred a selectivity toward copper. The same effect is not obtained by substitution in other positions, and the chain

$$CH_3—C=N—C—C—N=C—CH_3$$

is evidently copper selective as compared with the =N—C—C—N= chain which is more generally reactive. A carbon hydrogen unit of a benzenoid ring may also effectively replace the terminal CH_3 grouping, with similar results as in cuproine.

Both cuproine and neo-cuproine are used for the colorimetric determination of copper in circumstances where it is desired to avoid a separation of iron. Their popularity would probably increase considerably if they did not cost 46s. and 60s. per gram respectively, but these prices will, no doubt, be reduced in time when preparative methods are improved. The copper complexes are extracted with *iso*-amyl alcohol and *n*-hexyl alcohol respectively as a preliminary to spectrophotometric estimation.

The latest discovery in this field is 2,9-dimethyl-4,7-diphenyl - 1,10-phenanthroline[11], known as batho-cuproine. In this compound the 2,9-dimethyl substituents confer copper selectivity on the molecule and the 4,7-substituents increase the specific sensitivity. The complex has an absorption coefficient of 14,160 in *n*-hexyl alcohol. This is the highest figure for those members of the series so far examined and the reagent was deliberately designed according to the principles of previous experience, as distinct from many of the older discoveries which resulted largely from chance.

One of the latest papers on the subject appears to detract considerably from the practical necessity for the reagents just described. Smith[12] has shown that 1,10-phenanthroline itself can be used to afford a complete separation of iron and copper if the copper complex is extracted with *n*-octyl alcohol. Only one extraction is necessary to obtain a complete separation and the two metals can then each be determined colorimetrically in the respective layers.

Very recent American literature[13] includes a paper on two new reagents containing the same iron and copper chelating chain as phenanthroline. These are 2-(2-pyridyl)-benzimidazole and 2-(2-pyridyl)-imidazoline.

In spite of their greater structural complexity these substances appear to be somewhat easier to make than the simpler looking 1,10-phenanthroline (a circumstance that is not at all uncommon in preparative organic chemistry) and they may become available at a lower price. They are not of the same sensitivity as phenanthroline, however (see Table I), and a more stringent control of both *p*H and reagent excess is necessary in their use. On the other hand the iron complex can be extracted with *iso*-amyl alcohol with effective increase in sensitivity.

TABLE I

Substance	Molecular Extinction of Fe" Complex	Molecular Extinction of Cu Complex
1,10-Phenanthroline ..	11,100	7,150
2,2'-Dipyridyl	8,650	4,550
6,6'-Dimethyl-2, 2'-dipyridyl	—	6,570
2,2'-Diquinolyl	—	5,490
2,9-Dimethyl-1, 10-phenanthroline	—	7,950
2,9-Dimethyl-4,7-diphenyl phenanthroline	—	14,160
2-(2-pyridyl)-benzimidazole	3,800	—
2-(2-pyridyl)-imidazoline ..	7,800	—

Apart from their use as reagents for metals, the phenanthroline complexes have assumed some considerable importance in analysis as oxidation-reduction indicators. The phenanthroline-ferrous complex is intensely red while the ferric complex is much more faintly blue. Consequently, the system ferroin-ferriin functions effectively as a 'one-colour' redox indicator with an E_0 value of about 1.1 V. This change-potential is high compared with the older indicators and confers a considerable advantage in certain titrations.

Many related complexes have been prepared as redox indicators and the ferrous complex of 5-nitro-1,10-phenanthroline, which has a normal potential of about 1.25 V, has found a number of special applications including the titration of iron with permanganate in the presence of vanadate[14].

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New APV Process

Polarising Heat Exchange Gaskets

ONE of the more important advances that have been made in recent years in the study of adhesion is the recognition that the polarity of two surfaces which are to be joined together must be compatible, since good adhesion between the two polar surfaces is much more likely to take place than between a polar and a non-polar surface. It follows that in order to cause rubber, a non-polar material, to adhere to a polarisable surface such as that of stainless steel, the surface of the rubber must be made polar.

The APV Co. Ltd. has been carrying out research into the application of this principle to improve the adhesion of the rubber gaskets on the stainless steel plates of Paraflow heat exchangers. Now a method has been developed of subjecting the gasket to a rapid chemical treatment which changes the nature of the surface to be mated with the stainless steel heat exchanger plate groove. The surface of the polarised rubber is virtually unchanged in appearance to the naked eye but under magnification is seen to be covered by finely spaced parallel cracks. This effect is shown in Fig. 1. The surface of an untreated gasket is shown in Fig. 2.

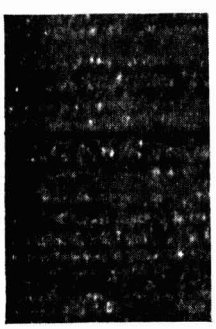


Fig. 1

Fig. 2

It is quite a simple matter to remove the gasket from a plate. This is done by softening the adhesive by means of a small flame, such as a painter's blow lamp, carefully applied to the back of the rubber groove. At about 150° the adhesive is sufficiently thermoplastic to permit the gasket to be gently lifted away from the plate without any tearing and in this way it is possible to remove a gasket completely in less than two minutes. The adhesive generally remains on the gasket so that the plate groove requires very little cleaning prior to the insertion of a new gasket.

The replacement 'polarised' gasket is supplied already coated with cement and may be inserted into a plate groove previously treated with a coat of APV cement, without further preparation. The subsequent treatment is that normally recommended when re-rubbering APV plates.

Canadian Firm Acquired

NEWS has been received from Ottawa that Mr. Gordon Roach and Mr. Montague Holbein, of D. & C. and William Press Ltd., of 27 Ashley Place, London, S.W.1, have concluded the purchase of the old established Canadian business of Ross-Meagher Ltd., civil engineers and building contractors. The Ross-Meagher company will now exploit the gas line laying and other techniques in which the purchasers specialise.

Only recently D. & C. and William Press, in association with the Morrison-Knudsen Corporation, secured the contract for laying the 350-mile SUI natural gas line in Pakistan, a task which has to be completed by May next year.

D. & C. and William Press are general contractors for both the civil engineering and mechanical erection for the £27,000,000 extension to Anglo-Iranian's Llandarcy refinery. Many other major projects at home and overseas have been successfully tendered for by them, and they are actively concerned with the developments in Kuwait, Bahrein and Iraq.

Chemical Engineers' Tour

FOLLOWING last year's successful tour in Southern France, the graduates and students' section of the Institution of Chemical Engineers have made arrangements for a similar visit to Holland from 24 July to 1 August. The tour will be based on two centres, the Hague and Amsterdam, and visits will be made by private bus to various works. Total cost, including 2nd class travel from London, accommodation and all meals, will be £37 per person. Participation in the tour is open to members of the Institution, but numbers will be limited and preference will be given to graduates and students.

Key Industry Duty

Many Chemicals Added to List

THE Board of Trade have made the Safeguarding of Industries (List of Dutiable Goods) (Amendment No. 6) Order, 1954, adding the following chemicals to the list of chemicals liable to Key Industry Duty:

4-Acetamidophenazone; 3-acetamido-2,4,6-tri-iodobenzoic acid; acetylthiocholine bromide; acetylthiocholine chloride; acetylthiocholine iodide; ambrettolide; 2-amino-4,6-dihydroxypteridine; *p*-amino-N-ethyl-N-2-hydroxyethylaniline; *p*-amino-N-ethyl-N-2-hydroxyethylaniline sulphate.

Barium oxalsuccinate; benzyltrimethylammonium chloride; 9-bromoanthracene; 1-bromo-*n*-decane; 1-bromo-*n*-dodecane; 1-bromo-*n*-hexadecane; 1-bromo-*n*-octadecane; 1-bromo-*n*-tetradecane; 9-bromophenanthrene;4-*tert*.-butylcatechol.

Calcium hydride; *p*-carboxyphenylhydrazine; D-cellobiose; *p*-chlorobenzenesulphonyl chloride; 1-chloro-*n*-decane; 3-chloro-10-(3-dimethylaminopropyl) phenothiazine; 3-chloro-10-(3-dimethylaminopropyl) phenothiazine hydrochloride; 1-chloro-*n*-dodecane; 1-chloro-*n*-hexadecane; 1-chloro-*n*-octadecane; 1-chloro-*n*-octane; *β*-chloropropionitrile; 1-chloro-*n*-tetradecane; DL-*iso*citric acid lactone; coumalic acid; 9-cyanononoic acid; cyclopentanol; cyclopentanol-1-carboxylic acid; L-cysteic acid; L-cysteine; DL-cystine.

Decane-1,10-dicarboxylic acid; decane-1,10-diol; dehydroisoandrosterone; 7-dehydrocholesterol; 1,10-diaminodecane; 4,4′-diamino-1,1′-dinaphthyl; 1,12-diaminododecane; 2,4-diaminopyrimidine; NN-dibenzyl-2-chloro-ethylamine hydrochloride; 1,10-dibromodecane; 2,5-di*tert*.-butylhydroquinone; NN-diethyl-*p*-phenylenediamine sulphate; NN-diethyl-*p*-phenylenediamine sulphite; dihydropyran; 2,4-dihydroxybenzamide; 3,4-dihydroxycinnamic acid; 3,4-dimethoxybenzoyl chloride; 5,5-dimethylhydantoin; 2,6-dimethylhydroquinone; 2,9-dimethylphenanthroline; 5,6-dimethylphenanthroline; 3,5-dimethylpyrazole; 2,2-dinitrodiphenyl; 1,4-diphenylbuta-1,3-diene; NN′-diphenylformamidine; 1,6-diphenylhexa-1,3,5-triene; 2,5-diphenyloxazole; 2,5-diphenyloxazolid-4-one; 4,7-diphenyl-1,10-phenanthroline; 1,2-diphenylpropylene; 4,4-dipyridyl; 2,2′diquinolyl; *n*-dodecyldimethylbenzylammonium chloride; N-*n*-dodecylpyridinium bromide; *n*-dodecyltrimethylammonium bromide.

1,2-Epoxyethylbenzene; ethylenediaminetetra-acetic acid; ethylenediaminetetra-acetic salts, the following: mono-ammonium, diammonium, triammonium, tetraammonium, monopotassium, dipotassium, tripotassium, tetrapotassium, monosodium, disodium, trisodium, and tetrasodium; N-ethylmaleimide; 4-ethylpyridine.

