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Oxford Retrospect

THERE is a tendency in some quarters to suggest that the annual meetings of the British Association for the Advancement of Science have lost their point because they are no longer used as occasions for announcing new scientific discoveries. But in the last century the British Association meetings were greatly concerned with the subject of natural evolution and the changes in function and purpose that have gradually come to the BA are indeed evolutionary. In an age when many scientific journals exist for the sole purpose of reporting new advances, no scientist is likely to delay announcing some important development in his work until an annual meeting reaches its appointed date. Instead, the BA meetings have become occasions for recapitulation and comment, for surveying the trends of progress in specific fields of science, and it is surely a sound enough argument to say that the BA is filling a more important gap in 20th century science than the gap it filled in the 19th century. Certainly one consequence must not be forgotten. The impact upon the public made by the modern BA meetings is much greater. As a contemporary non-scientific journal has reported, the papers are read 'before a visible audience in which schoolboys play an increasingly large part, and before an invisible audience with which the Press and the BBC serve as connecting links . . .' Science—as science, and not merely as a materialistic provider of new gadgets of peace and new weapons of war—receives a better share of public attention each autumn when the BA meets than at any other period of the year.

Dr. E. D. Adrian's presidential address included a plea for much greater support for social scientific research. This part of his address has received much less attention than the more general comments. In scarcely a century we have moved from an age 'when we had little control over the forces of nature' to one when 'we have now so much that we might soon be able to destroy two-thirds of the world by pressing a button.' Human nature with all its habits of thought and reaction to events has not been able to move as rapidly. The objective investigation of 'human nature' or 'human behaviour' may do no more than isolate the weak spots, the out-dated inadequacies, but knowledge and recognition are at least the starting-point of improvement and progress. The fearful gap between technical potentialities and human adaptability has been a frequent topic of discussion in the last few years—it is the inevitable consequence of the atomic revolution which has so tragically preceded the gift of organised power with its gifts of bigger and bigger bombs. Dr. Adrian's demand that there should be more financial backing for social science, that there should be more social scientists in all our universities, is the first practical effort to build a bridge, however slender, across that gap.

Sir John Lennard-Jones' address to the chemistry section has already been fully published in this journal (see THE CHEMICAL AGE, 1954, **71**, 519 & 659). The extension of the electron-nucleus theory of atoms to molecules *via* the wave theory of matter is far from easy meat for older chemists to digest, and it is possible to speculate—perhaps only

wistfully—that the further development of these conceptions will bring some simplification. For 30 years attempts to interpret chemical behaviour in terms of atomic structures have been progressing steadily but on the whole with deepening complexity. So, too, after long periods of difficult comprehensibility, the atomic theory of Dalton and the mineral plant nutrition theory of Liebig almost suddenly emerged and vanquished past bewilderments.

The subject of the presidential address to the engineering section—the dependence of progress upon improvements in older materials and the development of new ones—was unusually chemical. Dr. Willis Jackson took as one example the introduction of polyethylene in place of gutta-percha as an insulating material for submarine cables. Low-carbon silicon steel development, particularly after the discovery that crystal orientation could be produced by cold-rolling and annealing treatments, has greatly increased power transformer performance; new magnetic materials for telecommunication apparatus have come forward from nickel-iron alloys and from the wartime-born 'ferrites,' materials in which one of the iron atoms in Fe_3O_4 is replaced by other metallic elements.

The new germanium crystal triode, already achieving wide attention in the popular press because it may within a few years bring match-box sized radio sets and picture-frame sized television sets into general production, was another illustration in Dr. Jackson's address. The dependence of nuclear energy development upon new structural and intermediate materials, e.g., zirconium, heavy water, liquid sodium, etc., also emphasised the new and closer association of modern engineering and chemistry. Indeed, Dr. Jackson stressed the growing interdependence of chemistry, physics, metallurgy, and engineering.

To this there is an obvious corollary and one that must depress the individualist streak in scientific make-up. Technological progress in future must be less and less the product of personal genius and hard work and more and more the outcome of team-work. And on this matter Dr. Adrian's address can be returned to, for in referring to the more vigorous development of the social sciences in the US he said 'we are handicapped, no doubt, by smaller resources and perhaps by the remains of a national temperament that has made us prefer to work by ourselves and not as members of a large team.' It is a comment of wider implication than its context.

New methods for producing food were discussed in Professor Pearsall's address to the botany section. The farm animal as a means of concentrating proteins is wasteful, and new methods of isolating and storing leaf protein are now becoming available. Indeed, agriculture as the basic means of providing the human diet was criticised for three basic reasons; its low (under 0.1 per cent) absorption of the sun's available energy; its highly variable dependence upon the weather; and its poor yield or productivity performance in comparison with modern industrial processes.

The production of food by the controlled photo-synthetic use of micro-organisms, though at present facing a good many development difficulties, is a probability of the scientific future. A recent report (see THE CHEMICAL AGE, 1954, **71**, 163) showed that a fuller use of sewage wastes could not be economically introduced into agricultural practice; but organisms of algal nature could be grown on the nutrients now discarded in sewage— an idea that may initially have its distasteful impact but one which is scientifically feasible.

In contrast to this unconventional approach to food production, the address by Dr. R. E. Slade to the agriculture section insisted that after some 2,000 years of slight change in technology, agriculture in the past 50 years has made enormous scientific advances—fertilisers, insecticides, mechanisation, weedkillers, fungicides, new crop preservation methods, etc. It may well be a sounder judgment to back Dr. Slade's appraisal of modern agriculture than to accept the criticisms, fundamental though they may be, of Professor Pearsall.

Notes & Comments

Odd Man Out

THE report of the FBI Technical Colleges and Industry Conference held in May has now been published by the Federation. The contributions of the principal speakers are given in full and a summary of the broad conclusions reached is incorporated with the preface. It is a document to be studied by any one who is concerned with the future staffing of industry or with scientific education. (1954. Pp. 88. 4s. 6d. From FBI, 21 Tothill Street, London, S.W.1.) The outstandingly simple conclusion to be drawn from the conference is that the technical colleges occupy an 'odd-man-out' position in every sense of the phrase. Their functions are not fully understood even by industry — mainly because of the 'wide range of work the colleges undertake,' within which 'there are three educational levels, the craft, the technical and the technological levels.' Nor are the colleges' functions understood by the grammar schools, who seem unaware 'of the large number of their pupils who continue their education part-time at the technical colleges.' Such schools neglect the possibility that for many able boys excellent opportunities exist if they enter industry on leaving school and continue studying as technical college 'part-timers.' Since it is mainly from the schools that the raw student material must flow and it is within industry that the final products must be utilised, these two misunderstandings are fundamentally serious. They probably retard the pace of technical college development even more than the physical and financial limitations to which so much attention is at present being paid.

Chemical Boom?

A RECENT heading among the business notes of *The Economist* was 'Cheer about Chemicals,' and it is fairly clear that even the most cautious assessors of the current industrial scene have few misgivings about the prospects of British chemical industry. The interim statements from Monsanto and Albright and Wilson have both shown increased sales for the first half of the year with corresponding increases in profits. Expanded production facilities are strong features of both companies and it can be safely assumed that their increased outputs have not met with problems of disposal. Investors seem to have applied this assumption fairly generally for the stock market has registered substantial rises in the past two weeks for several of the leading chemical companies. Companies may display some caution in raising dividends —particularly interim dividends—but this does not diminish market optimism. However, there should not be any real surprise about this situation. The industry's expansion has been soundly and lengthily planned; much of it had to be delayed during the earlier post-war period with its capital and raw material restrictions. The new plants that have now been installed have on the whole been urgently needed, and where they have brought new products a ready home market, formerly served by imports, has been in waiting. Expansion, in brief, has not been speculative. There may be some tendency for prices to fall, as in the case of polythene, but these are not signs of recession so much as signs of vigour and widening usage. Indeed, it is difficult to recall a period when the prospects of the chemical industry were as good as they are in 1954. If there is a 'boom,' it is no artificial product of stock market tips and hopes; it is firmly based upon the facts of trade.

Microcosmos

IN the days when we learnt chemistry in college, the 10 ml. beaker was the standard vessel for organic preparations. Graduated, and translated to an industrial research laboratory, we drew 100 and 250 ml. beakers from the store, determined to work on a really industrial scale. Within a week these were replaced by 1 l. vessels, by 5 l. in a month, and after three months by 50 l. stainless steel cans. That seemed to be the direction

of all industrial research, and introduction to fermentation chemistry confirmed the impression. Experimental fermentations could be carried out in 50 ml. flasks, but the data obtained could not be adapted to pilot-scale work; the smallest unit which could reproduce plant conditions in the laboratory seemed to be the 15 l. aspirator. This is the scale on which the Chemical Research Laboratory at Teddington has been working with sulphate-reducing bacteria in continuous culture, and, as we found at the Open Days this week, the result is a room very nearly filled with large bottles and their associated equipment. But in one corner a small fermenter, about one-tenth of the capacity of the other (and christened, we believe, 'Whizzo') was achieving comparable results. This is progress which we really welcome and, at a time when CRL are bemoaning their very serious lack of accommodation, it should be most welcome at Teddington, too.

Company to be Acquired

THE Distillers Co. Ltd. and Fisons Ltd. have announced that they are arranging to acquire, in equal proportions, the whole of the ordinary capital of Murgatroyd's Salt & Chemical Co. Ltd., which consists of 1,047,000 £1 'A' ordinary and 150,000 £1 'B' ordinary shares.

Murgatroyd's, an old-established private company, has a large chemical works at Elworth, near Sandbach, Cheshire. It manufactures open pan salt, vacuum salt, caustic soda, chlorine and derivatives.

Last May the company announced a £1,500,000 expansion programme over the next two years, aimed at doubling production of chlorine and increasing output of high purity caustic soda. The Finance Corporation for Industry was to provide the necessary finance by way of loan.

No price has been mentioned for the present deal. For the year to March 1953, Murgatroyd's made a loss of £119,000.

Drunkenness Tests

THE value of chemical tests in determining drunkenness will be the subject of the first meeting of the Midlands Society for Analytical Chemistry in the Mason Theatre, The University, Edmund Street, Birmingham, on 12 October. The lecture will be by Dr. D. W. Kent-Jones, President of the Society for Analytical Chemistry.

Dr. Kent-Jones will speak about the growing interest in results of analysis of blood and urine, the work and methods of the committee set up by the Royal Institute of Chemistry, of which he was chairman (THE CHEMICAL AGE, 1954, **70**, 366), and the significance of the results.

Food Standards Committee

THE Preservatives Sub-Committee of the Food Standards Committee appointed to review the Public Health (Preservatives, etc., in Food) Regulations is at present investigating the use in food of substances which have emulsifying, stabilising, anti-staling or foaming properties.

The sub-committee is anxious to have from food manufacturing or other interests who have not already made submissions, information about the use, or proposed use, in food of such substances, the quantities employed in particular kinds of food and the purpose of such additions. It would also be useful to have available biological and physiological information.

Any person or organisation wishing to make a submission is invited to write as soon as possible to the Joint Secretary, Preservatives Sub-Committee, Ministry of Food, Food Standards and Labelling Division, Great Westminster House, Horseferry Road, London, S.W.1.

Exhibition in 1958

Arrangements have now been completed to hold for the first time in the United Kingdom a joint exhibition of chemical plant and petroleum equipment. This exhibition will be known as The Chemical and Petroleum Engineering Exhibition and will take place in the Grand Hall, Olympia, London, in June 1958; it will be organised by F. W. Bridges & Sons Ltd., and sponsored jointly by the British Chemical Plant Manufacturers' Association and the Council of British Manufacturers of Petroleum Equipment. The exhibition is to be held at four-yearly intervals.

The Export Situation

Business Declines in Holiday Month

CHEMICAL exports during August decreased by over £2,000,000 compared with the figures for the previous month. August is the favourite holiday month, and the figures reflect it, but they were still considerably higher than those of August last year. In July exports had increased, but last month they fell again from £18,799,420 to £16,642,186.

In general, figures for most commodities fell, but there were some welcome increases. Sodium hydroxide, for example, in the class of chemical elements and compounds, increased by more than 100 per cent. Lead tetra-ethyl, after declining slightly in July, began to approach its June figures. Compared with the figures for August last year, exports of lead tetra-ethyl have quadrupled. Aluminium oxide continued to fluctuate, and after reaching a high total in July, returned to its former level.

Coal-tar products rose, the figures for creosote oil being particularly high. Synthetic dyestuffs also increased slightly, but there were decreases in the fields of medicinal and pharmaceutical products, essential oils, etc., fertilisers, paints, pigments and tannins and plastics materials.

In the fertiliser field, both ammonium nitrate and ammonium sulphate showed decreases after their rise during July. Exports of fertilisers had reached the £1,000,000 mark, but they were well below it in August.

One encouraging feature of the position was the increase of exports to the United States. Dollar exports had been on the decline, but have been rising since June.

