Chemical Age

SAC's SUCCESSFUL CONGRESS (page 1097)

VOL. 77 No. 1981

29 June 1957

INDEX TO ADVERTISERS

The first figures refer to advertisement in **Chemical Age Year Book**, *the second to the current issue*

continued on page 1068

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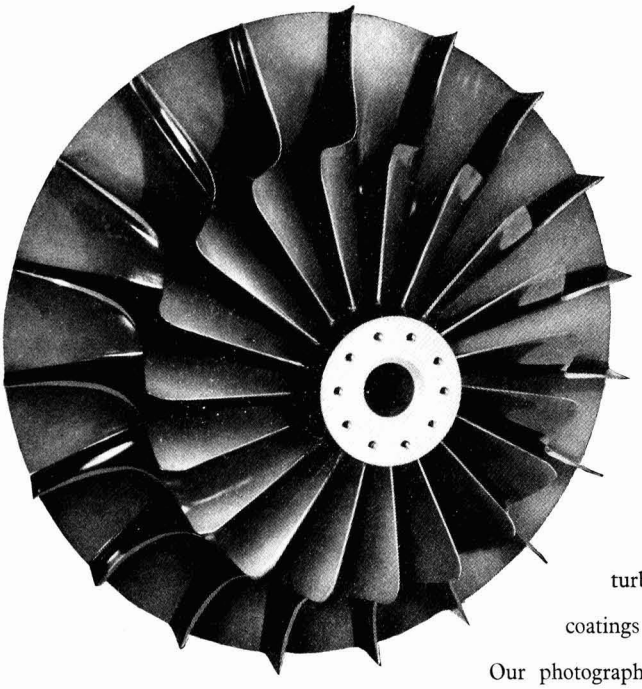

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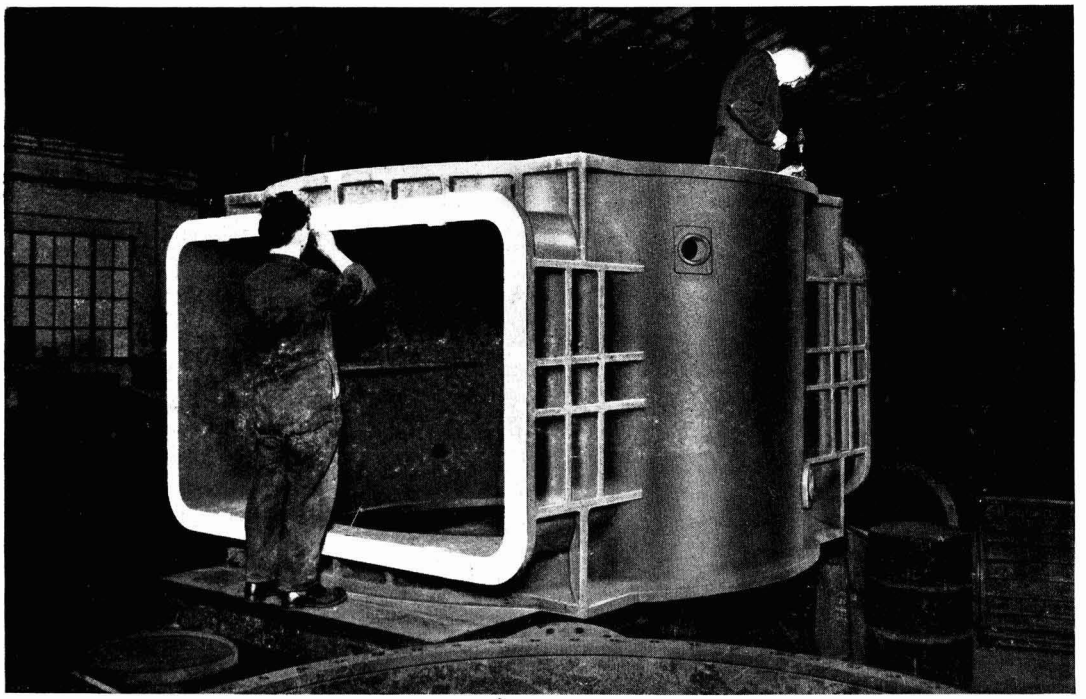