1-Fluoro-2,4-dinitrobenzene; formamidomalonic acid.

Glyceraldehyde; glycylglycine hydrochloride; glyoxylic acid.

Haemin; *n*-hexadecyldimethylbenzylammonium chloride; N-*n*-hexadecylpyridinium bromide; *n*-hexadecyltrimethylammonium bromide; *n*-hexadecyltrimethylammonium chloride; DL-homocystine; hydantoic acid; hydantoin; 2-hydroxybenzhydroxamic acid; 17-hydroxycorticosterone; 17-hydroxycorticosterone acetate; 4-hydroxy-3,5-dimethoxybenzoic acid; 3-hydroxy-2-naphthhydrazide; *p*-hydroxyphenylpyruvic acid; 3-hydroxypyridine.

2-Iodothiophen.

7-Ketocholesteryl acetate; α-ketoglutaric acid.

Lauroylsarcosine; lead acetylsalicylate; lead adipate; lead 12-hydroxystearate; lead phthalate; lead sebacate; lead tetra-acetate; leucopterin; lithium 12-hydroxystearate; lumisterol.

D-Melibiose; 3-mercaptopropane-1,2-diol; methylenedisalicylic acid.

N-1-Naphthylethylenediamine dihydrochloride; *p*-nitrophenacyl bromide; 2-nitrothiophen.

n - Octadecyldimethylbenzylammonium chloride; N-*n*-octadecylpyridinium bromide; N-*n*-octadecylpyridinium chloride; *n*-octadecyltrimethylammonium bromide; *n*-octadecyltrimethylammonium chloride.

Pentane-1,5-dipyrrolidinium methobromide; pentane-1,5 dipyrrolidinium methochloride; pentane-1,5-dipyrrolidinium tartrate; phenazine; *o*-phenoxybenzoic acid;

2-phenylindane-1,3-dione; phthalamic acid; pimelonitrile; piperonylideneacetone; potassium 3-acetone-2,4,6-tri-iodobenzoate; pyridine betaine hydrochloride.

Resazurin, sodium salt; rutin.

Sebaconitrile; sarcosine; sodium 3-acetamido-2,4,6-tri-iodobenzoate; disodium phenoltetrabromophthalein disulphonate; sodium riboflavine-5′-phosphate.

3,3′,4,4′-Tetra-aminodiphenyl; *n*-tetradecyldimethylbenzylammonium chloride; N-*n*-tetradecylpyridinium bromide; N-*n*-tetra decylpyridinium chloride; *n*-tetradecyltrimethylammonium bromide; *n*-tetradecyltrimethylammonium chloride; tetrahydrofuran; tetraiodothiophen; *p*-1,1,3,3-tetramethylbutylphenol; 4,4′-tetramethyldiaminoazobenzene; *β*-2-thienylalanine; thiocytosine; 4,5,6-triaminopyrimidine; trichloroacetamide; trichloroacetonitrile; tricholine citrate; 2,3,7-trihydroxy-9-phenylfluorone; NN′C-triphenylformazan.

Xanthen.

The order, which came into operation on 3 June, is published as Statutory Instrument 1954 No. 704. Copies may be obtained direct from HM Stationery Office, Kingsway, London, W.C.2, and branches, or through any bookseller, price 3d. net, by post 4½d.

Items added to the Key Industry Duty lists are automatically freed from import licensing control from certain countries at the same time. In the case of 17-hydroxycorticosterone and 17-hydroxycorticosterone acetate however, it is not proposed to alter the present licensing arrangements.

Science Museum Gas Display

DEVOTED to the history of gas manufacture, its distribution and its by-products up to the present day, a new gallery at the Science Museum, South Kensington, London, S.W.7, was opened by the Lord President of the Council, the Marquess of Salisbury, recently. The extensive development and modernisation of the Museum's collections, which this represents, is the first collective effort by an industry on behalf of the permanent collections at the Science Museum.

The display occupies a gallery of some 5,000 sq. ft. in a newly-finished wing of the Museum and has been organised by a committee of The Institution of Gas Engineers. The gallery illustrates not only the beginnings of the making of gas, first for lighting and then for heating, and its industrial uses, but also the later uses of the many by-products of coal created through the gas-making process.

A series of realistic dioramas shows some of the early experimenters at work, followed by representative retort houses at various dates up to the present day. A cyclorama running the whole length of the gallery depicts in lively form London's gas-lighted streets in 1812, the gas-lit scene at a Mansion House ball in 1830, private house lighting 30 years ago, and the advent of the incandescent mantle 64 years ago. Models representing gas works in 1890 and 1950 show the progress of the machinery for gas making. Illuminated panels, operated by push buttons, show by animated diagrams the various stages in the extraction of gas from coal, how it is distributed to the consumer, and what happens to the by-products that remain.

Research Scholarship

AN offer by the Aluminium Development Association of a research scholarship to the value of £400 a year, to enable the holder to undertake research on some aspect of the application of aluminium alloys to structures, has been accepted by the Institution of Structural Engineers. The scholarship will be awarded for two years, every other year.

It is the intention of the Council of the Institution to make the first award in the near future in order that the successful holder may commence his investigations in October. Entries for the scholarship to be awarded this year close on 15 July. The scholarship is to be administered by the institution and further particulars, together with forms of entry, can be obtained from the secretary of the Institution of Structural Engineers, 11 Upper Belgrave Street, London, S.W.1.

Q & Q Prize Fund

Quickfit & Quartz Ltd. have presented £50 to Norwood Technical College to provide an annual £2 prize for the best student of advanced chemistry. This money has been given in recognition of the work of Dr. J. T. Stock and Mr. M. A. Fill, of the college staff, who helped Quickfit & Quartz to develop a minature organic chemistry laboratory, now being marketed by that firm.

Industrial Distillation Development

New Column Packing Designed at Harwell

A NEW distillation column packing has recently been developed at the Atomic Energy Research Establishment, Harwell, primarily for the large scale separation of the hydrogen isotopes by the distillation of water. Owing to the comparatively low value of the separation factor for this system (1.026 at 100°) the primary requirements were a very large throughput, HETP values of the order of 2 ft. or less, and a low first cost. The new packing, which has tentatively been named 'Spraypak,' fully meets these requirements, and shows promise of wide application in industry.

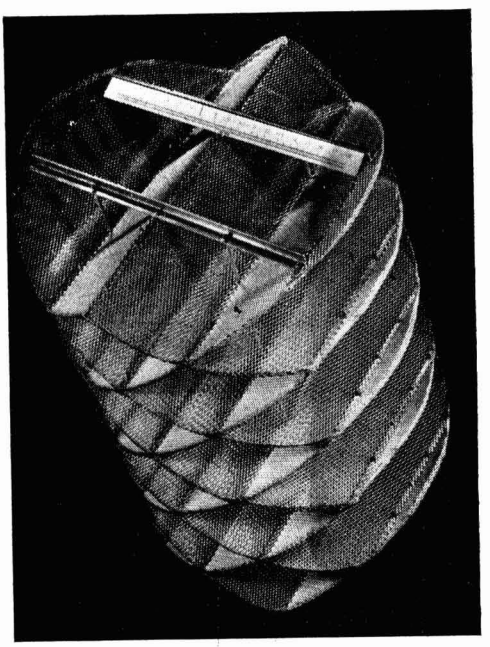
It is a surprising fact that distillation, undoubtedly the most important of the unit processes of chemical engineering today, is still carried out to a very large extent using bubble cap trays, which were first introduced more than one hundred years ago. However, within the last few years a number of new types of distillation and absorption column fillings[1] have been developed with the object of overcoming the inherent limitations of conventional packed and bubble plate columns. Some of these comprise modified forms of the bubble cap plate and perforated plate trays, designed to overcome inherent limitations such as the restricted throughput.

Others, such as the 'Turbogrid'[2], the Kittell expanded metal tray[3], and 'Panapak,' a multi-layer expanded metal packing developed by Scofield[4], are simpler in that downcomers for the liquid are avoided, and a perforated grid, either flat or corrugated, is employed to produce a dense spray at regular intervals throughout the column. This spray serves the double function of providing a large surface for efficient contacting between vapour and liquid phases, and of making the sytem inherently self-distributing. It is probable that these fillings will show little or no diameter effect, i.e. reduction in efficiency with increasing column diameter.

'Spraypak' is a novel form of the latter type of contact device, and consists of a cellular structure made for most purposes from commercial $\frac{1}{8}$ in. nominal mesh 20-24 SWG expanded metal of 1/16 in. strand width. An example of a typical pack, fitted within a 2-ft. dia. transparent column, is shown in the illustration. The walls of each cell comprise separate Z-shaped pieces bolted, welded or clipped together to form a packing unit which is installed through the top of the column. Modified forms of construction are at present under consideration which will be suitable for installation through the manholes of conventional tower shells.

Investigations of the effect of variations in the type of mesh used and in the geometry of the packing have been carried out in a transparent air-water rig with a cross-section of 15 in. by 27 in. and a packed height of 4 ft. Distillation tests have been carried out in a mild steel rectangular column of the same cross-section with a packed height of 20 ft., using as test systems water slightly enriched in isotopic content, and also benzene-carbon tetrachloride. Air-water tests are also being carried out in a large air-water rig with a cross-section of 2 ft. 6 in. by 7 ft. 6 in. and a packed height of 10 ft.

Experimental results to date show that the



The 'Spraypak' column packing. The ruler is 15 inches long

throughput is some 200-250 per cent of that of a well-designed bubble cap column with 18 in. plate spacing; thus, the flooding rate for the steam-water system is of the order of 2,500 lb. per hr. per sq. ft. at atmospheric pressure. The curves of HETP against throughput show a plateau in the range from about 50-80 per cent flooding so that the packing possesses a flexibility approaching that of the bubble cap tray.

At present it is not possible to assess accurately the cost of the packing as installed, since in any case this will to some extent be a function of the type of construction adopted. However, present indications are that the cost will be some one-third to one-half of that of bubble cap trays for the same duty.

A licence to manufacture 'Spraypak' in the US has been granted to Denholme Inc., New York.