TABLE 1

VALUE OF EXPORTS IN £ : PRINCIPAL COMMODITIES

	August 1954	July 1954	August 1953
Acids, inorganic	45,487	51,354	38,573
Copper sulphate	138,000	195,609	113,076
Sodium hydroxide	575,083	270,421	291,226
Sodium carbonate	246,625	283,033	185,157
Aluminium oxide, anhydrous	884	42,711	508
Aluminium sulphate	37,253	32,806	29,457
Ammonia	30,856	36,474	46,472
Ammonium chloride	41,421	54,498	25,501
Bismuth compounds	30,878	31,653	17,727
Chloride of lime	39,143	56,095	27,273
Hydrosulphite	57,455	57,141	27,763
Calcium compounds, inorganic	46,297	59,476	46,225
Lead compounds, inorganic	35,225	35,975	20,319
Magnesium compounds	35,904	50,289	44,223
Nickel salts	58,547	50,315	66,000
Ethyl, methyl, etc., alcohols	91,922	148,740	71,033
Acetone	38,055	48,248	52,408
Lead tetra-ethyl	806,379	771,988	191,338
Total for chemical elements and compounds	**4,792,060**	**5,212,042**	**6,794,072**
Coal tar	55,225	90,342	55,935
Cresylic acids	49,303	33,233	76,845
Creosote oil	240,237	167,744	50,436
Total from coal tar, etc.	**392,637**	**334,141**	**211,587**
Total for synthetic dyestuffs	**892,065**	**883,072**	**438,539**
Ammonium nitrate	17,163	27,758	85,117
Ammonium sulphate	628,274	940,974	607,745
Total for all fertilisers	**670,819**	**1,000,743**	**726,352**
Paints, pigments and tannins, total	**1,508,525**	**1,609,876**	**1,228,371**
Plastics materials, total	**1,910,930**	**2,036,517**	**1,503,593**

TABLE 2

VALUE OF EXPORTS IN £ : PRINCIPAL CUSTOMERS

	August 1954	July 1954	August 1953
Gold Coast	232,445	341,413	283,850
Nigeria	296,078	338,163	330,316
South Africa	786,035	1,026,744	720,574
India	1,588,772	1,117,790	1,028,086
Pakistan	196,541	349,812	174,949
Singapore	329,738	350,261	250,422
Malaya	270,294	272,466	230,810
Ceylon	299,893	252,980	284,831
Hong Kong	331,534	441,302	220,926
Australia	1,407,761	1,982,560	885,854
New Zealand	600,640	751,648	378,208
Canada	540,719	577,712	676,222
Eire	457,894	553,691	502,444
Finland	335,961	174,921	150,728
Sweden	569,033	494,291	303,258
Norway	200,995	306,163	155,559
Denmark	293,544	332,630	224,888
Western Germany	410,468	366,230	237,722
Netherlands	468,969	759,935	597,831
Belgium	298,372	390,257	253,407
France	340,010	451,277	331,363
Switzerland	246,859	206,641	147,368
Italy	339,776	400,637	366,746
Egypt	312,850	264,475	225,730
Burma	257,073	228,065	585,525
China	122,398	239,253	7,599
US	624,938	518,910	514,129
Argentine	388,241	371,387	189,798
Total value of chemical exports	**16,642,186**	**18,799,420**	**13,514,532**

Paper in Brazil

Reducing Newsprint Shortage

CAREFUL studies carried out by reliable specialists both in France and Germany have shown that the trunks and leaves of the babassu palm, which grows in Brazil, can be used to produce paper on an excellent economic basis.

Samples of the first paper produced from babassu have already been shown to paper manufacturers who are said to have been enthusiastic about the possibilities that this new raw material opens to the paper industry.

Covering two thirds of the entire territory of the State of Maranhao, and a third of Piaui, the palm stands would, if gathered in a compact mass, cover an area of about 300,000 square kilometres, 3.75 per cent of the entire territory of Brazil.

* * *

A BLEACHED bagasse pulp and fine paper mill belonging to Refinaders Paulista SA, of Sao Paulo, has completed the first two stages of going into full production. The start-up was planned in three phases. The first was to complete and start the minimum plant necessary to make corrugated board, and to profit from the sale of this while the chlorination and bleaching section, the electro-chemical plant, and a second paper-making machine were installed. The third phase will be the starting up of the large US-supplied paper machine, together with the necessary increase in pulp production.

The mill is the fourth designed to pulp bagasse using the processes and plant originally associated with Pomilio, and later developed by Cellulose Development Corporation Ltd. The Celcedor-Pomilio process lends itself to a stage-by-stage start-up, since the continuous digestion tower, which forms the first part of a bleached pulp plant, has already been used elsewhere, without the subsequent chlorination and bleaching, in mills for making semi-pulp for fluting papers, wrapping paper and boards. Examples of such units are the Ngoye bagasse pulp and corrugated paper mill near Durban, which started up last summer, and those producing semi-pulp from straw in plants in Brazil, France and the United Kingdom.

* * *

ANOTHER step closer to Brazil's self-sufficiency in the pulp and paper industry is the $20,000,000 paper factory to be built at Rio Claro by Companhia Paulista de Cellulose. British equipment is being incorporated in the new plant, but most of the equipment has been ordered from France and from a German firm.

Brazil's paper consumption is now about 320,000 tons annually and domestic output about 265,000. Biggest shortage is newsprint of which only 40 per cent is produced domestically. This project will save an estimated £3,500,000 in imports each year. The plant will process eucalyptus trees.

Increased Activity by BSI

THE Chemical Division of the British Standards Institution alone published 38 new standards during the year 1953-54. The division also published 21 revised standards and 21 amendments to standards and circulated 61 draft standards for comment and started work on 26 new items.

These figures are given in the British Standards Institution annual report, just published, which costs 5s. to non-members and is free to subscribing members. This is the first time since the end of the war that the BSI has issued a full printed report on its activities in the many fields of industry and trade with which it is now concerned.

The report runs to 200 pages; the largest single section describes standards projects undertaken and completed during the year by 60 major industries. In all, 286 new and revised standards were issued, compared with 260 in the previous year. There are now more than 8,000 subscribing members and committee membership is 14,000.

One of the most satisfactory features of the year is the completion of so much work on basic engineering standards, says the report, the standards being basic in the sense that many other projects depend on them.

A separate section of the report records the total of well over 100 subjects in which international alignment of standards is being prepared through the International Organisation for Standardisation and the International Electrotechnical Commission. There is a reference to the endeavours being made to co-ordinate terms and definitions used in the UK and the US. Quite encouraging progress has, the report says, been made in, among others, the fields of plastics, pest control products and textile testing.

Micro-Electrode Devices for Potentiometric & Other Electrometric Titrations—Part II

by JOHN THOMAS STOCK, M.Sc., Ph.D., F.R.I.C.
(Norwood Technical College, London, S.E.27)

IN the first part of Dr. Stock's article which appeared in THE CHEMICAL AGE *for 2 September, page 575, the construction and use of reference and indicator electrodes were described, and the method of titration to equivalence potential outlined.*

Bimetallic Electrode Systems

In place of the usual 'half-cell' reference electrode system, involving its own solution and contained in a separate vessel, a second but dissimilar metallic electrode which dips directly into the sample may sometimes be used as a reference. Thus a tungsten electrode may be used with a platinum indicator electrode in certain oxidation-reduction titrations[18]. Since tungsten wire may be sealed into borosilicate glass, such a 'reference' electrode may be constructed on the lines of Fig. 2 in Part I of this article. The platinum-tungsten pair may then be mounted side by side in the electrode holder.

This electrode combination is not suitable for the titration of very dilute solutions, so that its applications in the microchemical field are limited. Attention is, however, directed to the work of Bishop[7] on the replacement of 'half-cell' reference electrodes by ones dipping directly into the solution to be titrated. By suitably stabilising the solution with respect to the reference electrode, very satisfactory titration curves may be obtained.

Although the 'dead-stop end-point' method of titration[19] has been frequently classified as a potentiometric technique, the end-point is signalled by a sharp change in current-flow and not in potential. The technique is therefore galvanometric or amperometric. Electrical arrangements are very simple and consist of two platinum electrodes, upon which a suitable potential difference (usually 10 to 20 millivolts but sometimes higher) is impressed, and a sensitive galvanometer. A simple circuit is shown in Fig. 6; various mains-operated instruments, in which the end-point is signalled on a cathode-ray device such as a 'magic eye' tuning indicator, have been developed and are available commercially.

Since the electrode system is entirely of platinum and involves no solutions, salt bridges, etc., the 'dead-stop end-point' technique is particularly valuable in the determination of moisture in dehydrated foodstuffs, oils, etc., by the Karl Fischer method[20]. Two platinum electrodes of the form shown in Fig. 2 may be mounted side by side in the holder when it is desired to use this method. The electrodes need not be parallel but must not touch one another. For this method, an unplatinised micro-conductometric electrode assembly[8] is rather more satisfactory, since the platinum wires are rigidly located with respect to one another.

Differential Titration

Another form of titration involving electrodes of identical material is the differential technique, first suggested by Cox and developed by MacInnes and his co-workers. In this method one electrode dips into the bulk of the sample, a small isolated portion of the latter surrounding the second or 'retarded' electrode. Although the EMF of the electrode combination is initially zero, addition of titrant, which can

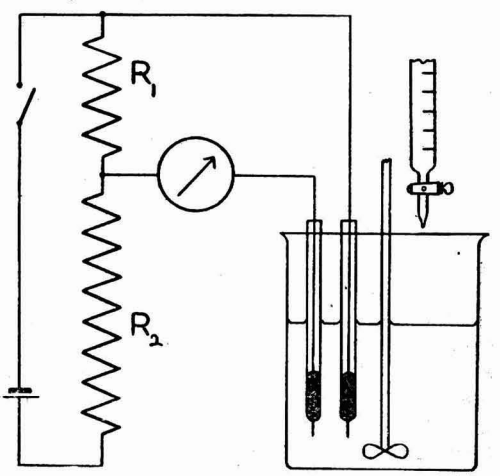

Fig. 6. Schematic arrangement for dead-stop end-point titration $R_1 = 10$; $R_2 = 1{,}000$

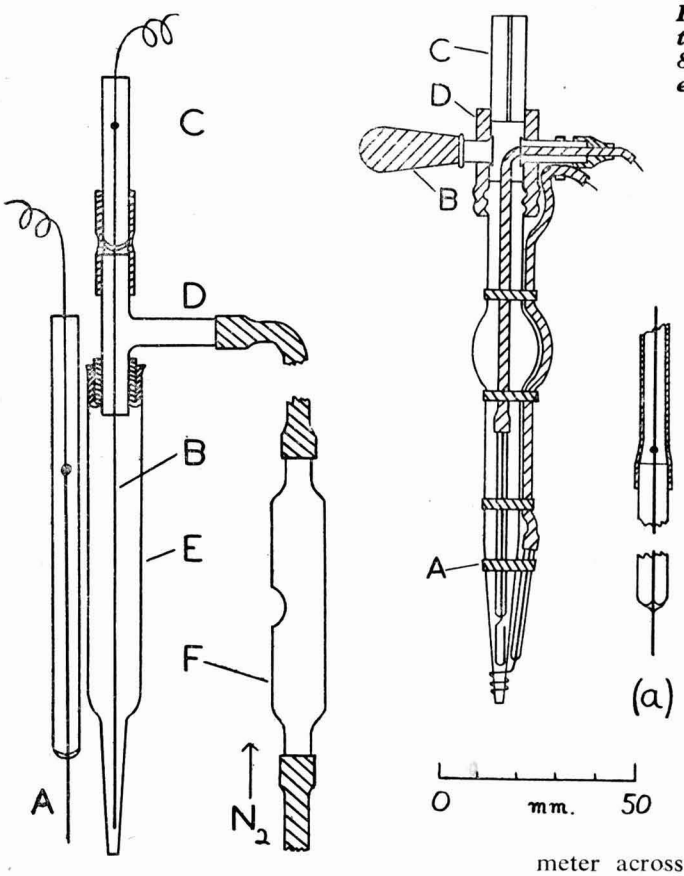

Fig. 7, Micro differential titration assembly; and Fig. 8, Pipette type differential electrode device (upper portion shown in section)

react with the bulk of the sample but cannot rapidly reach the isolated portion, causes the production of an EMF. After each measurement, the isolated portion of the sample is expelled into the main bulk, thoroughly mixed with the latter and then a portion of the mixture again withdrawn; since the electrodes now dip into identical solutions the EMF again falls to zero. (Particularly with certain micro electrode systems, fall of EMF to a small value, rather than to zero, may occur. In such cases, this value is taken as the 'zero' for the next observation.)

The titration is carried out by adding the titrant in small definite increments ΔV, measuring the resulting EMF ΔE, and remixing after each observation. If ΔV is fixed (e.g. 0.1 ml. or, if the drop-volume of the burette is known, one drop), ΔE rises to a maximum as the end-point is reached and then diminishes again. Although ΔE may be read merely by connecting a galvanometer across the electrodes, the tiny electrodes used in microchemical work are easily polarised by the current thus drawn. An electronic instrument is much to be preferred.

Hall, Jensen, and Baeckström[21] developed a simple differential electrode assembly which was based in a medicine dropper; Kirk and Hull[22] have adapted this assembly for ultra-microchemical work. An assembly developed by the author[23] is shown in section in Fig. 7; this apparatus is not only easily constructed but is readily dismantled for cleaning or changing electrodes. The 'exposed' electrode A is merely that shown in Fig. 2, but the 'retarded' electrode consists of a platinum wire B sealed through the end of a short piece of 2 mm. outside diameter glass tubing C and carrying a fine copper connecting lead. This electrode is mounted on T-piece D, likewise of 2 mm. tubing, which is supported upon an empty 'reference electrode vessel' E. Joints are made by sleeves of cycle valve tubing.