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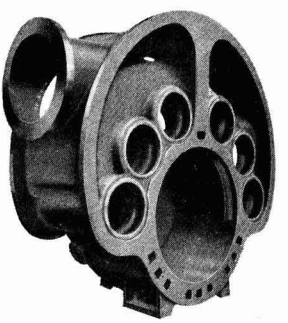
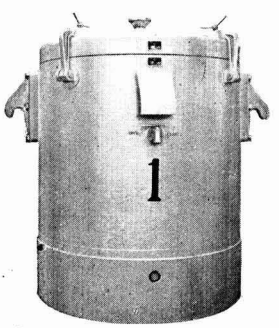


Compressor cylinder casting, 7′ 1¼″ high × 6′ 8″ wide × 2′ 7⅛″ deep. Weight 98 cwts.



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VOL. 77 No. 1981
29 JUNE 1957

Telephone : **FLEet Street 3212** *(26 lines)*
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IN THIS ISSUE

Annual subscription is 52s 6d ($7.40), single copies 1s 3d (by post 1s 6d).

CHEMICAL AGE

BOUVERIE HOUSE · 154 FLEET STREET · LONDON · EC4

PROGRESS IN ANALYSIS

THE congress on modern analytical methods in industry, organised this week by the Scottish section of the Society for Analytical Chemistry at St. Andrews University and reported extensively elsewhere in this issue proved a great success. The congress was over-subscribed not long after the first details became known. This is not surprising because not only did the congress provide the first opportunity for analysts to study closely the great progress made in their branch of science in recent years, but also because of the high quality of the papers presented.

This high standard is reflected in the special summaries of the papers that appear in this issue of CHEMICAL AGE; they will, we believe, create much interest in the papers when they are eventually published in full by the society. (It was not possible to include in this issue summaries of all papers, because some were not available until the middle of this week).

Main thread of the congress was the fundamental changes brought about by modern techniques, many of which have only been developed in the past year or two. Change has come not only because of the high degree of instrumentation, leading in many cases to semi- or fully-automatic techniques, but because of the changing needs of the chemical industry.

Dr. Magnus Pyke, congress chairman, provided the key to this in his opening speech of welcome when he said that analytical chemistry, although of service in almost every kind of industry, was most intimately concerned with the chemical industry and it was from this that the most dramatic progress was stemming.

The breaking down of complex reactions into 'unit processes' is also leading chemical manufacturers inevitably towards continuous operation and automatic control. It is in that context that the modern analytical chemist must develop his branch of chemistry.

Dr. James Craik, who gave the first of three congress lectures, spoke next and pinpointed some of the results of the introduction of new high speed and precision techniques, which are increasingly taking the place of many traditional methods of chemical analysis. Coupled with these new techniques, the present high degree of instrumentation is saving valuable manpower and providing solutions to problems that could not previously be solved by purely chemical methods.

These new developments have brought incalculable benefits not only to the research worker, but also to the chemical and other industries that use the services of analytical chemists. Despite all the progress that has been made, it is obvious that the analyst is still on the threshold of a still higher degree of instrumentation and automation. Delegates at St. Andrews saw new instruments shown and described for the first time; they also heard discussed many improvements that were suggested to instruments and techniques which had only recently been introduced.

It is significant that nearly every speaker referred to the benefits brought by instrumentation. A number of congress members readily admitted that they went to St. Andrews mainly to listen to descriptions of instruments in which they were interested and to learn of the work that was being carried out on them.

Of great interest to members was the paper by Dr. B. W. Bradford which reviewed problems of manpower, productivity and automation in connection with process analytical control. He provided statistics on manpower savings as a result of instrumentation, but clearly felt, as did several other members, that the next few years will see the development of more reliable quality control instruments. He criticised manufacturers for failing to appreciate either the potentialities or the difficulties in this field. He also asked for more information on the accuracy and reliability of instruments as he said this was seldom of the standard required to enable a decision to be made as to their capability of taking over routine analytical control duties.