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Power Convention

British Makers & Consumers Meet

THE Sixth British Electrical Power Convention, which meets at the Winter Gardens, Eastbourne, from 14 to 18 June, is a successor—although on a very much wider scale—to the Incorporated Municipal Electrical Association Convention, whose 52nd and last meeting was held at Eastbourne in June 1948, a few weeks after the electricity supply industry was nationalised. This year, for the first time, the president will be an engineer, Mr. J. R. Beard, C.B.E.

Representative of all the principal organisations, 38 in number, connected with the electrical power industry, the convention is attended by over 2,000 delegates from all parts of Great Britain, Northern Ireland, the Isle of Man and the Channel Islands.

Professional, industrial, commercial and other bodies who make indispensable contributions to this great modern public service of electricity are represented. There are also the designers and professional consultants to the manufacturers of the steam and electrical plant for generation, of the cables, transformer, switchgear and apparatus for transmission and distribution, and of the equipment for use by the consumers; the commercial distributors of electrical accessories and those who install the wiring and equipment in factories, farms, homes and premises of all kinds.

An important part is also played by the professional, engineering and research organisations and by the associations whose functions are to advance and develop the proper use of electricity. The consumers' interests are safeguarded by the presence of representatives from the Electrical Association for Women and the chairmen of the Area Electricity Consultative Councils, while the staff of the electricity supply industry is also represented.

Convention's Objects

The objects of this convention are to promote the mutual interests of the organisations engaged in the industry, to foster the maximum degree of co-operation between the various sections, to encourage and develop good relationships within the industry and to bring about the maximum development of electricity in the service of the community.

Papers covering a wide range of subjects of vital interest to the electrical power industry are presented to these conventions. This year, the principal theme will be the development of home and overseas markets for electricity and electrical appliances. Delegates will meet under the presidency of Mr. Beard, who represents the Association of Consulting Engineers. The principal paper will be by Sir George Nelson, chairman and managing director, The English Electric Co. Ltd., who will speak on 'Electrical Engineering in World Trade.'

Associated with the convention is the largest and most comprehensive electrical exhibition ever staged outside London. Exhibits by 100 firms and organisations will be housed in a mammoth marquee, covering 24,000 square feet of the Winter Garden grounds. The exhibition, which will be reserved for delegates only on Monday and Tuesday, 14 and 15 June, will be officially opened by the president on Monday night. On Wednesday, Thursday and Friday, the exhibition will be open to the public.

Austrian Fertilisers

The production of nitrogen fertilisers in Austria during 1953 amounted to 490,000 tons and exceeded the previous year's output by 28,000 tons or 6 per cent.

Synthetic Textiles & Treatment

Deliberations of First International Congress

THE first International Congress of Man-made Textiles, attended by some 3,200 delegates from 31 different countries, including many from the UK, US, Japan, France, Germany and Italy, was held in Paris at the Centre Marcelin Berthelot last week. In the absence of M. Edouard Herriot, who was indisposed, the congress was opened on the morning of Monday, 31 May, by M. M. Louvel, Minister of Industry and Commerce. Delegates were welcomed by M. J. de Precigout, president of the Management Committee of the International Rayon and Synthetic Fibres Committee.

The opening speech of the congress was a survey by Professor H. Staudinger, 1953 Nobel Prize winner in chemistry, of 'Macromolecular Chemistry and Man-made Textiles.'

After reviewing the pioneer work done by Count Chardonnet 60 years ago, and the production of the first fully synthetic fibre 25 years later, Professor Staudinger (whilst stressing that it was economically impossible to reproduce exactly natural fibres such as wool or cotton) said that textiles produced by technologists could be made more beautiful and had far more possibilities than natural textiles. Chemistry could accomplish more than nature.

The two principal tasks which synthetic fibres had to fulfil were to bridge the gap in textile supply, since natural fibres would be insufficient for world needs; and to create more new fibres with better properties, in a search for the ideal fibre.

The congress was divided into two sections, concerned with economic and technological aspects of the subject, and we print here extracts from some of the interesting papers presented in the latter section.

Progress in the Dyeing of Spun Rayon Woven Fabrics with Direct & Vat Dyes.

By P. A. Holt

The introduction of continuous methods of vat dyeing in the US was very timely in that it offered the means of satisfactorily dyeing spun viscose to high standards of all round fastness, with much greater possibilities of the preservation of the shrinkage so necessary in the production of attractive finishes. The size of the domestic market and the vertical integration of the textile industry in US afforded the long runs per shade desirable for continuous dyeing operations.

Latterly, experience with the Dupont Pad Steam process and the Standfast Molten Metal machine has demonstrated that short runs per shade can be conveniently dyed. Consequently, as these plants are installed in other countries where conditions favouring long runs are not so good, it is to be hoped that merchants will be alive to the necessity for specifying vat dyes for spun rayon fabrics, where very good fastness to light and to washing are necessary.

Particularly Versatile

The Du Pont process is particularly versatile. It depends on a very short steaming of some 10-20 seconds duration, during which reduction and dyeing of the vat dyestuffs takes place. The dyestuff is applied by padding. In dyeing pale or medium shades it may be in the alkaline leuco state or in the vat acid state. For deeper shades the dye is applied in pigment form, followed in the case of some shades by an intermediate drying. The essentials of any intermediate drying process are even drying conditions and the use of anti-migration agents such as an alginate salt. The cloth, impregnated with unreduced dye, then passes through a cold bath of hydrosulphite and caustic soda and enters the steaming chamber. Two essentials for success are the application of a level excess of reducing solution to the cloth, best achieved by using no nips, and an adequately high and well controlled steam temperature in the steamer.

If careful attention is given to these points, excellent dyeing of high colour value is achieved at speeds of from 50 yards to 120 yards per minute. As it must take some time for the cold fabric entering the steamer to attain a high temperature, the time of actual dyeing must be very small.

There follows a passage through an oxidising bath. A mixture of ammonium sulphate and sodium percarbonate gives good results. Soaping can then be carried out at width on a tensionless soaping range or in

rope form in the beck. The latter offers an opportunity for the release of any tension applied during the dyeing process.

The Gen Ray process promoted by the American General Dyestuff Corporation is excellent from the standpoint of the production of light, medium and dark shades of excellent appearance and penetration, free from shading both across the piece and from end to end of the run. The fabric is run at speeds varying from 20-40 yards per minute and the reduction bath is kept at a temperature of 85°. The cloth is padded with the vat dye suspension and run directly into the hot reducing liquor, which is contained in Williams Units placed in tandem. The reducing bath also contains a small amount of the pigment padding liquor and possibly common salt. A feed liquor of caustic soda and hydrosulphite, of strength calculated to maintain the correct reduction concentration, is fed continuously to the Williams Units.

Slower Speeds

The cloth is run at much slower speeds than is the case with the pad steam process. It is thought that the slow speed is necessary to allow time for the penetration into the wet fabric of the caustic soda-hydrosulphite reducing liquor.

The fabric is then run through additional Williams Units containing neutralising, oxidising and washing liquors.

Much attention has been paid recently to the proper control of the reduction bath by using *p*H recording instruments. The speed of a continuous machine demands quick and accurate feeding of dye liquor and chemicals, and especially is this so when vat dyes are used. Thus excess hydrosulphite would result in over-reduction and a shortage would give a poor vat. Delicate and quickly responding control is therefore required.

For this purpose there has been marketed in the US an instrument for measuring the redox potential of a vat dyebath. The redox potential may be regarded simply as the capacity of a bath to reduce or to oxidise. Clearly, in the case of a vat dye, the greater the capacity to oxidise the greater the need for a hydrosulphite addition. The potentials for a number of typical vat dyeing recipes have been ascertained and it is claimed that all that is needed is to adjust the bath conditions to maintain the potential within the desired limits. The tendency is to use an excess of hydrosulphite and those who have used the redox method state that it has resulted in substantial saving of this chemical and the achievement of greater shade control and uniformity.

The last widely used continuous method of dyeing with vat dyes is the British Standfast Molten Metal process, comprehensively described by Haworth & Kilby in the December 1951 issue of the *Journal of the Society of Dyers and Colourists.*

The machine is essentially a 'U' tube of molten metal alloy consisting of bismuth, cadmium, lead and tin, maintained at a temperature of about 95°. A small dyebath floats on one arm of the 'U' tube and a solution of sodium sulphate on the other.

The dye liquor is made up of pigment vat dye, hydrosulphite and caustic soda in the cold, with the addition of any necessary wetting and dispersing agents. It passes through a preheater, where reduction of the dye takes place immediately prior to floating on the molten metal, where it is continuously and uniformly replenished. The dye liquor is also mechanically circulated in the dye bath, which is only slightly over one gallon in volume.

The cloth is pre-heated over hot cylinders and enters the dyebath at a speed varying from 30-100 yards per minute. The length of passage in the molten metal is about 10 feet. The molten metal acts as a squeeze, an air excluder and an accurately controllable heat transfer medium. Its action in squeezing is very flexible as the molten metal adapts itself to any variation in the thickness of the cloth. The dyeing time is only a few seconds in duration, and admirably illustrates the high speed at which vat dyes can dye at temperatures approaching 100°.

Level Shades

In common with the other methods mentioned, vat dyes of all classes can be dyed in admixture. The process gives extremely level shades from pale to full depth on a variety of spun rayon fabrics, but the penetration is not good in the case of the more compact cloths. Such fabrics can, of course, be impregnated first with pigment dyestuff on a pad, dried and then passed through a reducing bath on the entering arm of the 'U' tube. In such cases, however, errors and lack of levelling in the

padding operation are not evened out in the molten metal machine.

A very recent continuous system sponsored by the Pittsburgh Coke & Chemical Co. is the Bond Dyeing Machine. It consists of several pairs of perforated plates between which the cloth passes horizontally. During its passage, dye or chemical solutions are forced by pressure through the material. Liquor temperature, rate of flow, pressure and fabric tension are all controlled and the system is claimed to be extremely flexible as regards rapid changes of shades and dealing with short runs. Evidently 'shock' dyeing methods are employed as in the systems already described. More experience of the working of this system is necessary before its value can be accurately assessed.

In the search for economic and technical progress in the field of continuous dyeing by direct dyestuffs, it has been observed that the tremendous reduction in the time of dyeing offers other advantages. The problems of varying affinity arising out of the variation of spinning and weaving processes is practically eliminated as is also the necessity for careful choice of dyestuffs in regard to their respective rates of dyeing.