When assembled, the electrode wire should reach to within about 3 mm. of the orifice and should preferably not touch the glass. The side arm of the T-piece is connected through bypass tube F to a low-pressure nitrogen supply. When it is desired to expel and mix the solution, the hole in F is momentarily closed with the forefinger. Removal of the finger allows a fresh portion of the liquid to rise in the vessel. In many cases, a stream of air may replace one of nitrogen and may be conveniently supplied by an aquarium aerator or a simple form of pump.[24]

Fig. 8 shows another form of differential titration apparatus suitable for work on a larger scale.[23] It is built up from a teat pipette of the form used for semi-micro qualitative analysis.[25] Each electrode is a length of platinum wire sealed through the end of a short piece of 2 mm. OD glass tubing. Passing through cycle valve tubing as shown enlarged at (a), flexible connecting leads run from the inner ends of the platinum wires. The 'exposed' electrode is wound round the lower end of the pipette and further secured by a rubber band A. Liquid is expelled from the pipette by the *sharp* operation of teat B; air-leak C, of thermometer tubing, prevents liquid from being drawn in to too high a level when the bulb is released. D is a piece of pressure rubber tubing with two holes bored in the walls.

Peaks (in arbitrary units) corresponding to the first two stages of hydrogen-replacement in the titration of 20 ml. portions of a solution of phosphoric acid with 1N sodium hydroxide (which contained carbonate) are shown in Fig. 9. The results were obtained with the pipette electrode assembly used in conjunction with a Cambridge 'spot' galvanometer of resistance about 450 ohms. The phosphoric acid solution was of course saturated with quinhydrone.

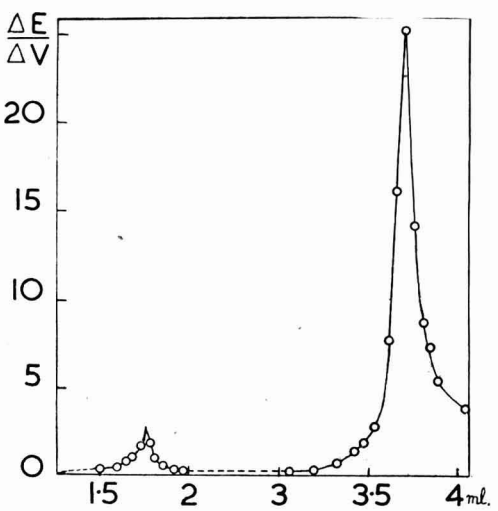

Fig. 9. Differential titration of phosphoric acid solution

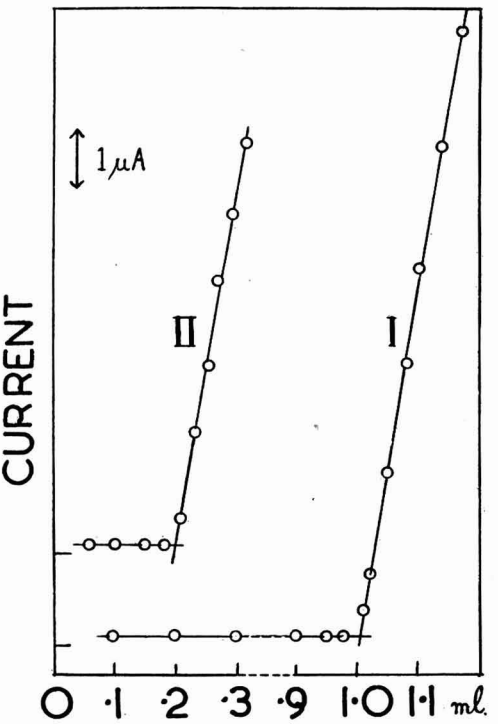

Fig. 10. Amperometric titration with potassium iodate solution of: I, 0.001 N, II, 0.0002 N, sodium thiosulphate solution

Amperometric Titration

Amperometric titration using a platinum micro-electrode[26,27,28] is a valuable analytical technique. The conditions of stirring necessary for the rapid registration of a steady current are normally met by rotating the electrode at constant speed. In some cases, however, satisfactory titration curves may be obtained by the simple procedure of using a fixed electrode and stirring the solution at a steady speed. Knowles and Lowden[29] were thus able to obtain excellent titration curves in the amperometric determination of low concentrations of iodine.

Using a silver-silver chloride reference electrode and a pointer-type microammeter, the micro-electrode assemblies may be used to illustrate this technique. The electrodes are connected directly to the microammeter, no external EMF being required. The platinum electrode should be bent as shown at (b) in Fig. 2 and arranged so that it lies approximately along a diameter of the titration vessel and about 3 mm. above the stirrer-bar. Using a simple geared-type micro magnetic stirrer,[30] a steady speed of about 500 rpm. may be satisfactorily maintained.

Typical titration curves are shown in Fig. 10. In each case, 10 ml. of sodium thiosulphate solution were added to 2 ml. of 1N sulphuric acid and 1 ml. of 10 per cent potassium iodide solution and titrated with 0.10N potassium iodate solution. Curves I and II are of 0.001N and 0.0002N sodium thiosulphate solution respectively. The titration of smaller volumes is possible and, with a more sensitive galvanometer, the concentrations of both sample and titrant may be reduced by a factor of 10.

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Reactor School Opened

AS a step towards encouraging industry to play a greater part in the development of atomic power, the United Kingdom Atomic Energy Authority has opened a Reactor School at Harwell. The new school will provide, for a fee of £250, a three-months' course of training for staff from industrial concerns to learn the techniques.

When the first course started on Monday, 27 September, an opening address was given by Sir John Cockcroft, Director of the Atomic Energy Research Establishment.

Three courses will be held each year starting in September, January and May. The syllabus includes lectures and individual instruction in nuclear physics, reactor physics, metallurgy and reactor engineering, as well as experimental work. Lectures are given by experts drawn from various divisions at Harwell, and by the full-time school staff.

The school is at present in temporary accommodation, which comprises lecture hall, office, laboratory and counting room. About 25 students can be accommodated. Applications for places should be made to the Manager, Reactor School, AERE, Harwell, Berkshire, and should give sufficient information for the Management Board to assess whether the student has the required academic standard.

British Firms at Leipzig

THREE British chemical firms, Biddle Sawyer & Co. Ltd., M. W. Hardy & Co. Ltd., and Propane Ltd., were among the 93 British firms which took part in the Leipzig Fair held from 5 to 15 September.

Representatives from several other chemical firms were present at the fair, attracted mainly by Chinese inquiries for chemical products, mainly pharmaceuticals and fine chemicals up to the value of £800,000. It is understood that some orders have been placed in Britain by the Chinese.

This year's fair was not only marked by big Western European participation, but also by growing trade contacts between East and West Germany, particularly in chemicals.

For the first time leading West German chemical firms placed big orders in the Eastern Zone, traditional source of their raw materials. On the last day of the fair, the trade turnover between the two zones reached 8,000,000 marks, compared with 2,000,000 on the same day of the 1953 fair.

The West German chemical firms also showed considerable interest in trade with Russia and China.

The East German authorities announced that during the fair they sold 20,000 tons of crude phosphate to a New York firm for delivery in the USA, and 2,500 tons each to France and Belgium.

New Rot-Proofing Compound

Valuable By-Product in Manufacture of Smokeless Fuel

REXCOPINE is a tarry by-product in the manufacture of Rexco, a low temperature coke. Such has been the popularity in the domestic market of this smokeless fuel (made at Mansfield by Midland Rexco Ltd.) that a considerable expansion of production is now taking place. With the greater quantities of tar available, increasing attention is being paid to the peculiar properties of the tar, with a view to its better and wider utilisation. In tests carried out by leading manufacturers of jute and hemp, and by a leading research association, Rexcopine has been found superior to any coal- or wood-tar product previously used as a preservative.

Rexcopine owes its specific characteristics largely to its mode of manufacture. Coal in lump form is carbonised in cylindrical vertical retorts of large capacity (32 tons for each retort) by the passage of hot gas from top to bottom of the charge. This gas is made by the controlled incomplete combustion, in a specially designed chamber at the top of each retort, of the gas formed in carbonisation. It is possible in this way to carbonise within a narrow margin of temperature, over a range up to 700°. Internal heating of the charge, as is well known, obviates the long period of carbonisation necessary in externally heated retorts. Further, the tar is carried away quickly from the coal surfaces at which it is liberated and out of the hot retorts.

The condensed material is said to be the least cracked of tars in commercial production; 'Rexcopine' is the name given to the product after dehydration. It is particularly rich in resinous and waxy constituents. More than one-fifth of the whole tar consists of phenols with a wide boiling range.

It was inferred that the combination of the known bactericidal and fungicidal properties of the phenols with the protective action of the resins and waxes was likely to make the tar suitable as a rot-proofing agent in a variety of surface coatings. In particular, it was thought the Rexcopine might be the equal, or even the superior, of the imported pine-wood tars used traditionally for the preservation of hemp and jute products. Further examination proved, in fact, that the two tars had much in common, but Rexcopine proved superior in the properties concerned with rot-proofing action.

For each test, a sample of material was padded through Archangel tar at 50-55°, a corresponding sample through Rexcopine, and a third left untreated. The three samples were then tested for resistance to both air-borne microbiological attack and soil bacterial degradation, using a procedure based on British Standard Method CK(T)442.

Six warp strips were cut from each of the three samples and placed around filter candles previously impregnated with the micro-organisms. The candles surrounded by the strips were then incubated in glass containers over water at 28-30°. The test strips were then washed in running cold water, air-dried, sterilised, and conditioned along with unincubated specimens in an atmosphere of 65 per cent relative humidity at 20° for not less than 72 hours. The tensile strength of each strip was then determined on a Goodbrand strip tester under standardised conditions. The results on hemp sacking, as used for the manufacture of coal and coke sacks, are summarised in Table I (on page 724).

In the course of the tests it was observed that the incubated samples increased in stiffness and rigidity. As it is a common assumption that such behaviour, when accompanied by an increase in tensile strength, results in a corresponding decrease in tearing strength, a fourth group of tests was devoted to the investigation of this possibility.

From each sample, six squares of 5 in. side were submitted to the standard rotting test, with an incubation period of 12 weeks. The squares were then washed, dried, sterilised and conditioned for 72 hours. They were then prepared for tearing by the method described in British Standard Handbook No. 11, and torn across the warp on the Goodbrand tester under standardised conditions. These results are given in Table II.

TABLE II

TEARING STRENGTH TESTS ON HEMP SACKING
Each value given is the mean of 25 determinations.

Samples	Tearing strength in lb. Unincubated	Incubated
Untreated control ..	226	0
With Archangel Tar ..	165	134
With Rexcopine	190	322

TABLE I

TESTS ON HEMP SACKING

Test Details	Tensile Strength in lb. (Mean of 6 tests for each value given) Untreated control A	Untreated control B	With Archangel tar A	With Archangel tar B	With Rexcopine A	With Rexcopine B	Comments
On standard hemp sacking, as used in the manufacture of coal and coke sacks. Incubation period, 5 weeks.	667.5	133.3	660.8	743.8	681.3	704.7	With both tarred specimens, incubated samples showed a significant increase in strength. The incubation period was then increased from 5 to 12 weeks to discover the effect of extended incubation.
As before, but incubation period of 12 weeks.	775	No strength	678.3	177.2	741.7	796.7	The true comparative values of the treated specimens begin to emerge. The Archangel tar had failed completely to protect the cloth over the extended period of incubation, while Rexcopine had caused a significant further *increase* in strength. It was found that Rexcopine had killed off all the micro-organisms at the end of the 12 weeks.
Effect of prolonged weathering : 6 months on factory roof.	775	No strength	(a) 678.3 (b) 781	(a) 265.2	(a) 741.7 (b) 860.2	Greater than 900	Rexcopine-treated material again shows better resistance to microbiological attack ; weathering has conferred a considerable increase in strength.

A = Unincubated. B = Incubated. (a) = Unweathered. (b) = Weathered.

Further tests were carried out on other fabrics, such as jute hessian, jute yarn and hemp yarn, and a similar series of results obtained in each case.

The results obtained in all these tests were so promising that the independent research organisation was asked to carry out a further series of tests on Rexcopine. These tests not only confirmed the original ones, but in an extension to the effect of sea-water on treated fabrics also proved the superiority of Rexcopine in this respect.

The value of Rexcopine as a rot-preserving agent for a variety of fabrics has thus been proved. Not only does it kill air-borne and soil bacteria, and thus confer immunity from microbiological attack, but it increases the tensile and tearing strength of the fabrics progressively with time. This increase in strength is almost certainly due to the gradual formation of polymers in the tar, accelerated by oxidation.

Rexcopine can safely be used for the treatment of articles such as coal and coke sacks which are exposed to all types of weather in the course of every day use. Further uses lie in the direction of proofing sacks, ropes, ships' stores, and in general, articles which come into contact with sea-water. It should also prove its merits in bituminous coatings and paint compositions (for example in protecting ships' bottoms). Further work is progressing in these directions.