Quoting the results of a survey carried out to examine the possible scope of instrumentation and to see whether suitable equipment was available or not, Dr. Bradford said it had established that the order of importance of major analytical operations, so far as the expenditure of manpower was concerned was: titration, gas chromatography, spectrophotometry, colorimetry, vapour pressure measurement, analytical distillation, specific gravity measurement and crystallising point measurement.

In the mechanisation of analytical procedures, he gave the more important instruments as: automatic and semi-automatic titrators, automatic apparatus to determine thermal arrest points; automatic distillation apparatus; apparatus for determining Reid vapour pressure of petrol.

A notable feature of this highly successful congress was the number of research chemists present who were not directly concerned with analytical problems. Many of these, too, were attracted by new developments in the instrument field.

The congress showed that these modern aids to analytical chemistry are helping the analyst in industry to keep abreast of the rapid and continuous expansion of the chemical industry and the new trends in chemical engineering and in processing and manufacturing stages. It is in fact true to say that many of the spectacular post-war developments in the plastics and other fields have stemmed directly from the work of the analytical chemist.

In reviewing the changing role of the analytical chemist and the increasing tempo of his work, the congress performed a vital task. It is often said that the chemist in industry is plagued with a surfeit of congresses, conferences and symposia; that they make too many demands on his time both in attendance and in the compilation of papers. There is no doubt, however, that the St. Andrews congress filled a definite need. Before it had concluded members were thinking in terms of making it an annual or biannual event, keeping the accent on a general front covering aspects of analysis in many different fields.

In any event, the thanks of all who attended were warmly accorded to the Scottish section for what proved to be a well-organised congress.

POLYCARBONATE COMPLEXITIES

NEWS from the US indicates that there is another company interested in polycarbonates, a new series of synthetics which we dealt with in our issue of 25 May, p. 876.

New patents (US 2,789,509 and 2,789,964 through 2,789,972) have been issued to Eastman Kodak. They give details of a new process for making polycarbonates and list different properties for these compared with other known polycarbonates.

Bayer AG have prepared polycarbonates by reacting an emulsion of a polyphenol in methylene chloride, caustic solution, phosgene and a quaternary ammonium hydroxide catalyst; or, an organic base, polyphenol, phosgene and solvent (such as carbon tetrachloride) in a nonaqueous system; or, dialkyl carbonates and a polyphenol—which produces a polymer via ester exchange. Details of General Electric's process are not known although it is believed to be somewhat similar to that of Bayer's.

The Eastman Kodak process describes a new approach. Titanium-containing catalysts (such as 1,4-dioxane complex of titanium tetrachloride) are used with self-condensing bis (carbonate) monomers to form highly polymeric linear polycarbonates. As an example, using p-xylylene glycol bis (ethyl carbonate) and titanium butoxide, a white crystalline product melting at 239°C is obtained. Eastman Kodak polycarbonates are stated to melt between 195°C and 250°C compared with those of Bayer which melt at around 268°C. According to US journal *Chemical Week*, 1 June, 1957, p. 57, Eastman Kodak polymers are different from those of Bayer and General Electric. The patent products have only been produced in the laboratory and are not considered important technologically by Eastman. There is also the suggestion of 'later work' by the company.

It is thought that there may be marked difficulties in commercial production using the Eastman process of titanium catalysts, such as titanium butoxide, which due to their being thick liquids, must be dissolved to be used to advantage.

Like Bayer and General Electric, Eastman appear to be interested in the use of polycarbonates as film. According to Eastman, the polymers can be used as photographic film supports for either black-and-white or colour film. Films are stated to have high strength, good resistance to tearing and repeated folding. A particularly suitable property of the polycarbonate films is that they are self-extinguishing when exposed to flame.