Forcibly Fed

Instead of the fabric slowly taking up the dye from the dyebath, during the course of which process the less dense or compact portions absorb more than their share of dye, the fabric is forcibly fed with a rationed amount of dye and this is then immediately fixed *in situ* by one method or another.

Following this principle, the direct dyestuff is applied by the usual padding technique, thus eliminating all factors of affinity and reducing the process almost to a mechanical operation. A perfect padding machine is required and the cloth to be padded must be thoroughly desized and scoured at width if chafes, streaks and stress marks are to be avoided in the final result. This added processing and the consequent pre-drying add, of course, to the cost of the process. The impregnated cloth is then steamed in the wet or dry state but the time of steaming is of order of 5-10 minutes in contrast to the much shorter fixation of vat dyes.

At present the process is limited to pale and medium shades, as the solubility of the direct colours available has to be taken into account. Direct dyestuffs vary enormously in the time they require for good fixation and shade production. Some require less than a minute, others require as long as 25 minutes. This will involve a search for a comprehensive range of quickly fixed colours, possessing good solubility and suitable for fabric intended for a crease-resist finish.

Development of Vinylon

By T. Tomonari

Vinylon is the generic name of polyvinyl alcohol fibre, which has been commercially produced in Japan for four years. The production of this fibre reached 8,600,000 lb. in 1953 and further increase is expected in the coming years.

Polyvinyl alcohol and its fibre may be characterised by its water sensitivity; it swells and dissolves in water, but it can also be made water resistant. Not only water sensitivity but other properties can be changed or improved by means of physical and chemical modification, based on the chemical reactivity of hydroxyl groups in the polyvinyl alcohol molecule. Thus, various kinds of vinylon with different characteristic properties are obtained.

In improving elastic resilience, dyeing properties, wet-heat resistance, hydrophilic properties, etc., constant progress is now being made. By blending or mixing with wool, cotton, rayon, acetate, nylon or other fibre, the property of the blended or mixed fabric can be much improved.

The Dyeing of 'Orlon' Acrylic Fibre & 'Dacron' Polyester Fibre & Blends with Other Fibres

By J. F. Laucius and Paul L. Meunier

Since the introduction of nylon, the first truly synthetic general purpose and textile fibre, much research has been done on new fibres having valuable properties for various end uses. The blends in particular are enjoying considerable popularity because of added functional properties or for economic reasons. Many problems in dyeing are being solved as they arise, so that the overall picture will change as new dyes and new dyeing procedures are developed and introduced.

'Orlon' Type 42 dyes only pale to light shades with disperse dyes. These dyes exhibit good washing and surprisingly good light-fastness. For deeper shades, the basic

dyes are recommended since they build up better than disperse dyes and good washing-fastness and light fastness are obtainable. Experience in dyeing other fibres with this class of dyes has been characterised by poor fastness to light. However on 'Orlon' good light-fastness is obtainable. Examination of light-fastness exposures of Du Pont Basic Yellow OL and Auramine at 5 and 20 hours shows Auramine to be considerably darker while Du Pont Basic Yellow OL is unaffected. At 5 and 25 hours exposures of Du Pont Basic Blue OB versus 'Lithosol' Blue 6GL, most of the old colour is destroyed, while the Basic Blue OB is unaffected. Washing-fastness (70°) of this and other basic dyes on 'Orlon' is good to excellent.

Basic dyes are applied from a dyebath containing acetic acid, sodium acetate, and an aliphatic nonionic surface active agent, and the dyeing should be made as close to the boil as possible. Use of higher temperature increases the dyeing rate. With the available colours, most popular shades can be obtained.

Acid Dyeing

'Orlon' has been dyed with cuprous ion formed from cupric sulphate by means of hydroxylammonium sulphate, sodium bisulphite, and glyoxal. Hydroxylammonium sulphate is used at the boil while sodium bisulphite or the mixture of sodium bisulphite and glyoxal is used at temperatures up to 110°. The use of the latter mixture of reducing agent is especially useful since it gives an ideal reducing system leading to more level dyeing.

Blends of 'Orlon' Type 42 and wool can be dyed efficiently by using basic dyes on the 'Orlon' and acid dyes on the wool with specific auxiliaries in the dyebath. Since acid dyes do not stain 'Orlon' acrylic fibre, it is a simple matter to dye the wool with desired acid colours. It is obvious that contrasting shades are easily obtainable. This process is enjoying considerable usage in the United States.

'Orlon' may be dyed in light shades with disperse dyes and cellulosic fibre with direct colours in a single bath. In applying basic colours to the 'Orlon,' a one-bath two-step operation is indicated as outlined. For heavy shades cuprous ion may be used with acid dyes to dye the 'Orlon', followed by dyeing the rayon in the second bath in the presence of an organic sequestering agent, such as 'Versene.' Where vat colours are desired for rayon or cotton, basic colours are dyed first, followed by the vat dye.

'Dacron' is dyeable only with disperse dyes. The development of 'Latyl' dyes has given impetus to dyeing this fibre because of their superior properties, especially good to excellent light-fastness and very good dispersibility in the dyebath.

A number of efficient carriers are used for dyeing various forms of 'Dacron.' Benzoic acid gives the best quality dyeing but it is expensive. Since it can be easily scoured with alkali from the fibre, its use does not lower light-fastness of the dyeings.

Chlorinated benzenes are toxic but are useful for dyeing rawstock and top. In dyeing piece goods they present difficulties since immiscible oil formed in dyeing equipment by condensation may drop on to fabric thus causing a carrier spot.

o-Phenylphenol used as sodium salt (Dowicide A) is the most widely used carrier because it is cheap and available in commercial quantities. Although it is difficult to scour from the fibre, many shades with good light-fastness are obtainable.

Much 'Dacron' polyester fibre is being dyed without carrier at temperatures of about 120° in circulating machines and the use of the Barotor pressure dyeing machine for fabric dyeing is being demonstrated on a mill scale. A complete shade range of dyes is available.

The Thermosol process of applying disperse and vat dyes is being studied but has not reached commercial acceptance.

Congress Resolutions

At the closing session of the congress on 3 June the following resolutions were approved:—

(1) This congress has examined the whole field of progress of man-made fibres. The producers consider it of prime importance to watch scrupulously over the quality of their products. Producers and users, conscious of the possibilities of developing man-made fibres, appreciate the need to pursue all forms of investigation which could improve the quality and use of these textiles. Scientists and manufacturers should combine their efforts to effect these improvements.

(2) The congress, considering that the development of the textile industry depends

increasingly on scientific research, believes that it is of the highest importance for the textiles of the future that collaboration should be intensified between textile laboratories and institutes and users of man-made fibres.

(3) The congress, considering that for many countries man-made fibres are by reason of their essential character the 'natural textiles' of these countries, believes it opportune that the attention of governments should be drawn to the need to treat all fibres in a non-discriminatory manner.

(4) The congress, considering that man-made filaments and fibres by reason of their characteristic properties offer numerous possibilities for production of new articles to meet the most exacting requirements, believes that the study of the most suitable types of textile articles should be pursued actively in close collaboration with administrations and public services, whose attention should be drawn to the advantages which they can obtain from a revision of their specifications for such articles following the lead of certain countries.

(5) The congress, considering that the use of man-made fibres permits a great variety of mixtures, either between one type of man-made fibre and other types, or between man-made and natural fibres, considers that blends and mixtures should be further developed with the aim of creating fabrics which take judicious advantage of each component to obtain a final product best suited to meet the consumers' needs.

Collaboration Emphasised

(6) The congress, considering that the quality of a textile article is not the result only of the properties of the fibres employed but depends also on the type of equipment used, believes that the importance should be emphasised of continuing close collaboration between users of man-made fibres, manufacturers of textile machinery and producers of these fibres.

(7) The congress, considering the diversity of finishing treatments for application to textiles of man-made fibres which themselves have diverse properties, believes it necessary to intensify the exchange of information and collaboration between the various sections of the industry.

(8) The congress, considering that the evolution of the modern way of life requires the creation of more varied clothes, considers that it is essential for new fabrics to be created to produce more comfortable clothes for present-day requirements.

(9) The congress, considering that the survey of achievements in all countries shows that the use of man-made filaments and fibres has led to remarkable successes in the field of industrial applications, believes that such applications are of interest to industry generally and that wider collaboration will lead to the development of new articles of improved serviceability.

Statistics Called For

(10) The congress, considering that it is important to have better statistics available covering the production, the development of consumption and the end use of the various textile fibres, that these statistics should include figures for the spinning, weaving, finishing, wholesale and retail trading industries, and that it is essential that if these statistics are to be used to the best advantage they should (as far as possible) be compiled on a uniform basis, hopes that the principal official and industrial textile bodies will co-operate with the object of providing these statistics.

(11) The congress, considering that a certain confusion exists at present in the terminology of man-made fibres, believes that it is essential for the International Rayon & Synthetic Fibres Committee to try to establish, in conjunction with the principal official and industrial bodies, an international terminology for these materials.

(12) The congress, considering that the official or other regulations concerning labelling, in force or in prospect in a large number of countries, often vary, believes that the study of labelling should be followed up in cooperation with the textile and standard organisations and national and international bodies concerned, and that in the countries which have adopted regulations in this field or which do so in future such regulations should cover all textile fibres, preferably in a uniform and non-discriminatory manner.

(13) The congress requests the International Rayon and Synthetic Fibres Committee to take the opportunity, in forming a Joint Committee with the users' organisations, to study the problems of terminology and informative labelling and in arranging international exchange of information on experience in this field.

Stole Ink Formulæ from His Firm

Industrial Chemist Given Conditional Discharge

CHEMICALS, formulae and ink, valued at £17, belonging to his employers, Watson's Drawing Ink Co. Ltd., of Retford, were alleged to have been stolen by John Hastings-Long (21), of Aston Drive, Leeds, when he appeared at Retford Court, on 31 May. Accused was granted a conditional discharge, the chairman of the Court, Mrs. K. L. Kayser, remarking that they were giving him 'a real chance.'