Another development of interest is the production of a refined version of Rexcopine which has been called 'Rexcopale.' This is a solvent extract which is, in effect, a concentrate of the constituents responsible for the properties described above. It is a thick oil of much lighter colour and less viscous than Rexcopine and can be made in a range of viscosities. Rexcopale, it is considered, will considerably extend the uses of the original material to products in which the darker colour of Rexcopine would be a disadvantage. Apart from the rot-proofing of fabrics, its applications to wax and polish formulations, as a constituent in preservative paint compositions, and as a source of resins and hydrocarbon waxes are being investigated.

Further inquiries are invited and should be addressed to Midland Rexco Ltd., 1 Royal Exchange Avenue, London, E.C.3.

First Meeting of New Group

THE inaugural meeting of the Pesticides Group of the Society of Chemical Industry will be held on 18 October in the Lecture Theatre of the Royal Institution in Albermale Street, London, W.1. This new group has been formed by the elevation of the Crop Protection Panel of the Agriculture Group to full group status, and all members of the panel will automatically become members, while still retaining membership of the Agriculture Group. The terms of reference have been widened to include not only the fields of agriculture and horticulture but also veterinary science, stored products and public health.

Detection of Toxic Gases

UNDER Regulation 7 of the Chemical Works Regulations, 1922, before any person is allowed to enter, without wearing an approved breathing apparatus and life-belt, any vessel or place which it is thought may contain a dangerous gas or fume, it is necessary that the vessel or place be tested by a responsible person appointed by the occupier, and that the appointed person shall certify, in writing, that it is free from dangerous gas or fume.

The use of white mice for the purpose of such tests is effective in the cases of carbon monoxide and hydrogen cyanide, but it cannot always be relied upon for other important gases and vapours encountered in industry. Experience has shown that there is a need for simple and rapid chemical or other means for determining low concentrations of dangerous gases, such as might occur in various circumstances in chemical works. It may be recalled that discussions were initiated before the war between the Association of British Chemical Manufacturers and the Home Office. As a result, arrangements were made by the Department of Scientific and Industrial Research, at the request of the Home Office, and with the financial and technical co-operation of the Association of British Chemical Manufacturers, for a series of tests to be developed by the Chemical Defence Research Department.

In carrying out this research the objective was not the accurate estimation of the concentration of dangerous vapour, but a rapid indication of the relative safety of the atmosphere. The tests had to be made as simple and straightforward as possible in order that they could be operated, given the necessary materials, by comparatively unskilled staffs. They could then be elaborated or modified to a certain extent to suit particular conditions, provided that the fundamental conditions laid down were not altered in any way. Tests meeting these requirements were worked out for a number of gases and vapours, each one being carefully standardised in the laboratory and tested under practical conditions in actual works.

The development of rapid and dependable methods for detecting toxic gases has contributed greatly to the safety of workers, not only in the chemical industry but also in many other industries in which the gases and vapours in question are encountered.

Hydrogen Sulphide

Hydrogen sulphide is of very widespread occurrence. Besides being formed during the decomposition of all organic matter contaning sulphur, this very poisonous gas is encountered in many important industries, including artificial silk works, chemical works, dye-making and dyeing works, coke oven and by-product plant, gas works, grease refining works, petroleum refining works, sewage works, and tar distillation works.

In concentrations of 1 in 1,000 by volume or higher, it will cause immediate unconsciousness and will result in death unless artificial respiration is at once applied. In a concentration of 1 in 2,000 it is very dangerous if inhaled for 15 to 30 minutes, while 1 part in 10,000 is sufficient to cause local irritation of the eyes and respiratory tract after one hour's exposure.

It is sometimes suggested that the presence of dangerous concentrations of hydrogen sulphide may be detected by smell. The sense of smell should on no account be relied upon as a guide to safety, however, because people differ greatly in their ability to detect smells; furthermore, the sense of smell readily becomes 'fatigued' and then ceases to be of much value in noting even greatly increased concentrations. The smell of hydrogen sulphide might also be masked by other odours. Similarly, the effects on the eyes are not sufficiently pronounced to serve as a reliable index of a concentration which may be injurious to health.

The lead acetate test has been adopted as the standard method of detecting hydrogen sulphide. It is capable of detecting concentrations of hydrogen sulphide as low as 1 part in 150,000 parts of air by volume. Concentrations lower than 1 part in 30,000 are not harmless, but may be regarded as unlikely to cause serious effects if the exposure is not continuous or prolonged.

Hydrogen Cyanide Vapour

Hydrogen cyanide may be encountered in dangerous concentrations in blast furnaces, dyestuff factories, gas and coke plants, gold

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mining, photo-engraving and other industries.

With very high concentrations symptoms appear rapidly; they take the form of giddiness, headache, unconsciousness and convulsions with cessation of respiration due to paralysis of the respiratory centre in the brain. With weaker concentrations the warning effects may comprise irritation of the throat, palpitation, difficulty in breathing, watering of the eyes, salivation, headache, weakness of the arms and legs, and giddiness—followed by collapse and convulsions.

Hydrogen cyanide is dangerous even to a man equipped with an efficient respirator or other form of breathing apparatus, because it can be absorbed through the skin. This hazard becomes still greater if the skin is wet with sweat, owing to the ready solubility of hydrogen cyanide in water.

A concentration of 1 part in 50,000 by volume is sufficient to produce slight symptoms after several hours; 1 part in 10,000 becomes very dangerous within one hour; 1 in 500 is fatal.

The faint almond-like smell associated with hydrogen cyanide is easily missed and is quite unsuitable as a method of detection. Various chemical tests for the detection of small quantities of hydrogen cyanide have been described, but all are interfered with to some extent by other gases. The most suitable ones for industrial use are considered to be the Congo Red-silver nitrate and the benzidine-copper acetate reactions, both applied as test-papers. A test-paper made from solutions of Congo Red and silver nitrate gives, when dry, a blue stain with hydrogen cyanide. The gas also reacts with a mixed solution of benzidine acetate and copper acetate, the benzidine being oxidised to a blue compound during the intermediate decomposition of cupric cyanide.

The standard procedures enable an estimate to be made of any concentration between 1 in 100,000 and 1 in 20,000 with the Congo Red-silver nitrate test, or between 1 in 100,000 and 1 in 30,000 with the benzidine-copper acetate test.

Carbon Monoxide

Carbon monoxide results from the incomplete combustion of carbonaceous materials and is therefore produced in a wide variety of processes and conditions. Being colourless and odourless it is most insidious in its action and is perhaps most dangerous when formed unknowingly.

The estimation of small amounts of carbon monoxide in the atmosphere by chemical methods depends usually on one of the following reactions of the gas: the reaction with the haemoglobin in blood to form carboxy-haemoglobin; the reaction with iodine pentoxide to liberate iodine; the reduction of palladium chloride to metallic palladium; the reduction of potassium palladosulphite to metallic palladium.

Accurate & Sensitive

The methods depending on the reaction with blood are accurate and sensitive, but owing to the elaborate and expensive apparatus required and the skill necessary for their performance, they are not suitable for general use in industry. The iodine pentoxide method also requires complicated apparatus. In a development of the iodine pentoxide reaction, known as the 'Hoolamite' method, fuming sulphuric acid is mixed with the pentoxide and the pasty mixture is supported on an inert porous material, such as pumice. The iodine liberated by carbon monoxide reacts with the sulphur trioxide from the acid, giving an unstable greenish compound.

The palladium chloride reaction is generally applied in the form of a test-paper, which is moistened with palladium chloride solution and suspended in the atmosphere for a definite period—usually 5 minutes. The stains obtained, due to the deposit of metallic palladium, are compared with standards. Various portable instruments operating on this principle have been developed. By this method concentrations of 0.2 per cent can be detected in less than 2 minutes, 0.05 per cent in 6 minutes, and 0.01 per cent in half an hour. A concentration of 0.01 per cent might cause a mild headache with some shortness of breath on exertion after 10 hours or longer. Any concentration below this level may be regarded as relatively harmless.

In view of the greater simplicity in the method of preparation of the reagent and of the comparative permanence of the stains obtained, the palladium chloride paper was preferred to the 'Hoolamite' test as the standard method for the detection of carbon monoxide in industry.

A new method developed during the war makes use of an indicator tube in which the active reagent is potassium palladosulphite impregnated on silica gel. Each tube contains a column of this yellow reagent and one or two columns of plain silica gel, the columns being sharply defined. The gas under test passes through the plain silica gel, where condensible vapours are removed, and then through the reagent. If carbon monoxide is present a dark brown stain appears in the yellow material, commencing at the junction of the two columns. Its length gives a measure of the concentration of carbon monoxide present in the gas. The volume of gas sampled is standardised at 120 ml. and is passed through the tube at a rate of 1 ml. per sec. Under these conditions 0.001 per cent of carbon monoxide may be detected and concentrations of 0.005 per cent and above determined with an accuracy of ± 20 per cent. In view of its much greater simplicity and its greater sensitivity, this test has replaced the palladium chloride paper as the standard method.

Sulphur Dioxide

This gas is produced during the burning of any substance containing sulphur and is also used in many industries. In high concentrations it is irrespirable and causes asphyxiation. In lower concentrations it is irritating to the eyes, nose, throat and lungs. Since adequate warning is given of its presence, sulphur dioxide may be regarded as not very dangerous. Nevertheless, it may cause inflammation of the nose and throat and set up bronchitis from prolonged exposure to relatively low concentrations which cause no immediate or marked discomfort. A chemical test is therefore essential for detecting harmful concentrations of the gas.

Sulphur dioxide may be detected by several simple tests. The potassium chromate test is not capable of detecting concentrations of sulphur dioxide of the order of those encountered in the atmosphere of works. The potassium ferricyanide-ferric chloride test-paper is a sensitive test, but the papers readily become coloured during preparation and on keeping. In the starch-potassium iodate paper test sulphur dioxide reduces the iodate to iodine with the production of the usual violet starch—iodine stain.

In a damp condition the test papers are sensitive to low concentrations of the gas when a suitable procedure is employed, but the incorporation of glycerol in order to keep them moist seriously affects the sensitivity of the test. This difficulty is effectively overcome by the addition of potassium iodide to the starch—potassium iodate mixture.

For these reasons the starch-potassium iodate-potassium iodide-glycerol test paper has been adopted as standard. This method is readily capable of detecting a concentration of 1 in 100,000, but is not specific for sulphur dioxide, since any gases capable of affecting a starch-potassium iodide mixture will give a stain. In cases where it is suspected that other gases which would affect the test are present in addition to sulphur dioxide, these should be identified and a suitable trap for them inserted before the mixture passes through the starch-iodate-iodide paper.

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Benzene Vapour

In high concentrations benzene acts as a narcotic (acute poisoning). In low concentrations over a prolonged period it affects the blood and the blood-forming organs of the body (chronic poisoning). Individual susceptibility varies, women and young persons being particularly liable to suffer from chronic poisoning. Acute poisoning is usually the result of an accident, such as breaking of distilling apparatus. The symptoms in slight cases are giddiness and a state of excitement. If the vapour is inhaled in quantity this is quickly followed by coma.

Chronic poisoning is due to the inhalation of low concentrations over a period of time and takes the form of an aplastic anaemia. One of the earliest manifestations of this type of poisoning is bleeding from the mucous membrane of the mouth. Later, haemorrhages occur under the skin and severe bleeding from the mucous membranes is frequently the cause of death. This form of anaemia is usually fatal.

Concentrations of 1 in 700 to 1 in 300 produce slight symptoms after several hours' exposure; 1 in 140 causes serious illness after 30 or 60 minutes' exposure; 1 in 50 becomes rapidly fatal. Over 1 mg. per litre of air (about 1 in 3,500) is necessary before the smell of benzene is distinctly perceived, but the sense of smell is very unreliable in estim-

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ating the safety of an atmosphere containing this vapour.

Most chemical methods for the detection of small amounts of benzene involve nitration to nitrobenzene or dinitrobenzene, with subsequent conversion to compounds which can be estimated colorimetrically. The processes are usually lengthy and complicated.

A more simple test has been chosen as a standardised method for the determination of small quantities of the vapour in industry. It involves the absorption of the vapour in concentrated sulphuric acid containing a trace of formaldehyde, traces of benzene being sufficient to produce an orange-brown colour. The test is carried out by drawing a sample of the atmosphere under test through a tube containing the reagent, using a hand pump of definite capacity, and determining the number of strokes required to produce a certain standard depth of colour. The method is capable of detecting concentrations down to 1 part in 10,000.

Nitrous Fumes

These are evolved when nitric acid acts on metals and organic material, during the burning of such nitrated materials as celluloid, or as the result of the incomplete detonation of explosives such as dynamite.

Because of their insidious character nitrous fumes are extremely dangerous. Usually there are no immediate effects. A workman may therefore carry on with his job, unaware that he has inhaled the fumes. Some hours later he becomes restless with a dry cough and shortness of breath. These symptoms increase and are accompanied by a frothy sputum tinged with blood. If appropriate treatment is not applied, death follows from oedema of the lungs.