CYANOCARBON DERIVATIVE

TETRA-CYANOETHYLENE, first example of a per-cyanoölefin, has been prepared by T. L. Cairns and co-workers of E. I. du Pont de Nemours (*J. Amer. Chem. Soc.*, 5 May). Principal interest in this compound is as a laboratory intermediate. It is described as being exceptionally reactive and undergoes readily a series of addition and substitution reactions.

Classes of compounds which can be obtained employing this percyanoölefin are: other cyanocarbons, such as metal salts of pentacyanopropylene.

Very strong acids such as hexacyanoisobutylene, having almost the same acid strength as sulphuric acid.

Heterocyclic compounds which include pyrroles, thiophenes, pyrazoles, isoxazoles, naphthyridines, and pyridines.

Highly coloured compounds with high extinction coefficient.

Tetracyanoethylene is prepared by treating dibromomalonitrile-potassium bromide complex with copper powder in benzene under reflux. A 65 per cent yield has been obtained.

These compounds have no commercial applications at present. Investigations by Du Pont are continuing.

AMMONIA IN THE PACK

AMMONIA is not generally looked upon as a fungicide, but in gaseous form it is toxic to some of the more common mould organisms that attack citrus fruits during storage or shipment. However, bulk fumigation with ammonia does not provide the long-term protection from moulds that commercial handling often requires. An ingenious solution to this dilemma has recently been put forward by the University of California Citrus Experiment Station—the use of 'pin-package' ammonia generators which will maintain adequate concentrations of ammonia gas over long periods. The generators release ammonia under the stimulation of the highly humid conditions that develop within a closed system that includes actively respiring citrus fruit. Both types of generator suggested at present are chemical in their *modus operandi*. One utilises the hydrolysis of diammonium succinate, the other the moisture-induced reaction between dry sulphate of ammonia and soda ash.

COBALT-60 USED BY DSIR STATION FOR PEST CONTROL

THE POSSIBLE use of cobalt-60 for controlling pests in foods by irradiation, either by direct lethal action on pests or by sterilising male insects in large numbers so that eggs laid are infertile, is one of the new developments reported on in the 1956 annual pest infestation report of the Department of Scientific and Industrial Research.

This particular work is being undertaken in conjunction with the Atomic Energy Research Establishment, Harwell. The value of these approaches cannot yet be assessed, either scientifically or in economic terms.

Another joint research project has been started in collaboration with the Official Seed Testing Station at Cambridge, studying effects of insecticides like DDT or gamma-BHC upon seed germination. The relationships between fumigant efficiency and conditions of fumigation is now being more thoroughly studied following the accumulation of a great mass of fumigation test data over recent years. Methyl bromide remains the main test fumigant for new experiments in which operative conditions will be varied. However, mention is made of preliminary tests with phosphine as a fumigant, the gas being released from a tabletted aluminium phosphide.

US evidence that malathion was toxic to DDT-resistant flies has been confirmed by tests at a large rural tip. Daily spraying with malathion was found necessary, however. In other tests with malathion, good results were secured but improved manufacturing control is regarded as necessary to reduce the objectionable odour present during and for a day or so after application. Resins containing insecticides have been tested in the hope that they will last longer than spray applications in stores. A resin containing 10 per cent of Dieldrin and 5 per cent of Aldrin was applied to the walls of a malt store; 11 months afterwards, when the store was cleared, some 2,000 test larvae were introduced and kept on the walls for 20 days, and the residual activity was good enough to give a 78 per cent kill.

The efficiency of distribution given by insecticidal smokes has been investigated. The data so far obtained has raised important queries about this method of application. In the test chamber of about 1,000 cu. ft. capacity DDT smoke generators laid deposits on walls and ceiling which were 10 per cent less (by weight per unit area) than deposits on the floor, and the crystals of DDT in the smoke deposit material were also found to be unevenly distributed.