Prosecuting, Supt. R. S. Dams said that Hastings-Long was employed as a chemist by Watson's and specialised in research and the manufacture of ink for ball-point pens. It was realised by Mr. B. L. Kidney, sales manager, that chemicals were being stolen and suspicion fell on Hastings-Long.

Formulae Found in Bag

Later, Mr. Kidney found in a bag belonging to Hastings-Long a number of formulae relating to inks which were the property of the firm. He reported the matter to the police.

Police stopped Hastings-Long as he was about to take a train for Leeds. He had the formulae in his possession and said to the police: 'I have a perfect right to take these papers, as I do a lot of studying at home.' Hastings-Long also said that he had a right to take ink from the works to his home, because he had not time to do all his experiments at the Retford works. Taken to Retford police station and confronted by Mr. Kidney, he admitted that he had taken chemicals from the works and had made them up into samples of ink which he sent to other firms.

Supt. Dams said that Hastings-Long made two voluntary statements in which he said he had been unhappy at Watsons and had been worried financially. Hastings-Long added: 'I visited Mr. Jack Keech, of Leeds Ink Company, and put a proposal to him that we should form a company and set up in opposition to Watsons.

'This was agreed upon, but there was to be no connection between myself and the new company until such a position was arrived at that I could be assured of a salary through the proposed company. I removed from Watsons many items, including chemicals, which I used in furthering the interests of Leeds Ink Company. Mr. Keech was quite unaware that the materials were coming from Watsons.'

Supt. Dams added that while at Retford, Hastings-Long, whom he described as a very clever chemist, was earning £500 a year and bonuses. This was the first time he had ever been in trouble.

For Hastings-Long, Mr. F. D. R. Loy, Leeds, described the thefts as 'stuplid.' Even now Hastings-Long did not know why he had committed them. The formulae were not trade secrets — they could be obtained through I.C.I. — and the chemicals were obtainable anywhere.

'This was a very foolish theft,' he added, 'for Hastings-Long had nothing to gain by taking these things. It seems to be the act of a very foolish young man, an act which will go against him for the rest of his life.'

Granting Hastings-Long a conditional discharge, the chairman (Mrs. K. L. Kayser) said that they were giving him 'a real chance.'

'But you committed a serious crime,' she added. 'You took these things home with you and used them to the detriment of the firm by whom you were employed. We do not want to make things too hard for your family,' she said, 'or pull you downhill. We would rather help you build up your character again.'

I.C.I. at Bath & West Show

Imperial Chemical Industries Ltd. were represented at the Bath and West Show, on a composite site, by their plastics division, metals division, Imperial Chemical (Pharmaceuticals) and Plant Protection Ltd. Products which were displayed in the plastics division included 'Alkathene' tubing for cold water services, and corrugated 'Perspex' for roof lighting for farm buildings and outhouses. Imperial Chemical (Pharmaceuticals) demonstrated also many products of interest to the dairy farmer, including 'Phenovis' brand phenothiazine for the treatment of worms, 'Cetavlon' M.C. for the prevention of mastitis, and 'Minel,' a combined worm and fluke remedy for sheep and cattle.

HISTOCHEMISCHE METHODEN. A Collection by W. Lipp. Part 1. R. Oldenbourg, Munich. 1954. Pp. 24. DM. 6.

Histochemistry, the detection of chemical substances in histological preparations, is a branch of microscopic research methods which is undergoing considerable development. This is the first part of a collection of histochemical methods, it being intended to publish 6 parts annually. Topics to be covered in this and subsequent issues include the preparation of histological specimens and reagents and the detection of elements, inorganic groups and compounds and such organic substances as proteins, polysaccharides, nucleic acids, fats and lipoids, vitamins, enzymes, hormones and pigments. The use of physical methods such as fluorescence microscopy, spectroscopy and radiography will also be included.

This first part gives details of the preparation of Schiff's reagents and methods of detection of potassium, arginine, carbohydrates, esterases, mercaptans and thioketones. Alternative methods are given in some cases and the references, some of which are very recent, include a number from British and American journals. This, and subsequent issues, should be of interest to those engaged in histological studies of a chemical nature.—W.R.M.

YEAST TECHNOLOGY. By John White. Chapman and Hall Ltd., London. 1954. Pp. 432 + xvi. 55s.

If technology is defined as the study and application of methods whereby a traditional industrial art is transformed into an applied science the inclusion of this term in the title of Mr. White's book is notably apt. In his work the author has assembled many matters of physical, chemical and biological provenance relating to what was once an industrial art, and he has provided a logical and very readable account of the transformation of the primitive production of 'leaven' into the highly efficient, scientifically controlled manufacture of *Saccharomyces cerevisiae* in pure culture on the enormous scale we know today.

The book opens with chapters on yeast classification and physiology and continues with an outline of modern practice in the production of baker's yeast. Chapters follow on the nutrilites important in the production of yeast, and on the methods used in the industry for the determination of biotin, pantothenic acid and inositol. Various aspects of yeast physiology are then discussed and the influence of temperature and aeration on the fermentation is described. While the emphasis in this book is largely on the baking strain of *Saccharomyces,* chapters are included on food and fodder yeasts, on brewer's yeast, on yeast genetics, on the water content of yeasts, on yeast products, on panary fermentations, on effluent disposal and on yeast osmosensitivity.

The whole work summarises the knowledge which has enabled the industry to progress from the early Vienna process of 1860, in which the fermented malted grain was subjected to gentle aeration, to the modern methods now used in which the yields are ten times those obtained ninety years ago.

The book would be of even greater interest to workers in allied industries if the biochemical engineering side of yeast technology were dealt with in greater detail. A high degree of aeration is necessary in the manufacture of antibiotics and for the controlled growth of organisms of such importance as the *Aspergilli* and the *Acetobacteria.* It is perhaps not quite as critical in the production of yeast, but the variation in yield with aeration is nevertheless very striking, and a more detailed description and evaluation of aerators such as spargers, stationary and rotary ceramic candles, sintered metals, marine-type propellers and turbo-aerators would be welcomed.

Such highly important matters as sterility and the industrial possibilities of continuous fermentation also deserve a more thorough examination. The maintenance of sterility on a large scale is still both a practical and an economic difficulty in this as in other fermentations, and all the precautions taken in the industry to prevent ingress of infecting material should be described. Continuous fermentation has been manifestly successful at Porton and an account of similar work carried out with yeast on a pilot scale would be a valuable addition to the book. Unfortunately much pertinent information on such matters is inaccessible; the somewhat scanty treatment given to them here should not in any way be allowed to detract from the value of the remainder of this meritorious work.

The book will appeal strongly to most scientists engaged in the food industry and it is particularly recommended to all chemists and biologists who have to deal with the problems of fermentation.—J. G. BARNES.

A NEW PERIODIC TABLE OF THE ELEMENTS. By S. I. Tomkeiff. Chapman and Hall, London. 1954. Pp. 34. 10s.

This can hardly be called a book, but seems to be too unwieldy, with a page size of 13 in. by 12 in., to be referred to as a pamphlet. Its aim is as indeterminate as its category, but it is probably an attempt to introduce a cone-shaped form of the periodic classification to geologists. The first half-dozen pages are devoted to an introduction to atomic structure, leading up to an elementary qualitative account of *s*, *p*, *d* and *f* levels. Fourteen pages are lavishly used to present a table of the elements, in order of atomic number, which provides a heterogeneous miscellany of information such as the symbol, atomic weight, isotopes and their relative abundance, electronic structure, valency, colour, year of discovery, and derivation of the name. Two pages present an account of various types of the periodic classification which is quite inadequate for a critical assessment of the value of the cone-shaped form. This latter form is itself described in four pages, a large area of these being occupied by two-colour diagrams. The final two pages offer black-and-white representation of the classification and a multicoloured representation with respect to the distribution of weak and strong acids and bases, the latter of which is intended to be detached and formed into a cone.

As is well known, practically every form of the periodic classification stresses some relationships satisfactorily. The present one is no exception. It is doubtful, however, whether the elaborate contour maps which are instanced as representing the distribution of the specific gravities of the solid elements, the hardness of minerals, or the composition of meteorites, do anything to add to our existing knowledge of these matters or to classify our existing knowledge more vividly or compellingly.

It is stated that the only isotopes listed in the Table of Elements are the stable ones or the long-lived alpha-emitters; but the radioactive isotope of potassium, ^{40}K, for example, is included, without any indication that it is a beta-emitter. The multicoloured diagram showing weak and strong acids and bases ignores the existence of amphoteric character or of several oxides of differing nature for various elements; and the inclusion of copper and silver, for example, among the strong bases, is hardly in accordance with accepted chemical usage.

The list of 10 books in physics and chemistry, given as further reading on the periodic classification, is unfortunately chosen, including as it does one book over 20 years old and at least three of which the newest editions are not quoted although in each case they appeared a year or more ago. In view of the rapid advances in our knowledge of the structure of matter over the past two or three decades this does not inspire confidence. It could, with some justice, be argued that theoretical chemistry for scientists outside the field, although simplified, should, if possible, be even more up-to-date than chemistry for chemists, since the readers may not be equipped with the fundamental background which would enable them to judge any new theory.

In any case, the entire contents of the book, with the exception of the two full-size charts, could well have been confined, even in their present content, to a very much smaller space without any serious loss in readability and with a great gain in convenience of handling. It is probable that the only purpose of this book for chemists will be to remind them rather nostalgically of the spate of novel forms of the periodic table which appeared in the early years of this century.—CECIL L. WILSON.

HYDROCARBONS FROM PETROLEUM. The Fractionation, Analysis, Isolation, Purification and Properties of Petroleum Hydrocarbons. By Frederick D. Rossini, Beveridge J. Mair and Anton J. Streiff. A.C.S. Monograph No. 121. Rheinhold Publishing Company, New York; Messrs. Chapman & Hall, London. Pp. 554. 148s.

This book 'brings together the results of more than 300 man years of work which has been performed since 1927 by the API Research Project No. 6 on the composition of petroleum, the development of fractionating processes, the purification and purity of hydrocarbons and the measurement of the physical properties of hydrocarbons. This information is at present scattered among approximately 140 publications.' The book consists of 27 chapters, the first 10 dealing with methods of separation, the next seven with determination of physical constants and purification, and the last 10 with the analysis of different materials such as the gasoline fraction, kerosene and gas oil fractions, etc., and hydrocarbons in different crude oils. Reference is made to other workers in the field of hydrocarbon analysis only where their work has a bearing on the work of the API Research Project, except in chapter 18 where a brief summary is given of the work of other laboratories on the composition of petroleum.