A concentration of 1 in 10,000 will produce nothing more noticeable than mild irritation of the throat and chest, but is dangerous to inhale even for only a few minutes. Any atmosphere in which nitrous fumes become apparent, whether by smell, irritation or colour, should therefore be regarded as dangerous.

Several test-papers exist for the qualitative detection of nitrous fumes, but the majority are unsuitable for adopting as a standard quantitative method owing to lack of specificity, low degree of sensitivity, or because the reaction concerned is a bleaching one.

There are two tests which both depend on the diazo-reaction, each one is carried out in solution, is specific for the gas, and is very sensitive to low concentrations. These are the Griess-Ilosvay reaction and the Bismarck Brown test. In the former, the gas is bubbled through a mixed solution of α-naphthylamine and sulphanilic acid in acetic acid, a rose-pink colour being produced; in the latter test it is bubbled through a solution of *m*-phenylene-diamine hydrochloride in acetic acid, resulting in the production of an orange colour due to the formation of Bismarck Brown. Being rather the more sensitive of the two, the Griess-Ilosvay test has been adopted as the standard method for nitrous fumes. It is readily capable of detecting a concentration of 1 part in 100,000.

Carbon Disulphide Vapour

Carbon disulphide is used extensively in many important industries. Dangerous concentrations of the vapour may be found, for example, in works manufacturing viscose, chemicals, coal gas, vulcanised and 'dipped' rubber goods, and tar distillation products.

In high concentrations carbon bisulphide may cause delirium, coma, and death from respiratory failure. The better known effects, however, are those of a severe chronic poisoning of the nervous system, the symptoms varying in degree from slight fatigue and giddiness to serious mental derangement, blindness, and paralysis. The permissible concentration of carbon bisulphide vapour in the atmosphere of workrooms should be kept well below one part in 30,000, and preferably not above one part in 100,000.

The standard method for the detection of low concentrations of this vapour in industry depends upon interaction with diethylamine and copper acetate to produce copper diethyldithiocarbamate. A series of standard colours is first made up by the addition of small quantities of the reagents to dilute alcoholic solutions of carbon bisulphide of known strength. Samples of the air are then drawn, by means of a handpump of definite capacity, through a bubbler of alcohol containing the reagents, and the mixture is allowed to stand. The colour developed is compared with the series of standards. From the number of pump strokes made and the colour obtained, the

concentration is estimated by reference to a table. Concentrations down to 1 part in 120,000 can be estimated in this manner with 20 strokes or less of the pump.

Any traces of hydrogen sulphide in the atmosphere will also produce a colour with the reagent, but these can be removed (if not more than 1 part in 10,000) by drawing the air sample first through a filter paper impregnated with lead acetate.

Phosgene

Phosgene (carbonyl chloride) is made specially for use in certain processes, particularly in the dyestuffs, organic-chemical and pharmaceutical industries, and is used in the manufacture of various metallic oxides. It may also occur as a decomposition product of trichloroethylene and of carbon tetrachloride.

This gas has a strong 'musty' smell and produces lachrymation, but is not so immediately irritant to the senses as chlorine, though much more deadly. Atmospheres containing concentrations only just detectable by smell or lachrymation may prove fatal. Another feature which renders phosgene particularly dangerous is an apparently rapid recovery from the initial symptoms, followed by the delayed onset of an acute illness. One part in 6,000 of phosgene is sufficient to cause very serious lung injury after an exposure of two minutes.

The standard method of detecting low concentrations of phosgene is by the use of a test paper containing diphenylamine and *p*-dimethylaminobenzaldehyde. The gas produces a yellow or orange stain on the paper and an indication of its presence may be obtained even at concentrations of the order of 1 in 1,000,000 by exposing the paper for a few minutes. Continuous work must not be permitted in an atmosphere in which the presence of phosgene can be detected by this test.

Arsine

Arsine is always formed when nascent hydrogen is produced in the presence of arsenical compounds. It smells faintly of garlic, but the smell may easily pass unobserved. It is an extremely poisonous gas to breath. Following exposure, there is nearly always some delay in the onset of symptoms of poisoning. This delay may be only an hour or two in the case of high concentrations, but a day or more may elapse before symptoms follow exposure to

low concentrations. With still lower concentrations there may only be a feeling of vague general ill-health, and in such cases the true cause may only be determined by finding arsenic in the urine.

There is evidence that repeated exposure to very low concentrations has a cumulative effect, with possibly severe poisoning as a result. It follows that continuous work should never be permitted in an atmosphere in which the presence of arsine can be detected.

Two simple chemical tests are available for the detection of small concentrations of arsine, silver nitrate papers and mercuric chloride papers. The former are by far the more sensitive, but stains vary in colour according to temperature and darken rapidly on exposure to light, while the test papers cannot be kept more than 24 hours, becoming discoloured even in the dark. On the other hand, mercuric chloride papers can be stored without serious deterioration, if kept dry and in the dark, and the stains produced on them by arsenic remain unaltered long enough for test requirements. These papers have therefore been adopted as the standard method. When carried out by the procedure laid down, the test is capable of detecting a concentration of arsine of 1 in 200,000/1 in 250,000 by means of 50 strokes of the hand pump employed.

Chlorine

Acute poisoning by chlorine is unusual, since this gas is easily detected by its strong smell and irritant qualities even in low and harmless concentrations. It can be recognised by smell in as low a dilution as 1 in 1,000,000. On the other hand, very low concentrations of chlorine may be dangerous on prolonged exposure. Any test suitable for industrial use must therefore be capable of detecting at least 1 in 1,000,000 without requiring an inconveniently large sample. The only known test which is sufficiently sensitive is that depending on the interaction between chlorine and a dilute solution of *o*-tolidine to give a yellow compound, which can be estimated colorimetrically.

Aniline Vapour

In spite of its relatively low vapour pressure at low temperatures aniline may cause

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poisoning by inhalation of the vapour. Experience has shown that most cases of acute aniline poisoning arise by absorption through the skin, from splashes either directly on to the skin or indirectly through the clothing. Scrupulous cleanliness of the skin and the clothing is therefore essential.

The immediate toxic effect of aniline is on the blood, with the formation of methaemoglobin, causing cyanosis (characterised by a blue-grey discoloration chiefly of the lips, ears, cheeks, tip of the nose, and nails). Other symptoms such as shortness of breath, rapid feeble pulse, and nervous excitement, may subsequently occur. In persons exposed continuously to small doses of aniline the cyanosis may be little marked, but anaemia is present with loss of energy, digestive disturbances, and headaches.

It appears undesirable to breathe 1 part in 200,000 for several hours, particularly if the exposure is to be repeated on successive days. Concentrations of this order can be detected by drawing a sample of the air under test through a small bubbler containing dilute hydrochloric acid. Any aniline vapour present is converted to the hydrochloride, to which any of the usual tests for aniline may be applied.

Normally the concentration of aniline vapour present in the atmosphere is so small that very little hydrochloride is obtained without taking an inconveniently large sample of air. A more sensitive test was therefore developed from the bleaching powder test. After the addition of the bleaching powder the solution is made alkaline with ammonia and a dilute aqueous solution of phenol is added, a permanent blue colour being produced even with minute quantities of aniline. This test has been made quantitative by comparing the colours obtained at known concentrations with a series of standard colours prepared from a dye.

Organic Halogen Compounds

These are widely used as solvents, degreasing and cleaning agents. Their vapours, if inhaled in high concentrations, may produce narcosis, and death may follow if exposure is prolonged. Such concentrations may occur in many important industries. Much information is available as to the toxic effects of a single exposure to the vapours of these compounds. Information as to the effects of repeated exposures to low concentrations is less extensive, but indicates that under these conditions they should all be regarded as harmful to a varying degree.

The only simple method of detection of organic halogen compounds is by the use of a 'halide detector lamp.' This is a form of blow lamp which burns pure alcohol in a supply of the air under test. Any traces of organic halides present in the air are decomposed by the heat of the flame and react with a small copper screw in the nozzle of the lamp, forming the corresponding copper halide. This immediately imparts a green coloration to the otherwise colourless flame, the degree of coloration depending to some extent on the nature of the organic halide and the concentration present.

The colour of the flame is not matched against a standard colour, but when routine tests are made at certain specific points in a works under conditions of illumination which remain constant, any substantial change in the amount of halide in the atmosphere can be detected. A bright green flame in the lamp gives an unmistakable warning of harmful concentrations of most of the halogen compounds. For dichloroethane and carbon tetrachloride it is obtained at approximately the maximum permissible concentration for continuous exposures; for the chlorinated ethylenes it appears at a much lower concentration than can be considered dangerous; for methyl bromide, trichloroethane, tetrachloroethane, pentachloroethane, and possibly monochlorobenzene, the concentrations which may possibly give rise to chronic effects are too low to give a coloured flame; methyl bromide concentrations below those which give a green colour may also give rise to acute effects.

The simple and rapid tests described in this article are set out fully in a series of leaflets collectively entitled 'Methods for the Detection of Toxic Gases in Industry,' which are obtainable from HMSO. Each leaflet deals with a particular gas or group.

Salt Pan Found

A large salt pan which will be of great economic value to South Africa has been found 24 miles north of Cape Cross in South West Africa. Because it is covered by sand its exact size is unknown, but it is believed to extend over 40 sq. miles.

The Dust Problem in Chemical Plant

Crystal Treatment Provides Increased Hygiene

THE danger of dust from concrete floors in chemical plant has long presented a problem to plant engineers and company executives. The problem has been tackled by scientists but only half tackled by executives—primarily because not enough has been made known of the cause of the dust or the developed antidotes which have been produced as an answer.

An investigation of the dust problem has reduced the major cause to the soft particles of lime and calcium carbonate in the concrete. These particles are stirred up by the workers' feet, by abrasion from the movement of heavy vehicles or equipment, by mechanical handling and by vibration of machinery.

Only Temporary Solution

In the past the problem has been approached by using sodium silicate which forms, in the main, only a superficial film or skin. Experience has shown that this skin wears off quickly, and the old dust problem arises again. Sodium silicate combines incompletely with the concrete as a temporary remedy which must be repeated each time the floor goes 'soft.' The alternative and only successful treatment must obviously be one in which the soft particles in the concrete are hardened and made insoluble; not merely superficially, but to a considerable depth within the concrete matrix.

A material which can produce this effect and give the dustless quality to old existing floors in addition to new ones has been the subject of research, experiment and development by the laboratories of Evode Limited. The firm have now perfected a prover which at once eliminates dusting, resists corrosion and provides an effective hardening treatment for cement surfaces, concrete and granolithic floors.

This answer to the concrete dusting problem contains no sodium silicate. It is not a temporary treatment but penetrates the concrete, transforming the soft particles which cause dust into hard, insoluble flint-like compounds. These compounds occupy a larger volume than the soft materials from which they were formed, and a densifying action on the concrete provides distinct strength improvement in addition to abrasion resistance. The result is a hard, strong floor which cannot be worn down by abrasion or vibration to the point where dust would again be generated.

Evode scientists have studied both the problem of the new and the old floor. The new factory or laboratory floor receives a prover crystal treatment (known as Evode Prover II) while, with old floors which have been in use for more than a year, a prover solution (known as Evode Prover V), has been developed for brushing in.

The floor is given three applications, each 24 hours apart. To avoid losses through disorganisation and wasted production hours the formula has been extended to allow the floor to be used within an hour after the first treatment. Between the second and third prover-treatments the floor is not in any way affected by use.

These provers end dust, but they are not calculated to create a true reinforcement of the concrete. Research in a cross-section of chemical plant satisfied the Evode team that there was a need for a dust inhibitor which would simultaneously waterproof and increase the strength of concrete flooring in the formation stages. Development produced Mellitol, a powder whose consistent behaviour as a catalyst increases the homogeneous quality of concrete both in uniformity and density. It is concentrated to a degree whereby 1 lb. provides full treatment for each 100 lb. of cement.

These developed dust inhibitors have proved successful in practical application in chemical plant, refractories workshops and in a wide range of industrial buildings. It is believed that the economy and saving the provers give will do much to promote dustless industrial plants of the future—a matter of vital importance to efficiency and health.

Sulphuric Acid Production

Sulphuric acid produced in this country during June amounted to 165,500 tons, 4,400 tons less than in May; 160,000 tons were used, against 168,000 tons.

Safety Notebook

MORE safety education and propaganda are recommended for British factories by the specialist team on industrial engineering who visited the United States last year under the auspices of the British Productivity Council. In their report, recently issued, they point out that in America education is considered more important than safety devices and regulations. Here, since the law prescribes guards, they are often thought to be enough, and the human element receives scant attention.

As an example of the importance of the appeal to the individual, the team cite a poster of a human head they saw in one American plant. The caption read: 'Your best safety device is above your shoulders.' In another plant they were told that a worker who had two avoidable accidents after being briefed on a new process or machine tool would be dismissed.

The team came to the conclusion that in Britain the Factory Acts sometimes contained 'over-elaborate and detailed legislation on safety,' so that firms did little constructive thinking of their own but merely ensured that the letter of the law was being carried out. In the USA the drawing-up of safety rules is left largely to individual managements and local union branches, and to some extent to the influence of insurance companies, whose premiums for compensation take them into account.