The introductory report of the board stresses the importance of basic research work in this field; it is already yielding valuable results on the sorption of fumigant gases and in developing bio-assay techniques for insecticide evaluation. The international importance of the Pest Infestation Laboratory's work is also emphasised; work on overseas pest control problems is vital as a high proportion of UK food still has to be imported.

£100,000 Effluent Treatment Plant Installed by Reed Paper Group

EFFLUENT treatment plant is being installed in two adjoining mills of the Reed Paper Group at Maidstone, Kent, at a cost approaching £100,000. The plant, which is being brought into operation at the group's Tovil and Bridge mills, includes three circular settling tanks. Two are at Tovil and the other, pictured here, is at Bridge.

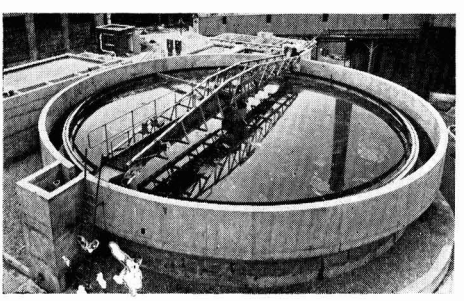
An important feature of the plant is the biological treatment unit, believed to be the only one of its kind used in the British papermaking industry. In the activated sludge tanks the effluent is purified for discharge into the River Medway.

The three Ames Crosta settling tanks are each of 50 ft. dia. Minute pulp fibres are separated from the mill effluent in these tanks and returned as settled solids to the papermaking system.

At Bridge mill the storage lagoon has a capacity of about ¼ million gallons. The aeration tank capacity of the diffused air activated sludge unit is 50,000 gallons. The two final settling tanks in this unit have a combined capacity of 20,000 gallons. Air is supplied by a Marshall blower (Sir George Godfrey and Partners (Industrial) Ltd.), at 110 or 130 c.f.m.

The available domestic sewage from the mill is collected in a 2,500 gallon capacity sump, and from there pumped by an Ames Crosta 4-in. dia. sewage pump to the activated sludge unit. The main mill waste is collected in another sump, which has a capacity of 2,500 gallons, and this is pumped to the main inlet of the 50-ft. dia. settling tank at Bridge by two 80 g.p.m. Mono pumps and two D.V.S. 500 g.p.m. pumps. For pumping water to the lagoon, and settled water and solids back to Bridge mill there are five other pumps, each of 500 g.p.m. capacity.

At Tovil the loose stream, which used to go under the mill, has been diverted round the building. The old bed of the stream has become the collecting sump for the effluent, which is pumped by two 800 g.p.m. D.V.S. pumps to the 50-ft. dia. settling tanks. All the settled solids and most of the settled water will be reused in the mill. There is a constant bleed-off to the Corporation sewer at an average of 11,000 gallons per hour.



One of the three circular settling tanks installed by Reeds

Fall in Basic Materials Price Index

BASIC materials price index fell by 0.3 (160.2 to 159.7) per cent between April and May. This is attributed mainly to lower prices for lead (a fall of 11.1 per cent), raw cotton (1.5 per cent), zinc (12.8 per cent), rubber (2.3 per cent) and copper (1.2 per cent). The price index for 30 June 1949 is taken as 100.

The index for chemical and allied products fell from 142.4 to 142.0 in the same period. The figure for May 1956 was 138.4.

More detailed figures for chemical products are as follows:

	May 1956	April 1957	May 1957
Dyes & dyestuffs	138.0	143.1	143.1
Disinfectants ...	123.7	126.5	126.5
Insecticides, weed-killers & fungicides	138.3	131.7	131.7
Synthetic & plastics materials ...	122.8	122.6	121.1
General chemicals	156.3	159.6	158.4
Benzole, pure BSS 136:1950	182.9	193.1	182.9
Caustic soda liquor, 100 Tw.	157.6	157.6	157.6
Soda ash, light (d/d) ...	164.5	164.5	164.5
Soda ash, light, f.o.r. works	173.4	173.4	173.4
Sulphuric acid, BOV ...	173.7	177.2	177.2
Sulphuric acid, ROV 94/95 per cent ...	181.8	181.8	181.8
Drug & pharmaceutical preparations ...	105.2	103.7	104.2
Explosives, private sector only	154.0	154.0	154.0
Ethyl alcohol, industrial, BSS 507:1953 ...	146.7	241.1	241.1
Commodities wholly or partly imported into the UK			
Carbon black ...	130.8	134.7	135.4
Fertilisers ...	198.3	203.8	203.8
Pyrites	176.9	173.5	173.5
Sulphur	179.2	185.4	185.4