The book is essentially an account of the practical work undertaken by the Project 6 workers during the past 26 years. Details are given, with working drawings, of various fractionating columns, still pots, density balance, freezing point equipment, etc. Methods of testing column efficiency and of determining the purity of hydrocarbons isolated are given in full. The analyses include gasolines from different crude oils, alkylates, hydroco-dimers and co-dimers. The physical constants established for the pure hydrocarbons isolated from petroleum are used in the identification of fractions obtained by high efficiency fractionation.

The work of the API Project 6 has set new standards in the accuracy of physical constant measurements and much of the apparatus and methods given in this book have already achieved wide acceptance and usage throughout the hydrocarbon industries. API data has become the standard to which reference is normally made. It is therefore particularly valuable to have collected within one book the whole of the experimental techniques, analysis and data established by the API Project 6. Unfortunately this has resulted in a price outside the reach of students and perhaps beyond the pocket of individual chemists and physicists in the industry. It is, however, an important addition to the library of all laboratories concerned with the separation and purification of hydrocarbons.—F. MORTON.

CHEMISTRY OF CARBON COMPOUNDS. Volume II. Part B. Edited by E. H. Rodd. Elsevier Publishing Company, Amsterdam. Distributed by Cleaver-Hume Press Ltd., London. 1953. Pp. xvi + 604. £5 5s.

As each volume appears in this first-class series of reference books devoted to organic compounds it is assessed according to the very exacting standards which have come to be expected from the E. H. Rodd-Elsevier combination, and no greater tribute can be paid to Volume IIB than to record that it passes this critical test with ease.

In Part A, the simpler alicyclic compounds were described, and now attention is turned to the more complex members of this group which are of great biological significance. The first five chapters, covering about 270 pages, have been written by D. H. R. Barton and (in part) S. H. Harper, who unfold logically the story of the mono-, sesqui-, di- and tri-terpenoids. The remainder of the text is contributed by C. W. and Eileen Shoppee and covers such compounds as the sterols, bile acids, sex hormones, adrenocortical hormones, cardiotonic glycosides and aglycones, toad poisons, and steroid saponins. The printers were set a very difficult task with hundreds of complicated structural formulae and merit hearty congratulations for the excellent manner in which they have accomplished it; an abundance of neat and clear formulae greatly facilitates the understanding of each of these fields.

Every endeavour has been made to bring the subject matter as nearly as possible up to date. The literature was initially covered in detail up to the end of 1949, and additional references to work published up to June, 1953, were inserted at the proof stage. At least one organic chemist derives great pride and comfort as he sees the volumes increase on his book-shelf.—E.J.B.

HOME

New London Sales Office

The British Chrome and Chemicals Ltd., parent company of the Eaglescliffe Chemical Co. Ltd., of Eaglescliffe, Stockton-on-Tees, Co. Durham, have opened a new sales office at 6 Arlington Street, London, S.W.1.

Technical Palm Oil

The Ministry of Food have announced that they will still have some technical quality palm oil for delivery after 12 June, 1954, when allocations of technical oils come to an end. Subject to availability, orders for this product will be accepted up to 21 June, for delivery not later than 31 July at £68 per ton in bulk on a basis of 18 per cent ffa.

New Premises in London

Kirby Chemicals Ltd. have begun work at their new premises in 5 Rampayne Street, London, S.W.1, which they have been installing since the company was formed last year. The firm is engaged in the preparation of new chemicals in development and evaluation quantities, and their new laboratories have been specially designed for the rational manufacture of such products on a pilot scale.

Synthetic Rubber Imports

The Board of Trade announce that they are prepared to consider applications to import certain types of synthetic rubber from dollar sources during the six months ended 31 December, 1954. Separate applications for each type of synthetic rubber required, supported on this occasion only by full information about the purpose for which the material is to be used, should be submitted on Form ILB/A and should reach Branch 1A, Ministry of Materials, Horse Guards Avenue (Room 9380), London, S.W.1, not later than 15 June.

Bakerian Lecture

The Bakerian Lecture of the Royal Society will be presented on Thursday, 17 June, 1954, at 4.30 p.m. in the Society's apartments at Burlington House, London, by Professor A. R. Todd, F.R.S. The subject of the lecture is 'The Chemistry of the Nucleotides' and Professor Todd will review recent work with especial emphasis on the synthetic approach to the nucleotide coenzymes and its possible biological implications.

Man-Hour Production Rise

Man-hour production in the fertiliser section of the Billingham works of Imperial Chemical Industries Ltd., has been raised two-and-a-half times since 1946, says the British Productivity Council pamphlet, 'A Review of Productivity in the Fertiliser Industry' published on 31 May.

University Status for Hull

The University College of Hull, founded in 1928, has been granted full university status. The present Principal, Mr. J. H. Nicholson, becomes first Vice-Chancellor, and Lord Middleton, Lord Lieutenant of the East Riding, becomes Chancellor.

More Bradford By-Products

A substantial order for 5,000 gal. has been received by the Bradford Corporation By-Products Department, from the Ministry of Food, Meat and Livestock Division, at Guildford, for the newly-developed sheep-branding fluid which can be applied to a wet fleece.

Oxford Accepts Gifts

In Congregation at Oxford on 1 June a statute was promulgated accepting the offer of the Pressed Steel Company to establish a readership in metallurgy to commemorate its late managing director, Dr. George Kelley. The University also accepted a gift from the Wellcome Trustees of £10,000 for the purchase of the lease of a house and its adaptation for use as a laboratory of human nutrition.

Atomic Power Station Growing

Eight heat exchangers, 80 ft. high, are now under construction at the Renfrew works of Babcock & Wilcox Ltd. for Britain's first atomic power station at Calder Hall. Hot carbon dioxide under pressure will be continuously circulated from the reactor to provide superheated steam to the turbines. The contract allocated to Babcock & Wilcox includes the complete steam towers and their associated feed pumps. The reactors are being built by the Department of Atomic Energy, and the pressure vessel or outer shell for the reactors by Whessoe Ltd. The circulating gas blowers and pipework are by C. and A. Parsons & Co. Ltd., who are also supplying the turbo-alternator plant. The main contractors are Taylor Woodrow.

• OVERSEAS •

US Magnesium Less

USA production of primary magnesium during the first quarterly period of this year totalled 18,848 tons according to the Bureau of Mines, Department of the Interior. This was 187 tons below the figure for the last quarterly period of 1953.

Under-Sea Search for Oil

Commander J. Y. Cousteau, famous under-water 'explorer' has been commissioned by D'Arcy Exploration Company, the prospecting subsidiary of Anglo-Iranian Oil Company, to investigate the waters off Abu Dhabi in the Persian Gulf. Commander Cousteau with his team of divers, operating from the research vessel *Calypso*, will examine the sea-bed in waters up to 250 feet in depth and bring to the surface specimens for checking by the company's geologist.

Canadian Petrochemical Plant

Negotiations are in progress for construction of a large petrochemical plant in Southern Alberta. The New British Dominion Co. and a large US chemical firm are expected to share principally in the multi-million dollar project. Chief product will be ammonia for which a growing demand exists in mid-continent United States, as a chemical fertiliser. Basic raw material will be derived from the substantial natural gas reserves in the Etzikom area of South-Eastern Alberta. The Etzikom field is estimated to contain gas reserves of some 108,000,000,000 cu. ft.

Israeli Progress

Big strides are being made by Israel's chemical industry, according to recently released figures. The output of sulphuric acid by Chemicals and Fertilisers Ltd. was almost 3,300 tons in January (against 950 tons in January, 1953), and 6,800 tons of superphosphates were produced (2,635 tons in January, 1953). In the ceramic industry output of ball and fire clay averaged 550 tons in recent months as against 110 tons a year ago. The output of quartz sand, used as raw material for glass production, rose by 10 per cent in 1953 but is very irregular.

Liquid Synthetic Rubber

Developed by D.P.R. Incorporated, Belleville, New Jersey, is a liquid synthetic rubber material which can be added to resins and adhesives to give them rubber-like qualities. The material is said to be easily modified in form and is therefore especially suitable for a wide range of compounds.

Terylene Very Soon

Imperial Chemical Industries of Canada are expected to produce the first Canadian Terylene from their $20,000,000 plant at Millhaven, Ontario, at the end of June. Full production and employment of 1,000 workers is expected by September, 1955. The production has already been sold to a long list of customers previously served through importation from Britain.

Canada's Exports to Russia

Canada's exports to Russia may rise to a seven year high this year mainly because of one controversial item—rayon woodpulp—which, experts say, can be used either for textile production or gunpowder. Disclosure that Russia is buying rayon woodpulp from Canada was made in a recent parliamentary return, stating that the Government has authorised the export of 9,850 tons to the Soviet since last January. The shipments, approved by the Trade Department which maintains the export ban on strategic goods, total $1,678,000. If all that amount is shipped this year, and this is likely, Canadian exports to Russia, through that single item, will rise to the highest level since $4,900,000 worth of goods were shipped in 1947.

Pakistan Gas Pipeline

The World Bank has made a loan of £5,000,000 to SUI Gas Transmission Company for the construction of a natural-gas transmission line in West Pakistan. Total cost of the project has been put at about £9,000,000. Sterling for the loan has been made available to the bank by Britain out of its sterling subscription to the bank's capital.

• PERSONAL •

MR. ALEXANDER WATERSTON, a director of the Esso Petroleum Co. Ltd. since 1938, has retired after 40 years' service with the company. A Scotsman by birth, Mr. Waterston began his career in the company's Glasgow office in 1914, and after war service with the Royal Artillery he rejoined the company in 1919, eventually becoming branch manager in Glasgow. He was appointed general sales manager in London in 1934, and after a brief period in Europe, where he studied marketing operations of the French and Italian affiliated companies, he was made a director.

MR. GEORGE M. WALKER, vice-president and general manager, chemical division, Koppers Company Inc., has been elected to the board of directors of the Manufacturing Chemists' Association in Washington. Mr. Walker, whose headquarters are in Pittsburgh, Pa., will fill the unexpired term of the late Mr. Dan M. Rugg, also of the Koppers Company.