The report praises the generally high standard of heating, ventilation and lighting in American factories, which, it says, could well be emulated in Britain. It also has something to say about canteens: 'We were especially impressed by many of the works canteens which we saw . . . . We consider that it would not be amiss if the standard of cleanliness in British factory canteens were to be raised; cracked cups, dirty dishcloths and unwashed overalls are probably not unrelated to standards in the factory itself.'

* * *

MORE than 600 references are contained in the bibliography 'References to scientific literature on fire' (Part VI) issued by the Joint Fire Research Organisation of the Department of Scientific and Industrial Research and the Fire Offices' Committee. Most of the references are to information published in 1952, but a few earlier ones not included in Part V are also given.

The bibliography is divided into sections, dealing with different aspects of research into fires. The longest one is on studies in initiation and development of combustion.

* * *

A REVISED safety data sheet on butadiene, a chemical widely used in the manufacture of rubber products, is now available according to an announcement by the Manufacturing Chemists' Association. Chemical Safety Data Sheet SD-55, covering the properties and essential information for the safe handling and use of butadiene, has been revised to include more up-to-date and complete information. In the interest of safe handling of this material, a number of important changes have been made in the sections relating to personal protective equipment and general handling procedures.

Copies of SD-55, Butadiene, may be obtained from the Manufacturing Chemists' Association, 1625 Eye Street, N.W., Washington 6, D.C., at 25 cents each.

* * *

PRAISE for I.C.I., Billingham, for work in reducing the accident rate in the anhydrite mine is contained in the report for 1952 of HM Inspectors of Mines and Quarries. The report, quoted in the September issue of the *Tees-Side Journal of Commerce*, says that few large firms operating safety devices can have achieved such success.

The accident frequency rate at the I.C.I. mine is calculated on the number of accidents per 100,000 man-hours worked, accidents including any occurrence which results in any loss of time beyond the day or shift in which it happens, or one which prevents the injured man from carrying out his work.

Interest is sustained by monthly meetings. Safety panels, consisting of junior officials, union shop stewards and representatives of the miners, investigate every accident and issue a report, with recommendations, which is posted on the surface and underground. Senior officials are not present to encourage the men to voice their opinions freely.

Antioxidants in Food

Revised Report Presented to Standards Committee

THE Minister of Food has approved for publication a revised report presented to the Food Standards Committee by their Preservatives Sub-Committee, making recommendations about the use in foods of antioxidants.

An earlier report on this subject by the sub-committee was published in June, 1953 (see THE CHEMICAL AGE, 1953, **68**, 924). Since then the sub-committee have reviewed the representations received from trade and other interests and the revised report replaces the earlier report.

Controlled Use Desirable

In the revised report the sub-committee point out that doubt exists whether use of antioxidants in foods would infringe the Public Health (Preservatives, etc., in Food) Regulations; that use, under strict control, of this class of substance in foods liable to oxidative rancidity is desirable to enable such foods to be kept in sound condition for longer periods and that use of antioxidants in foods is permitted in some other countries which may export foods so treated to this country.

The sub-committee have given consideration to the biological, physiological and functional properties of antioxidants and the technical problems involved in food manufacturing. In the light of the evidence available the sub-committee have recommended that antioxidants should be confined to foods liable to oxidative rancidity and should not be added to any foods other than to edible oils and fats and to essential oils, to which it should be permissible to add the undermentioned substances in quantities not exceeding those stated.

	Edible oils and fats	*Essential oils*
Propyl, or octyl or dodecyl gallate, or any mixture thereof	0.01 %	0.1 %
Butylated hydroxyanisole	0.02 %	0.1 %

Butylated hydroxyanisole (up to 0.02 per cent) may be used in conjunction with the gallates (up to 0.01 per cent) in edible oils and fats; in the case of essential oils the total amount of antioxidant or mixture of antioxidants should not exceed 0.1 per cent.

In the earlier report the antioxidants recommended were confined to propyl gallate and butylated hydroxyanisole; and the amount of antioxidant to be permitted in essential oils was the same as for edible oils and fats.

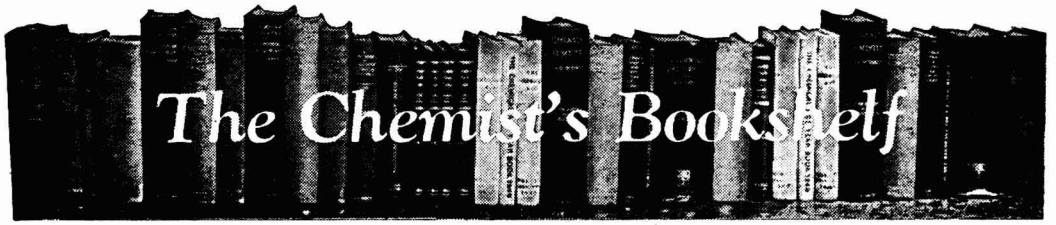
For the purposes of the recommendations in the revised report the term 'edible oils and fats' covers animal, vegetable and fish oils, whether hardened or not, vitamin oils and concentrates, and products consisting essentially of fat such as margarine, shredded suet, etc., but not including butter; and the term 'essential oils' includes their flavouring constituents—isolates and concentrates—but not flavouring essences.

The sub-committee finally recommend that the permissive addition of antioxidants to foods should be reviewed and if necessary amended in the light of experiences after a period of, say, two years.

Before taking any action on the report the Minister of Food will receive any further representations which interested parties may wish to make. They should be addressed to the Assistant Secretary, Food Standards and Labelling Division, Ministry of Food, Great Westminster House, Horseferry Road, London, S.W.1, and they should be lodged not later than 30 November.

Epoxide Resins Patent Agreement

An agreement has been reached between Aero Research Ltd. and Shell Chemicals Ltd. covering, in the United Kingdom, the patents held by Ciba and Shell in the field of epoxide resins. This agreement will be of particular value to the paint industry in that it will give freedom under both the Ciba and Shell patents to all purchasers of epoxide resins from either company to sell or use these materials in the surface coating field. In the specialised fields of potting, casting, laminating and adhesives, similar freedom under the patents will be available to customers purchasing epoxide resins from either company for their own use but not for resale in their original or modified form.



INDUSTRIAL FERMENTATIONS. Vol. 1. Edited by Leland A. Underkofler and Richard J. Hickey. New York, Chemical Publishing Co. Inc. 1954. Pp. lx, + 565. $12.

Of late years, an abundant shower of American books relating to industrial processes has fallen upon the country; they lie thick on the hills; every industry has one or more of them; they are fresh enough in outlook greatly to stimulate their readers, and ought to be doing a great deal of good. It is an interesting conjecture that had Charlotte Bronte been born in the changed conditions of the twentieth century she might never have written 'Shirley'; she might well have taken up her pen not on the subject of curates but on American Scientific Literature. The opening sentence given above would then have been hers, and yet with slight alteration would have been equally apposite to both subjects.

It is natural in reviewing a book such as this, which spreads over a very wide field, to turn first to those sub-divisions of the subject one knows thoroughly. The first appraisal obtained in this manner covered a considerable portion of Volume 1, since five of the fermentations there described have at one time or another commanded the close attention of your reviewer. It was found that certain mis-statements as to what is current industrial practice in the United States have crept in. In one instance even the type of organism commonly used for a particular fermentation is wrongly given. This is unfortunate, but it is only to be expected of a text-book on a rapidly developing industry of such ramifications that much secrecy—often such unnecessary secrecy—is still maintained. Indeed, indulgence will readily be granted for such errors in view of the undoubtedy excellence of the book as a whole. Encyclopædic in scope, the first volume has nineteen contributors of whom most have an international reputation. The contents may be divided into four parts:—the production of alcohol; the production of yeast; the butanol-acetone fermentations; the production of organic acids by fermentation. The first part describes the alcoholic fermentation of grain, of molasses, of sulphite waste liquor, the production of alcohol from wood waste, the brewing industry and the American wine industry. The second part deals with commercial yeast manufacture and with food and feed yeast. The third part is a single chapter on the butanol-acetone fermentations, and the fourth deals with lactic acid, citric acid, gluconic acid, fumaric acid, itaconic acid and acetic acid—vinegar. Apart from a few errors the chapters are authoritative, and it is particularly heartening to see considerable attention given to the chemical engineering side of the subject by some of the contributors. Inevitably differences in style and lucidity are discernible, but it can be stated with confidence that 'Underkofler and Hickey' will become a standard book of reference on fermentation and one which will be found in the libraries of all engaged in the subject.—J. G. BARNES.

HISTOCHEMISCHE METHODEN. A collection by Walther Lipp. Part 2. R. Oldenbourg, Munich. 1954. Pp. 24. DM 6.

The last two decades have seen the development of a large number of new chemical tests for the microscopical detection of tissue components. Unfortunately, the literature about these techniques is somewhat scattered and much of the work is published in rather inaccessible journals. In this new periodical, 'histochemical methods' are collected together in a convenient form.

Part I has already been reviewed in THE CHEMICAL AGE (1954, **70**, 1309). Part 2 describes the detection of arginine with α-naphthol and hypobromite, and gives several tests for succino-dehydrase. It also includes recipes for various types of buffer solutions, and an interesting section on the detection of radioactive substances in tissue slices by impregnation with silver salts. All details are presented clearly.—J.C.P.S.

HOME

Interest Acquired in Jamaican Firm

The Berger group of companies has acquired a controlling interest in New World Paints, a company operating from its factory in Kingston, Jamaica, and the group's paints will be manufactured under licence in Jamaica in the near future. The aim is to extend trade in the West Indies and in an area where government support is given to the establishment of local industry.

More Chemical Workers

A total of 507,800 people—the highest figure to date—was employed in the chemicals and allied trades in June. Well over half of them (287,700) were working at coke ovens or in the manufacture of chemicals, dyes, explosives or fireworks. About one-fifth were engaged in making pharmaceutical and toilet preparations, perfumery or soap.

Import Duties Exemption Order

The Treasury have made the Import Duties (Exemptions) (No. 7) Order, 1954, which provides for the exemption of all grades of titanium dioxide from duties chargeable under the Import Duties Act, 1932, for a period of six months. The Order came into operation on 27 September, 1954, and has been published as Statutory Instruments 1954, No. 1234.

Natural Gas Research

A detailed report on the natural gas experiments at Crowborough will soon be presented to the Minister of Fuel, Mr. Geoffrey Lloyd. This is the first major project under the scheme to spend £1,000,000 a year on research. The site for a second drilling is now being considered.

Port Sunlight Commemorates its Founder

The Mayor and Mayoress of Bebington (Mr. and Mrs. F. McNeil) and the Mayor and Mayoress of Birkenhead (Alderman and Mrs. Hugh Platt) were in the congregation at Port Sunlight, on 19 September, when the 103rd anniversary of the birth of William Hesketh Lever, first Viscount Leverhulme and founder of Port Sunlight, was commemorated. Before the service wreaths were placed on the founder's tomb by his grandson, Lord Leverhulme, and Mr. G. A. S. Nairn (chairman of Lever Brothers, Port Sunlight Ltd.).

London Ladies Night

The 1954 dinner-dance of the London section of the Oil & Colour Chemists' Association, popularly known as 'Ladies' Night,' will be held at the Monico Restaurant, Piccadilly, London, W.1, on Friday, 26 November. Single tickets will be one and a half guineas each. Further details may be obtained from the General Secretary, Mr. R. H. Hamblin.

New Wood Preservative Formulation

Announced by Detel Products Ltd. is a new preservative, Detel W/P, based on pentachlorophenol. The solution is supplied in 1, 5 and 40 gal. drums, and although care must be taken in its application, as it is a skin irritant, it can be used on finished articles without risk of swelling or shrinking. It should prove particularly suitable for preservation of packages of scientific instruments, drugs, etc, against the attack of insects and fungi in tropical climates. Further details obtainable from the manufacturers at Victoria Park Estate, South Ruislip, Middlesex.

The Institution of Chemical Engineers

The subject at The Institution of Chemical Engineers' meeting at The Royal Institution, Albermarle Street, London, W.1, at 5.30 p.m. on 14 October will be 'Pre-design estimation of the capital cost of chemical plant' by Mr. R. Edgeworth Johnstone, a member. The president, Sir Harold Hartley, will take the chair, and members' guests will be welcome. Members who make a written request for the preprint will be supplied with one when it is available.

Telcon Office at Newcastle

The Telegraph Construction & Maintenance Co. Ltd., Telcon Works, Greenwich, announce the opening of a new branch office and depot at 2 St. Nicholas Buildings, Newcastle-on-Tyne 1, under the management of Mr. R. Fenwick. Stocks are carried of PVC wiring cables and flexibles, radio frequency and broadcast relay types of cables and the branch handles inquiries for other Telcon products. The company have also opened a London sales office at Norfolk House, St. James's Square, S.W.1, under the management of Mr. A. W. Matkin.

• OVERSEAS •

Petrochemical Plants for Germany

Four plants for producing chemicals from petroleum are being built in Western Germany. When completed, by the end of next year, they will have a combined output of 30,000 tons which will treble the country's production of petro-chemicals.

Brazil Major Nicotine Producer

Sociedade Agricole e Industrial de Adubos de Fumo Ltda., Passa Quatro, has become one of the nine nicotine producers in the world. The alkaloid is extracted during the conversion of tobacco waste to fertiliser. This is the second factory to produce nicotine in Brazil, the first being that of Luiz de Oliveira Barreto Filho, at Bahia.