DISTILLATES

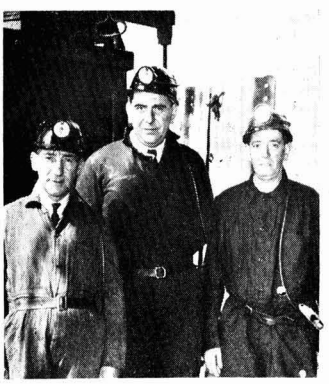
★ ALEMBIC was interested in an out-of-session discussion at St. Andrews this week when a distinguished group of congress members exchanged views on what would be the most fundamental discovery of the 1960's. Dr. Magnus Pyke, chairman of the SAC Scottish section, had general agreement with his view that since most of the really important discoveries, such as polythene, penicillin etc., were not developed until many years after the first work was done on them, current literature must contain the answer.

In other words, any major discoveries that will be commercially developed in the 1960's have already been the subject of work. They will lie dormant, until some research worker turning to the literature for reference realises their significance. It was generally agreed that the outstanding discovery of the next decade would come from the field of plastics. The fluorine range was mentioned, but since these are the subject of much work already, both in this country and more particularly in the US, it is likely that they will have achieved great commercial significance before the 1960's.

Without searching the literature, Alembic offers sucrochemistry or the use of acetylene as a starting point for the manufacture of chemicals as possible claimants for the role. He would be interested to hear what other readers think, but feels that the person, if any, who holds the answer to this question is likely to keep it up his sleeve!

★ IN AN effort to get to the bottom of things, or at least, to the source, a sales manager and one of his customers recently crawled on hands and knees along 100 yards of pit face. They were Mr. F. R. James, chemicals division of Newton Chambers and Co., and Mr. F. R. Smith, director of Sangers Ltd., wholesale and manufacturing chemists.

First, Mr. Smith had toured the Izal products factory. The nearby Thorpe pit that he later visited was owned by the company before nationalisation and Mr. Smith learned that it was through activities in coking and coal by-prodocts that the disinfectant properties of Izal were discovered in the 1880's.



F. R. James, chemical sales manager (left) with P. F. R. Smith (centre) and the guide at the head of Thorpe Pit.

★ WHERE does the money go—4? This week Alembic turns his attention to the German chemical and dyestuff giant, Farbenfabriken Bayer. Turnover in 1956 totalled DM 1,596 million (DM 1,437 m.). Net profit totalled DM 55 m. The balance sheet shows that 1956 gross receipts were appropriated as follows, after allowing for changes in stocks:

Raw materials, auxiliaries and fuel accounted for 39.1 per cent; wages, salaries and 'expenditure for social purposes', 23.6 per cent; power and other services, 16 per cent; depreciation, 10.9 per cent; taxes, 6.9 per cent; dividends, 3.5 per cent.

★ SOME of the difficulties facing water undertakings owing to the great expansion in chemical and allied industries were underlined at a recent meeting of the Tees Valley Water Board. Chairman, Alderman C. W. Allison, quoting ICI Billingham division as an example, said that three years hence their anticipated needs would be 42 million gallons a week. Yet in one week in June the chemical works had taken 50 million gallons!

Industry had expanded beyond all estimates and was drawing from the Tees-side gathering grounds more than was anticipated would be needed when the new reservoir at Selset is completed in 1960. Mr. Allison added that even if it rained every day, the board could still find itself in difficulties.