The directors of Glaxo Laboratories Ltd. announce that MR. WALTER JOHN HURRAN, B.Sc., F.R.I.C., has been appointed an executive director. He was until recently managing director of the company's New Zealand subsidiary.

In Convocation at Oxford on 15 June it will be proposed that the honorary degree of Doctor of Science be conferred upon SIR HAROLD SPENCER JONES, F.R.S., Astronomer Royal; SIR BEN LOCKSPEISER, F.R.S., secretary of DSIR; and SIR JOHN LENNARD-JONES, F.R.S., Principal of the University College of North Staffordshire. The degrees, if approved, will be conferred before the formal opening on 1 September in the Sheldonian of the British Association meeting. It will be a departure from precedent for the ceremony to take place in the evening.

MR. M. E. O'K. TROWBRIDGE has been appointed general sales manager of Sharples Centrifuges Ltd., of Woodchester, Stroud, Glos. Mr. Trowbridge recently returned from a tour of the company's extensive operations in the US, where he made a study of recent developments in separational techniques.

MR. LESLIE O'CONNOR has been appointed chairman of the Council of the British Coke Research Association in succession to MR. G. A. HEBDEN, who has retired after serving as chairman for five years. SIR CHARLES ELLIS, the scientific member of the National Coal Board, DR. R. J. MORLEY, director-general of carbonisation, National Coal Board, and MR. S. KELLETT, of the South Yorkshire Chemical Works, have been appointed members of the Council.

MR. C. F. THRING, assistant secretary of Billingham-on-Tees Division of Imperial Chemical Industries Ltd., is a candidate for a by-election in the Norton area, for Durham County Council.

MR. P. J. C. BOVILL, an assistant managing director and a local director of Newton, Chambers & Co. Ltd., and general manager of the company's chemicals branch, has been appointed a county magistrate in the West Riding of Yorkshire. He went to Thorncliffe in 1922, entered the service of Thorncliffe Coal Distillation Ltd. (then newly-formed) and became general manager of the chemicals branch in 1941.

SIR JOHN CARGILL, Bt., formerly chairman of the Burmah Oil Company, the Assam Oil Company, and Scottish Oils, and formerly a director of the Anglo-Iranian Oil Company, who died on 29 May, aged 87, left personal estate in England and Scotland valued at £296,765. His many benefactions included £20,000 to Glasgow University to found a Chair of Applied Physics.

Obituary

The death has occurred in Glasgow of MR. ALFRED R. CAMPBELL, who was a partner for 25 years in the firm of R. R. Tatlock & Thomson, analytical chemists, Glasgow. He took an active interest in various local chemical organisations and was a former gas examiner for Glasgow and neighbouring gas undertakings.

Publications & Announcements

THE latest (March) issue of the Bulletin of the British Whiting Research Laboratories, published by the Research Council of the British Whiting Research Federation, 245 Ampthill Road, Bedford, is made up mostly of classified abstracts from recent literature. There is also a list of additions to the library since the date of the previous bulletin.

* * *

THE first 1954 issue of *Oil*, the journal of the Manchester Oil Refinery group of companies, Premier House, 48 Dover Street, London, W.1, is as well illustrated and attractively produced as usual. Among the articles are one entitled 'Building An Oil Refinery,' by H. E. Charlton, and another describing the first fully automatic oil blending plant in Britain—at Manchester.

* * *

FIVE lectures delivered at the Institution of Metallurgists' annual refresher course in 1953 by experts in their own fields of knowledge have been reproduced in the form of a book, 'The Microscopy of Metals,' which is fully illustrated. Copies of the book, price 15s. 6d., are obtainable from the Registrar-Secretary, Institution of Metallurgists, 28 Victoria Street, London, S.W.1.

* * *

A NEW electric oven made to stand on a heat-insulated floor for charging at floor level has been designed by The General Electric Co. Ltd. The design greatly facilitates the use of bogies which can be moved directly into the oven. By using two or more bogies the oven can be kept in continuous operation. To minimise heat losses through the walls the oven has a double-cased construction, the space between inner and outer casing being packed with a high grade refractory. Tubular heating elements are arranged in the oven walls behind baffles. A fan in the roof provides vertical forced air circulation down over the elements and up through the oven. This increases the rate of heat transfer to the charge and the overall efficiency, the forced air flow evening out the temperature distribution and reducing temperature gradients in the oven to a minimum. The oven can be supplied in a wide range of sizes to operate at temperatures up to 250°. An oven with internal dimensions of 5 ft. 8 in. high by 3 ft. by 3 ft. will probably have a rating of about 16 kW, the exact loading depending upon the nature of the charge and the permissible heating time.

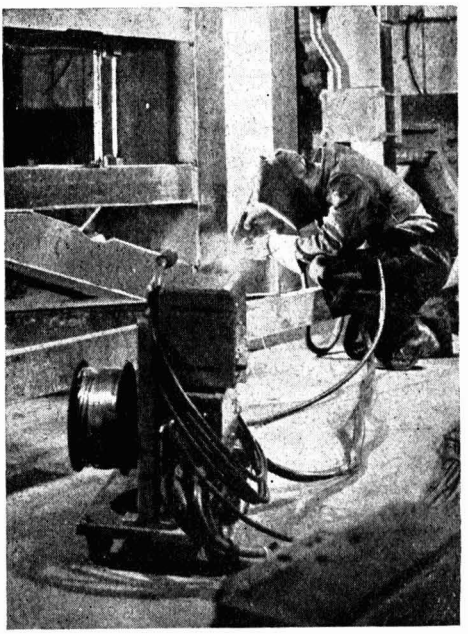
The new GEC oven which is designed for charging at floor level. By using two or more bogies the oven can be kept in continuous operation

RECEIVED from British Unicorn Ltd., 36-8 Southampton Street, London, W.C.2, is a pamphlet describing beryllium-nickel alloys made by the Beryllium Corporation of Reading, Pennsylvania. These alloys have proved their worth in casting applications, where parts may be produced which can be heat-treated to excellent physical properties. Wearing qualities are excellent, and corrosion resistance is what would be expected of a high-nickel metal.

* * *

THE first number of Volume 6 of 'Hungarian Technical Abstracts,' a quarterly bulletin issued by the National Technical Library of Hungary, includes among its varied contents numerous abstracts relating to physical chemistry, chemical technology, metallurgy, etc. Further information is obtainable from the editorial office, Rakoczi-ut 5, Budapest, VIII.

THE Quasi-Arc Co. Ltd., Bilston, Staffordshire, have announced that from 1 June they are the licensees in Great Britain and the Commonwealth (excluding Canada) for the Sigma shielded inert gas metallic arc welding process. Sigma welding equipment, with DC selenium plate rectifier power packs, is now available from Bilston. The Sigma process provides sound and speedy welding on aluminium alloys and corrosion resisting steels in particular, and Sigma equipment—with a light, easy to handle, water cooled torch, and remote control for the welding wire speed placed conveniently near to the operator—is compact and efficient in use.



Quasi-Arc Sigma shielded inert gas arc welding in use

* * *

HIGH purity, low cost: that is the claim of the Power-Gas Corporation Ltd. for their package carbon dioxide plant. In order to meet the rapidly increasing demand for pure CO_2 in foodstuffs and beverage industries, and in other applications, this company is manufacturing mobile or semi-mobile plant producing CO_2 in either liquid or gaseous form. The equipment incorporates the results of the latest research into the production of carbon dioxide from oil fuel. Two standard sizes are manufactured, one designed to produce 150 lb. per hour, and the other 300 lb., but one producing 50 lb. is also available. A pamphlet describing the equipment is obtainable from the company at Stockton-on-Tees.

* * *

FOR the progressive non-destructive verification of welding quality during plant construction, a new field engineering radiographic unit has been made available by the Power-Gas Corporation Ltd. and Ashmore, Benson, Pease & Co. Ltd., of Stockton-on-Tees. The equipment and methods used vary according to the type of work under examination. Depending on the gauge and size of the work, the materials involved, and the method of production, choice is made of X-ray photographic units ranging from 150 kV to 300 kV or gamma-ray photography using one of the radioactive isotopes iridium-192, thulium-170 or cobalt-60. Details of hire arrangements may be obtained from the owners of the unit.

* * *

TO give the very many users of oil products, who may have only a very slight understanding of the way in which those products are made available to them, an insight into the long sequence of operations involved, the Petroleum Information Bureau, 29 New Bond Street, London, W.1, have brought out an illustrated booklet entitled 'The World of Oil.' Copies may be obtained free from the Bureau.

* * *

REPRINTED for the third time is 'Cabot Carbon Blacks under the Microscope,' from Godfrey L. Cabot Inc., Boston. Forty-one grades of black are described, suitable for colours, inks and rubber, and an appendix gives details of the analytical procedures employed and the use of the electron microscope with which the many illustrations were obtained.

* * *

GRIFFIN & Tatlock Ltd., Kemble Street, London, W.C.2, have a division specialising in the planning of laboratories and the manufacture of furniture for their complete outfitting for industry, education and research. Catalogue No. 16B-LF describes the organisation of a complete service covering all features of laboratory installation, and a copy of this catalogue, and advice on the design of new laboratories or the adaptation of old ones, may be obtained from the company at the above address.

Law & Company News

Commercial Intelligence

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

Mortgages & Charges

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

LUMEX (GREAT BRITAIN) LTD., Surbiton, manufacturers of luminous paint. 4 May, mortgage, to the National Provincial Bank Ltd. securing all moneys due or to become due to the bank; charged on factory premises on the south side of Davis Road, Tolworth, with plant fixtures, etc.

WESTMANCOTT (THERMOMETERS) LTD., London, E.C.—23 April, mortgage, to Martins Bank Ltd. securing all moneys due or to become due to the bank; charged on 31 Britton Street, Clerkenwell, with plant, fixtures, etc. *£569. 12 September, 1953.

Satisfactions

BRITISH CELANESE LTD., London, W. Satisfactions, 4 May, of first debenture stock registered 2 October, 1943, and 8 November, 1944, to the extent of £11,056 and of second debenture stock registered 24 September, 1946, to the extent of £550.

J. W. CHAFER LTD., Doncaster, chemical manufacturers and spraying specialists. Satisfaction 1 May, of mortgage registered 7 January, 1942.