More Magnesium Used

Magnesium consumption in the USA during 1953 was 14 per cent higher than in 1952, according to the Bureau of Mines, United States Department of the Interior. Primary magnesium production fell during the year to 93,075 tons, a decrease of 12 per cent from the 1952 figure.

Phosphate Concentrate for S. Africa

When the big Government undertaking at Phalaborwa, FOSKOR, starts production, it will be in a position to supply the South African Union's demand for phosphate concentrate for the next 100 years, the South African Minister of Economic Affairs, Mr. E. H. Louw, said at Pietersburg recently. Up to the present, rock phosphate had been imported from North Africa, he added. In the event of a war, however, the Union's supplies from North Africa could be cut off completely. FOSKOR could therefore be regarded as a strategic industry.

Record World Bauxite Production

Record world production of bauxite, amounting to 13,800,000 long tons, was reached in 1953. In the USA less was produced than in 1952, but more was imported and more used, mainly by aluminium manufacturers. Since 1947 the United States has been increasingly dependent on imports, which last year reached nearly three times the figures for domestic production.

Strikes Affect Carbon Black Shipments

Strikes in the rubber industry caused a decline in shipments of carbon black in the USA during July. Average daily production was 2 per cent higher than in June.

Phosphate Rock in the USA

Mine production of phosphate rock ore in the USA in 1953 was more than 40,000,000 long tons, according to reports by producers to the Bureau of Mines, United States Department of the Interior. Total marketable production rose by 4 per cent, but stocks in producers' hands were slightly less than in 1952.

More Sulphur

The United States domestic sulphur industry produced 471,594 long tons of native sulphur and 31,900 tons of recovered sulphur (of a purity of 97 per cent or more) during July, according to reports of producers to the Bureau of Mines, United States Department of the Interior. The figures compare with 455,174 long tons and 30,500 tons respectively in June.

New Dutch Oil Cracking Plant

It was announced at Rotterdam recently that a second catalytic cracking plant, with a capacity of 5,000 tons daily, is to be built in the Pernis Refineries of the Bataafsche Petroleum Maatschappij. The new plant, according to the managing director of the concern, is to be of the 'fluid bed' type. Building is to begin at once, and completion is expected within two years. The new installation is to produce mainly high quality motor spirit, but some of its output will be high-octane aviation fuel.

Uranium Fields Development

Saskatchewan's uranium fields are being developed at the fastest pace since the initial discoveries, Resources Minister Brockelbank of Saskatchewan said recently on his return from a 1,400-mile inspection trip. Smaller mines have been stimulated into production by the Federal Government-owned Eldorado Mining Co., which has started milling ores produced by private companies, Mr. Brockelbank reported. Between 50 and 60 companies were exploring or processing in the Beaverlodge area, 500 miles northwest of Saskatoon, he added.

PERSONAL

SIR ALEXANDER FLEMING is giving up his post as head of the Wright-Fleming Institute of Microbiology at St. Mary's Hospital, London, at the end of the year to concentrate on medical research. Sir Alexander, who is 73, will continue experiments at St. Mary's laboratories, where he first went as a student more than 50 years ago.

MR. F. H. STRUTT, of Exeter, newly-appointed chief chemist, has taken up his duties at the Nantwich Tannery of Harvey & Sons Ltd.

MR. T. H. BENNETT, M.P.S., has been appointed administration manager of the Overseas Division of Evans Medical Supplies Ltd., Speke. During the last war Mr. Bennett was adviser on imports and exports in the chemical and pharmaceutical departments of the Directorate General, Indian Medical Service. Subsequently he became manager for SE Asia for Evans Medical Supplies Ltd., and since 1944 has been managing director of Evans Medical Supplies (India) Ltd.

In a ceremony watched by 500 workers and heard by thousands more, Port Sunlight on 24 September paid tribute to its retiring chairman, MR. G. A. S. NAIRN, who left on 30 September. Lord Leverhulme presented him with a TV set and a cheque, subscribed to by all employees at Port Sunlight. Speeches were relayed to the works and offices over the company's internal broadcasting system. Lord Leverhulme said that Mr. Nairn had had a long and distinguished career in the service of the Unilever family, joining the business in 1919 and going straight to Port Sunlight. He was appointed to the board of William Gossage & Sons Ltd., Widnes, and was chairman there from 1932 to 1934. He was president of Lever Brothers, Canada, in 1945 returned to London as a member of the United Kingdom Food Executive and two years later was appointed chairman of the company at Port Sunlight.

DR. ARTHUR F. MCKAY has been appointed Director of Research and Development of Monsanto Canada Ltd. Dr. McKay will direct Monsanto's extensive programme of research and development from the Montreal head office laboratories, including among his responsibilities the company's research activities in Vancouver. A doctor of philosophy from the University of Toronto, 1944, Dr. McKay also holds chemical degrees from McGill and Dalhousie universities. From 1945 to 1946 he was a post-doctorate research fellow of the Ontario Cancer Treatment and Research Foundation; from 1946 to 1949 assistant professor of chemistry, Queen's University; and from 1949 to his present appointment with Monsanto Chemical, head of the organic chemistry division of Defence Research Laboratories, Ottawa.

A new director of the Beecham Group is MR. ROBERT CRAIG WOOD who resigned the managing directorship of Thomas Hedley & Co. Ltd. in May. He is to join the executive directors at headquarters and will be principally concerned with development projects. Earlier this year, Mr. Craig Wood refused an offer by Procter & Gamble, the US parent company of Thomas Hedley, of a post in America equivalent to the one he then held.

MR. J. B. CHARTERS has succeeded MR. MARSDEN RYLE, who recently retired, as manager of the Osram Glass Works at Wembley and Lemington. Mr. Charters began his career with the General Electric Co. Ltd. at the Osram Lamp Works, Hammersmith, and was assistant factory superintendent there when he joined Wembley Glass Works in 1943 as factory superintendent. Early in 1947 he was appointed production manager. The post of production manager left vacant by Mr. Charters has been filled by DR. F. S. HAWKINS who before joining the staff of Wembley Glass Works in February this year, was in charge of the glass department at the research laboratories of the company.

MR. B. W. GALVIN WRIGHT has been appointed publicity controller of Imperial Chemical Industries Ltd. with effect from 1 October, in succession to MR. SIDNEY ROGERSON, who will relinquish the office on 30 September in order to retire from the company's service. Mr. Rogerson joined the

company in 1930, and was I.C.I.'s Press manager until the end of 1936, when he was appointed departmental manager of the newly former central publicity department. He was appointed publicity controller on 1 January, 1944, when that office was first instituted. Mr. Rogerson was seconded by the company to the War Office in April, 1952, to act as Adviser on Public Relations to the Army Council, and has recently relinquished that appointment. As controller of I.C.I.'s publicity, Mr. Galvin Wright will have the assistance of Mr. Gordon Long, who will continue in charge of the public relations section of the department, with MR. GEOFFREY RICHARDS as Press officer, and MR W. J. MARRABLE, who is in charge of the commercial advertising and exhibitions section.

The directors of The Brush Group Ltd. announce that SIR HAROLD ROXBEE COX, B.Sc., Ph.D., D.I.C., M.I.Mech.E., R.R.Ae.S., F.Inst.F., has been elected a director of the company. Until recently Sir Harold was Chief Scientist, Ministry of Fuel and Power. He has also been director of the National Gas Turbine Establishment, chairman and managing director of Power Jets (Research and Development) Ltd., and Director of Special Projects, Ministry of Aircraft Production.

At the annual general meeting of the National Smoke Abatement Society, held on 24 September at the end of their three-day conference at Scarborough, SIR ERNEST SMITH, C.B.E., was elected for a second year of office as president. Sir Ernest, a former president of the Institute of Fuel, is also chairman of the Industrial Coal Consumers' Council.

PROFESSOR D. W. VAN KREVELEN has accepted an invitation to deliver the British Coal Utilisation Research Association's third coal science lecture on 13 October. He has chosen as his title 'The Problem of Coal Constitution.' A native of Rotterdam, Professor van Krevelen has travelled and lectured extensively in Western Europe and the USA. He has published about 60 papers on subjects covering chemical engineering, fuel and gas technology and coal chemistry.

Four Britons and a British-born American have been elected Fellows of the Textile Institute. The American, MR. P. J. WOOD, was born in Leeds. He went to the USA in 1903 and is now technical director of the Royce Chemical Company, New Jersey. The other four Fellows are MR. A. CHARLESWORTH, M.Sc., of Barrowford, Nelson, Lancs; MR. H. T. FERGUSSON, A.M.C.T., A.R.I.C., of Bramhall, Cheshire; MR. G. ROBINSON, of West Hagley, Nr. Stourbridge, Worcs,, and DR. A. E. STUBBS, M.Sc., F.R.I.C., F.S.D.C., of Bolton, Lancs. Mr. Charlesworth is works manager at Jopson, Bardley & Jopson Ltd., of Nelson; Mr. Fergusson a research chemist at Geigy Co. Ltd., of Middleton, Lancs; Mr. Robinson head chemist of Carpet Trades Ltd., of Kidderminster; and Dr. Stubbs head of the chemical section of the research laboratories of the Bleachers Association Ltd.

Will

MR. SAMUEL ERNEST MELLING, M.Sc., F.R.I.C., of 2 Stanley Road, Ansdell, Lytham St. Annes, for 30 years public analyst for Cheshire and S.E. Lancashire, left £23,317 gross, £22,783 net (duty paid £3,270).

Association Changes Name

THE Institute of Science Technology Ltd., registered on 21 September as a company limited by guarantee without share capital, is the new name of the former Science Technologists' Association. Members of the association automatically become members of the institute, and they will now be eligible for election as Fellows, on submission of a thesis.

The objects of the institute are 'to advance the knowledge of science laboratory techniques by all means, etc.' The income and property of the institute are to be applied solely towards promoting its objects.

The management is vested in a Council the first members of which are:—Francis L. W. Croker, Chemistry Department, Imperial College, S. Kensington, S.W.7; Reginald Brinsden, Botany Department, University College, Gower Street, W.C.1; Frank W. Jane, Nelson E. Condon, Fredk. C. Padley, Edwin S. Brett, Andrew Clunie, John R. Redpath, Ronald F. G. Coles, Wm. Laing, Evan O. Rowland, Cecil S. Simmonds, Wm. J. Tucker, Harold J. Smith, Wm. R. Weedon, Arthur Welch and Sidney A. Smith.

The registered office is Chemistry Department, Imperial College, S. Kensington, London, S.W.7.

Publications & Announcements

THE Doran Instrument Co. Ltd., Stroud, Glos, has issued two pamphlets, one describing the Dual Titrometer, the general design of which is due to the Shell Development Company of America, and the other, their range of *p*H electrodes. The Dual Titrometer is a continuously indicating instrument employing a step potentiometer in combination with an electrometer valve circuit. The use of a continuously indicating meter not only requires less manipulation by the operator but also enables him, easily and definitely, to ascertain when the potential reaches equilibrium. The step potentiometer makes it possible to meet the requirements of a wide range and high resistance sensitivity in a single indicating meter.

* * *

TWO leaflets, Nos. 55 and 56, have been issued by Croydon Precision Instrument Co., describing their precision Vernier potentiometer and their portable thermocouple potentiometer. A special feature of the construction of the Vernier potentiometer is that all terminals, studs, etc., are of copper. The studs are tipped with a precious metal alloy which ensures a good clean contact and minimises the thermo-electric EMF's generated by the action of the switches. A galvanometer key and a series sensitivity control are included. The accuracy is of the order of 1 part in 100,000 of the 1 volt setting. The portable thermocouple potentiometer is suitable for temperature measurement with all thermocouples and for calibrating the indicating instruments which are used with thermocouples.

* * *

FOR filling thermometers at temperatures below −40° the only medium previously available was of the spirit type, such as toulene, pentane, etc.; these fluids were not suitable where an accuracy of 0.1° was essential. An alloy mercury of thallium is now available, having a freezing point below −51°. It is particularly suitable for low temperature viscosity thermometers as specified by the Institute of Petroleum Ref. 65F and C ASTM 43F, etc. These thermometers are now being manufactured by H. J. Elliott Ltd., E-Mil Works, Treforest, Pontypridd, Glam.

CRUSILITE, the new silicon carbide furnace element made by the Morgan Crucible Co. Ltd., of London, S.W.11, is now available in diameters of 10 mm., 14 mm., 18 mm., 22 mm., and 28 mm. Larger diameters will be available later. The company have issued a pamphlet describing the advantages of Crusilite elements in heating high temperature industrial furnaces by electrical means.

* * *

AUGUST additions to the catalogue of BDH, Poole, Dorset, are 4,4′-diamino-stilbene-2,2′-disulphonic acid, an important dyestuff intermediate, available in technical quality; and potassium hydroxide in flakes. Thermochemical standard benzoic acid is now available in pellet form, and the company announce that the current batch has a NPL-certified calorific value of 26435 J per g. (standard error 3 J per g.), which is in good agreement with the generally accepted value of 26433.8 ± 2.6 J per g. Biuret is available for technical investigation in technical quantities, and notes on its chemistry may be obtained on application.

* * *

THE tetraacetonitrile of ethylene diamine is now commercially available. Ethylene diamine tetraacetonitrile (EDTN) is a cream to light tan powder having a purity of more than 95 per cent. It melts at 131-133°. The *p*H of a 2 per cent solution is 4-6. EDTN is soluble in hot water, methanol and ethyl acetate. It is practically insoluble in cold water, hydrocarbons, vegetable and mineral oils. It exhibits the typical reactions of nitriles. Its polynitrile structure makes it an interesting intermediate for making polyamino derivatives. For example, it can be readily hydrolysed with dilute alkalies or acids. EDTN reacts with alcohols to give long chain esters. It readily forms new compounds by reduction. It produces interesting new compounds by Friedel-Craft reactions. It forms quaternary compounds and many complex derivatives. EDTN is available in drums at $1.00 per lb. A bulletin giving its properties and chemical reactions is available from the manufacturers, Glyco Products Co. Inc., 26 Court Street, Brooklyn, New York.

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.)

STOCKO (METAL WORKS) LTD., London, E.C.—23 August, charge to Halifax Building Society securing all moneys due from Stephen George King to the charges; charged on certain war stock. *Nil. 18 May, 1951.

NORCO LTD., Birkenhead, manufacturers of oils, etc.—23 August, two charges, to Midland Bank Ltd., each securing all moneys due or to become due to the bank from T. & A. Burns & Co. Ltd.; respectively charged on certain moneys and a general charge. *Nil. 10 August, 1953.

Satisfactions

BRITISH CELANESE LTD., London, W.—Satisfactions, 27 August, of debenture stock registered 2 October, 1943, and 8 November, 1944, to the extent of £10,297 and of second debenture stock registered 24 September, 1946, to the extent of £20,000.

New Registrations

Fomac Ltd.

Private company. (15,223.) Registered in Dublin. Capital £5,000. To carry on the business of manufacturers and distributors of fertilisers and fertiliser compounds, etc. The subscribers (each with one share) are: Maurice E. Veale, and Evelyn Grogan. Gerard F. M. Van Den Bergh is the first director.

Tees-Side Chemical & Engineering Merchants Ltd.

Private company. (538,244.) Capital £5,000. The subscribers (each with one share) are: D. V. Jennings and M. B. Boreham. The first directors are not named.

Company News

Birlec Ltd.

The Mond Nickel Co. Ltd., on behalf of its parent company, The International Nickel Company of Canada Ltd., announces that following negotiations between Associated Electrical Industries Ltd., Mond and Birlec Ltd., the sale by Mond of its wholly-owned subsidiary Birlec to AEI has been agreed. Birlec will operate as an individual company with the AEI group. Mr. George P. Tinker will continue as managing director and Mr. T. G. Tanner and Mr. J. H. Crossley as executive directors.

Imperial Chemical Industries Ltd.

The Directors of Imperial Chemical Industries Ltd. announce that they have declared an interim dividend of 4 per cent (actual) in respect of the year ending 31 December 1954, on the Ordinary stock of the company. This dividend will be payable on 1 December 1954, less income tax at the United Kingdom standard rate for 1954/55, to members on the Register on 8 October, 1954.

Lawes Chemical Company Ltd.

A dividend of 10 per cent for the year was approved at the annual general meeting of Lawes Chemical Company Ltd., on 27 September. At an extraordinary general meeting which followed, unanimous approval was given for the capitalisation of reserves and the distribution to members of one new Ordinary share for every four Ordinary shares held.

Dorman Long & Co. Ltd.

Dorman Long & Co. Ltd. has formed three wholly-owned subsidiary companies to take over its trading activities. They are: Dorman Long (Bridge and Engineering) which will take over the trading activities carried on at the Bridge and Constructional Works, Middlesbrough, the London Constructional Works and the Bridge and Contracting Department, Luton; Dorman Long (Chemicals), which will take over the trading activities of coal by-products, distillation, etc., at Port Clarence; and Dorman Long (Steel) which will carry on

with the direct trading activities, other than those taken over by the other subsidiaries, of the parent concern. Dorman Long and Co., Ltd., will cease to trade but will continue as a holding company to co-ordinate the general policy of the group.

Canadian Industries (1954) Ltd.

Directors of Canadian Industries (1954) Ltd., have declared an initial quarterly dividend of 1⅞ per cent (93¾ cents) on the company's 7½ per cent, $50 par preferred stock, and an initial quarterly dividend of ten cents on the common stock. Both dividends are payable in Canadian funds, the preferred on 15 October to shareholders on the register on 15 September and the common on 29 October to holders on the register on 30 September. Canadian Industries (1954) Ltd., is one of the two successor companies (the other being Du Pont of Canada Ltd.) of Canadian Industries Ltd., which was split up into two separate firms as from 1 July.

Vitamins Ltd.

Vitamins Ltd. propose to issue 150,000 6 per cent cumulative preference shares of £1 each at 20s. per share to holders of Ordinary stock and the 4½ per cent Unsecured Notes of the company on the registers at the close of business on 16 September.

Geo. Adlam & Sons Ltd.

Net profit, before taxation, of Geo. Adlam & Sons Ltd., for the year ended 31 March, 1954, was £36,102, compared with £25,022 in the previous year. A dividend of 3d. on the 1s. Ordinary shares, against 2d., is recommended.

Sturtevant Engineering Co. Ltd.

The board of Sturtevant Engineering Co., Ltd., has declared a tax-free interim dividend of 5½ per cent for 1954, as for the previous year but payable on £443,826 capital as raised by a 12½ per cent free scrip issue. A final dividend of 14 per cent tax free was paid on the increased amount for 1953. It is proposed to double the authorised capital to £1,000,000 and make a free issue of new shares on a one-for-one basis from general reserve. CIC consent has been obtained. The new shares will not rank for the above interim.

Stream-Line Filters Ltd.

The directors of Stream-Line Filters Ltd., cannot see any prospect of maintaining the present level of profits in the immediate future, shareholders were told at the annual general meeting on 25 September. The chairman, Mr. S. C. Garland, A.R.C.S. B.Sc., F.R.I.C., M.I.Chem.E., said that 1953 was remarkable for the coincidence of a number of favourable factors which were unlikely to continue. Combined profits for the year were £97,162, after providing £332,412 for taxation.

Market Reports

LONDON.—Firm price conditions continue on the industrial chemicals market, and a steady flow of new business for home accounts has been reported, covering a fairly wide range of materials. Export trade in chemicals remains good and shipments so far this year are substantially higher than for the same period of 1953. At the time of this report no further change in prices for non-ferrous metal compounds has been notified. The coal tar products market has no special features. Supplies in most cases may be no more than sufficient to meet the demand.

MANCHESTER.—Both home and export business in heavy chemical products on the Manchester market during the past week has been generally well maintained so far as deliveries against old bookings are concerned, while a fair number of fresh inquiries has also been dealt with for the soda and potash compounds, as well as for a wide range of other products. Prices are held pretty well throughout the range. In the fertilisers, basic slag and the compounds are attracting fair attention, but otherwise the demand is no more than moderate. Most of the light and heavy tar products are in steady request, and the undertone is firm.

GLASGOW.—The position has changed very little during the last two or three weeks. The demand for industrial chemicals still remains very good. Prices on the whole have been steady, although copper derivatives have been advancing steadily over the last fortnight. Some interesting inquiries and offers have been received from overseas and on the whole manufacturers and merchants alike seem to be well satisfied with the conditions.

Next Week's Events

MONDAY 4 OCTOBER

The Royal Institute of Chemistry

London: Chemical Society's Rooms, Burlington House, Piccadilly, 6.30 p.m. Joint meeting of London section with London section, Society of Chemical Industry. 'Some industrial applications of metal cleaning' by E. L. Streatfield.

TUESDAY 5 OCTOBER

Incorporated Plant Engineers

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. 'Controlled air conditions in factories,' by D. J. Hyam (G. N. Haden & Sons Ltd., London, W.C.1).

Edinburgh: 25 Charlotte Square, 7 p.m. 'Trends in industrial instrumentation,' by A. B. Dryburgh, Chief Instrument Engineer, Grangemouth Petroleum Refinery Ltd.

The Institute of Metals

Oxford: Cadena Cafe ballroom, Cornmarket Street, 7 p.m. 'Diffusion in metals' by A. D. Le Claire.

WEDNESDAY 6 OCTOBER

The Institute of Fuel

London: The Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1, 10 a.m. Opening conference of a special study of sulphur removal and recovery from fuels. (Continuing on 7 October.)

Leeds: Hotel Metropole, 2.30 p.m. Yorkshire section meeting. Chairman's address by S. J. Eardley.

The Institute of Metals

Southampton: Visit by Birmingham local section to John I. Thornycroft Ltd.

Society of Chemical Industry

London: Chemical Society lecture theatre, Burlington House, Piccadilly, 6.30 p.m. Joint meeting of corrosion and microbiology groups. 'The influence of micro-organisms on the corrosion of metals,' by Dr. F. Wormwell and T. W. Farrer.

The Society of Analytical Chemistry

London: Royal Society meeting room, Burlington House, 6.45 p.m. 'The theoretical basis of sensitivity tests and their application to some potential organic reagents for metals' by Dr. H. M. N. H. Irving and Mrs. H. S. Rossotti, and 'An investigation of 5-nitroso-oxine as an analytical reagent' by H. M. N. H. Irving and R. G. W. Hollingshead.

Institution of Chemical Engineers

Cardiff: University College of South Wales and Monmouthshire, Cathays Park, 7 p.m. Graduates and students section meeting. 'Use of glass in the chemical industry' by C. E. McEwan.

Institute of Metal Finishing

Glasgow: Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, 7 p.m. Scottish branch meeting. Chairman's address: 'This electroplating' by S. A. J. Murray.

THURSDAY 7 OCTOBER.

The Royal Institute of Chemistry

Dagenham: South-East Essex Technical College, Longbridge Road, 6.30 p.m. 'Chromatography; theory and some applications' by Dr. Tudor S. G. Jones.

The Chemical Society

Bristol: Department of Chemistry, The University, 7 p.m. Joint meeting with the Royal Institute of Chemistry and the Society of Chemical Industry.

The Institute of Metals

London: 4 Grosvenor Gardens, S.W.1, 6.30 p.m. London local section. Chairman's address: 'Some men of metallurgy.'

FRIDAY 8 OCTOBER.

The Institute of Fuel

Edinburgh: North British Hotel, 7 p.m. Joint meeting of Scottish section with the Institute of Petroleum. Special study of sulphur removal and recovery. Paper 9.

SATURDAY 9 OCTOBER.

The Institution of Chemical Engineers

Manchester: College of Technology, 3 p.m. North Western branch meeting. 'The absorption of carbon dioxide in liquid spray' by F. Rumford.

Less Carbon Black

British carbon black production during June averaged 1,290 tons a week, against 1,320 tons in May. Less was used during the month, an average of 1,210 tons a week comparing with the record figure of 1,340 tons in May.

CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

UNIVERSITY OF LONDON. A Course of Two Lectures on "**HETEROGENEOUS REACTION PROCESSES**" will be given by Professor D. W. van Krevelen (Director of Research, Dutch State Mines) at 5.30 p.m. on 12 and 22 October, at University College (Anatomy Theatre), Gower Street, W.C.1.

ADMISSION FREE, WITHOUT TICKET.

JAMES HENDERSON,
Academic Registrar.

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. BOAKE, ROBERTS & CO., LTD., require the services of **SHIFT CHEMISTS** for Plant Control work. Academic qualifications will be an advantage, but less essential than industrial experience. The work is interesting and varied, and the appointments will be progressive. There is every opportunity for advancement. Initial salary will be in the range of £600 to £700 per annum. Applications plainly marked "Shift Chemists" to **PERSONNEL MANAGER, A. BOAKE, ROBERTS & CO., LTD., 100, CARPENTERS ROAD, LONDON, E.15.**

APPLICATIONS are invited by **MUFULIRA COPPER MINES, LIMITED, NORTHERN RHODESIA,** for post of **ASSISTANT GENERAL FOREMAN** in furnace and casting section of electrolytic refinery. Successful candidate will be required to commence work early in 1955. Applicants must have expert knowledge of casting copper wirebars, cakes and billets, together with long experience in position of responsibility connected with furnace refining of copper. Commencing basic salary, £1,176 per annum, plus copper bonus at present 57 per cent on basic salary and cost-of-living allowance currently £66 per annum. Free outward passage. Leave at 51 days per annum may be accumulated over three years. Write **MINE EMPLOYMENT DEPARTMENT, SELECTION TRUST BUILDING, MASON'S AVENUE, COLEMAN STREET, LONDON, E.C.2.**

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THE Proprietors of Patent Nos. 592,587 and 592,588, for **"PROCESS AND APPARATUS FOR DIALYZING SOLUTIONS,"** and **"METHOD OF AND APPARATUS FOR DIALYZING SOLUTIONS"** respectively, desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietor of British Patent No. 639,951, entitled **"IMPROVEMENTS IN METHOD OF TREATING SUGAR-CONTAINING SOLUTION,"** offers same for licence or otherwise to ensure its practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG, CHRYSLER BUILDING, NEW YORK 17, N.Y., U.S.A.**

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