MURGATROYD'S SALT & CHEMICAL CO. LTD., Sandbach. Satisfaction 14 April, of prior lieu loan stock registered 11 November, 1952; also satisfaction 20 April, of 'A' and 'B' debenture stock registered 12 August, 1947, and supplemental deeds registered 16 and 17 February, 1948, 8 November and 20 December, 1949, and 28 December, 1950.

Increases of Capital

The following increases of capital have been announced: MIDDLESEX OIL & CHEMICAL WORKS, LTD., from £5,000 to £20,000. COLTHURST & HARDING, LTD., from £185,000 to £295,000.

New Registrations

Cotton (Seaford) Ltd.

Private company. Capital £5,000. Wholesale or retail consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: Jas. A. F. Murray, Eileen M. M. Murray and Chas. R. Cotton. Reg. office: 44 Broad Street, Seaford, Sussex.

Phyllis Mainwaring Ltd.

Private company. Capital £400. Wholesale or retail consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: Mrs. Phyllis M. Mainwaring and Gwynfryn Williams. Reg. office: Shop No. 6, Morrison Road, Aberavon, Port Talbot.

Schimmel-Boehm Ltd.

Private company. Capital £1,000. Manufacturers of and dealers in essential oils, drugs, etc. Directors: Gert Keller and Paul E. Kunzer. Reg. office: 19 Bentinck Street, London, W.1.

Company News

A. Boake, Roberts (Holdings) Ltd.

A. Boake, Roberts & Co. (Holdings) Ltd., manufacturing chemists, have announced that they are redeeming their debentures on 30 June.

Bowmans Chemicals Ltd.

The board of Bowmans Chemicals Ltd. announces that at the extraordinary meeting held on 3 June the requisitionists of the meeting did not move the resolutions to remove certain directors. It was announced that proxies had been received for 175,515 shares against the resolutions and 11,480 in favour. Mr. John Boardman, representing the requisitionists, then said that, in view of those figures and the desire of Mr. D. A. Marsh-Smith and his family not to widen the family breach, the requisitionists deemed it right not to move the resolutions.

Coalite and Chemical Products Ltd.

With a final recommended dividend of 7 per cent (compared with 5 per cent the previous year), Coalite and Chemical Products Ltd. are raising the total for the year to 31 March, 1954, from 8 per cent to 10 per cent, less tax, on the £1,603,250 one-class capital. Trading surplus, after depreciation

and debenture interest, amounts to £477,494 (compared with £356,832) and the group net profit has increased from £152,827 to £183,267.

W. J. Bush & Co. Ltd.

W. J. Bush & Co. Ltd., manufacturing chemists, etc., are raising their annual dividend from 10 per cent to 12 per cent for the year 1953. The interim dividend was raised from 2 per cent to 2½ per cent, and now a final of 9½ per cent is recommended on the £250,000 ordinary shares and £350,000 'A' ordinary shares, against 8 per cent a year ago. Consolidated trading profit for the year was £636,861 (against £540,787 for 1952).

Shawinigan Chemicals Ltd.

The business of Shawinigan Chemicals Ltd. held up well during the first quarter, although the volume was somewhat affected by the general decline in the chemical industry. The newest of Shawinigan Chemicals' associated companies, Gelvatex Coatings Corporation, controlled by Shawinigan Products Corporation, New York, began production in its new plant at Anaheim, California. Production of weather-proof paints and industrial coatings is up to schedule. Shawinigan Products itself had sales about the same as in the corresponding period of last year, and Shawinigan Resins Corporation, at Springfield, showed an improvement. In Canada, Canadian Resins and Chemicals Ltd. reported sales considerably better than during the last part of 1953, although a little lower than during the first quarter of last year.

Market Reports

LONDON.—Activity on the industrial chemicals market has been fully maintained and the movement to the chief consuming industries has been of fairly substantial dimensions. A good inquiry is reported for raw materials for the paint and plastics industries, while steady deliveries continue to be made to the textile and finishing trades. Among the soda products both bichromate and chlorate of soda are in good demand, and the usual seasonal inquiry has been experienced for tartaric and citric acids. The only price changes of note have been in the compounds of lead, the latest basis prices being dry red lead £128 per ton, litharge £130 per ton, and dry white lead £133 15s. per ton. The coal tar products market has no outstanding features. The current demand for most items remains steady.

MANCHESTER.—The observance of the Whitsun holidays in Lancashire industrial towns has left its usual mark on business on the Manchester chemical market during the past week. New bookings, as well as deliveries under contracts, have been affected. Traders, however, are confidently looking for a resumption of active business early next week. The demand for fertilisers has, of course, also been affected by off-season influences and will probably remain relatively quiet for some time. A fair movement of supplies of most of the light and heavy tar products has been reported.

GLASGOW.—As compared with a falling off last week both in delivery and demand, this week has been extremely busy and, apart from a slight unsettlement in some of the metal salts in the earlier part of the week, prices have been firm. The demand for agricultural chemicals has, if anything, intensified and, apart from a slight seasonal easing in certain sections of the consuming trade, the majority report a very satisfactory period.

Next Week's Events

WEDNESDAY 16 JUNE

Royal Institute of Chemistry

London: 30 Russell Square, 8 a.m. Leave by motor-coach for visit to British Drug Houses Ltd., BDH Laboratory Chemicals Group, Poole, Dorset.

Society of Chemical Industry

Shinfield, Berks.: 11 a.m. Summer meeting of the Biological Methods Group at the National Institute for Research in Dairying, Shinfield, near Reading, Berks.

THURSDAY 17 JUNE

Royal Society

London: Burlington House, Piccadilly, 4.30 p.m. The Bakerian Lecture: 'Chemistry of the Nucleotides,' by A. R. Todd.

Royal Institute of Chemistry

Watford, Herts.: 2.30 p.m. Visit to John Dickinson & Co. Ltd., Croxley Mills, Watford, Herts.

FRIDAY 18 JUNE

Society of Chemical Industry

Nutfield, Surrey: Brewing Industry Research Foundation, Lyttel Hall. Visit by Microbiology Group.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

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

A **MAJOR OIL COMPANY** has a vacancy in **ADEN** for a **GRADUATE CHEMIST** with 1st or 2nd Class Honours. Applicants must be experienced in general industrial inorganic analysis, including knowledge of boiler water treatment and water testing generally. Age limit, 35. Attractive salary plus generous allowance in local currency, free passages, kit allowance, free medical attention, good leave arrangements, pension scheme. Write, giving personal particulars and details of qualifications and experience, quoting F.18, to **BOX 1145, c/o 191, GRESHAM HOUSE, E.C.2.**

THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS., requires a Senior Experimental Officer or Experimental Officer to undertake detailed flowsheeting and specification of new plant and equipment developed by chemical engineering scientists, for presentation to design mechanical engineers. Previous experience of this type of work is highly desirable. Applicants should have Higher School Certificate or Higher National Certificate or equivalent as a minimum qualification, or several years' experience in this type of work. The salary range for Senior Experimental Officer (minimum age for recruitment normally 35) is £982-£1,162 and for Experimental Officer (minimum age 26) is £690 to £850. Houses available within a reasonable period for married staff who live outside the Establishment's transport facilities. Application form from **ADMINISTRATIVE OFFICER (RECRUITMENT), A.W.R.E., ALDERMASTON, BERKS.** Quote reference 299/W.G.E./38.

CHEMIST/TECHNOLOGIST with experience of Rubber Latices, Dispersions, Adhesives and allied products is required by a public company in the Manchester area manufacturing for the rubber and associated industries. This is a completely new appointment and the successful candidate, who should be of approx. B.Sc. standard, will be required for technical development work in our laboratories and complete liaison with customers. The position provides excellent prospects for someone possessing the necessary experience and personality. Good commencing salary and participation in Staff Bonus and Pension Schemes. Full details should be given of age, education, experience and salary required. Our present staff is aware of vacancy. **BOX No. C.A. 3326, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

GRADUATE CHEMICAL ENGINEER required, having one to two years' industrial experience. The position involves technical and commercial operations and presents excellent opportunities for the right man. Write, stating age and giving full details of experience, to **SHARPLES CENTRIFUGES, LTD.** (Reference MEO'KT Confidential), **"TOWER HOUSE," WOODCHESTER, STROUD, GLOS.**

SITUATIONS VACANT

QUALIFIED ORGANIC CHEMISTS required, preferably with experience in petroleum technology and/or technology of fats. Salary according to age and experience. This appointment offers excellent opportunity for men to specialize in both academic and applied petroleum chemistry. Details to **DR. A. C. PEPPER, ALEXANDER DUCKHAM & CO., HAMMERSMITH, LONDON, W.6.**

SHIFT SUPERINTENDENTS, CHEMICAL WORKS IN WEST RIDING, at Kilnhurst and Knottingley. Duties include continuous supervision on shift rota with authority of deputy manager—prospects of advancement are appropriate. Salary, £500-£700 per annum, according to age, experience, etc., with contributory pension scheme **PLUS** shift allowance £100 per annum. Applicants should hold qualifications at least as high as the Higher National Certificate in Chemistry. Personal details in confidence to D. W. Milner, Assistant Director, Yorkshire Tar Distillers, Ltd., Stairfoot, nr. Barnsley.

THE POWER-GAS CORPORATION, LTD., Stockton-on-Tees, require **GRADUATE STAFF** for gas, chemical and petrochemical technical development and sales work. Age preferably 27-35. Apply giving full details.

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MORTON, SON AND WARD, LIMITED,

Invite inquiries for

STAINLESS steel and mild steel **JACKETED** and **UNJACKETED** Vessels to requirements. In all sizes and arranged with mixing gear and agitators of varying types.

"MORWARD" "U"-shaped TROUGH MIXERS—in stainless steel or mild steel, made in sizes up to 3 tons. Scroll and paddle-type agitators, jacketed or unjacketed.

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100g., 150g. and 200g. **NEW** in mild steel for 100 lb. w.p., with or without mixing gear.

200g. stainless steel jacketed Pan and one jacketed **AUTOCLAVE** with detachable cover, 150 lb. in jacket.

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30 in., 36 in., 42 in. and 72 in., by **BROADBENT** and **WATSON LAIDLAW.**

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