★ THE CHEMICAL industry is going to hear much more about the shortage of scientific, technological and technical workers which is making itself increasingly felt. Much has already been said about the lack of women science graduates and undoubtedly more could be done to recruit women to science.

There is, however, a fairly large reservoir of trained women who gave up their full-time careers on marriage. Many such women are keen to use their qualifications and experience in suitable part-time work, either on a daily basis, or full-time for short periods or working at home.

Alembic has this week received from Mrs. D. D. Furley, B.A. (Cantab), details of the University Women's Part-Time Employment Agency which, with its headquarters in New Barnet, provides a link between such women graduates and employers in the London area.

Mrs. Furley says that graduates can usually be found for abstracting, indexing, proof-reading, research work, statistical analysis, translation, teaching and the typing of manuscripts.

★ SAID to be the youngest member in the Incorporated Sales Managers' Association, 28 year old Mr. F. D. Cameron, sales manager of the BB Chemical Co. Ltd., has just joined the Leicester branch. Another new recruit to the branch is Mr. A. D. Denaro of Cascelloid.

Rules set the limit age of membership at 30, but Mr. Cameron was admitted under a clause which covers exceptional cases.

Alembic

Chemical Firms at Liverpool Show

MODERN trends in construction and production in the chemical industry were shown by Imperial Chemical Industries Ltd. on their stand at the Industry Advances Exhibition, 17 to 29 June, sponsored by Liverpool Corporation as part of the city's 750th charter anniversary celebrations.

Highlights of the history of chemical manufacture on Merseyside were recorded, together with a display of the intricate network of present-day production in the ICI general chemicals division. Progress in engineering techniques, fuel efficiency and welfare were illustrated by models of plant and buildings.

Shell Chemical Co. Ltd. featured the developing production of chemicals from petroleum. The increasing range of chemical products for use in industry, agriculture and in the home, manufactured at Stanlow and Partington, were featured.

Plant Produces Pure Water From Salt Water

DISTILLATION plant of a new type for the production of pure water from salt water has been developed by Richardson, Westgarth and Co. Ltd., Wallsend-on-Tyne.

The plant design was based on an exhaustive series of tests conducted under industrial operating conditions on large scale test rigs, using sea water. Operating methods have been developed permitting the plant to be run continuously without being opened for cleaning, and without loss of output due to scaling. Designs for outputs up to 1 million gallons a day in one unit are available.

Instrumentation the Keynote at St. Andrews

THREE HUNDRED delegates attended the congress on modern analytical chemistry in industry organised by the Scottish section, Society for Analytical Chemistry, at St. Andrews University this week. This was considerably more than expected and so large was the attendance at the dinner, in the St. Andrews Town Hall on Tuesday evening, that speeches had to be televised on a closed circuit to an overflow hall.

Congress members from home and overseas began arriving at this ancient university town by plane, train and road on Saturday, 22 June. After registering at the congress office in McIntosh Hall, Abbotsford Crescent, they were able to spend Sunday afternoon touring St. Andrews with university staff as guides. On Sunday evening they were welcomed by Dr. Magnus Pyke and other members of the organising committee at an informal reception at McIntosh Hall.

The congress was opened by Dr. Magnus Pyke at 9.20 a.m. the following morning and in the afternoon an exhibition of scientific apparatus was held in the physics laboratory. That evening, lecturers and speakers were entertained at a cocktail party by Imperial Chemical Industries Ltd.

Two congress sessions were held on Tuesday and were followed in the evening by the congress dinner. After the Wednesday sessions, members were able to attend a special performance at the Byre Theatre. Two sessions were also held on Thursday and in the evening all congress members were invited to a cocktail party by the Distillers Co. Ltd. The congress closed officially after a morning session on Friday, 28 June.

The congress was divided into three sections with three congress lectures. The first section was entitled 'Analysis in modern industry' and the first congress lecturer was Dr. James Craik, chairman, ICI Nobel division, whose subject was 'Analytical chemistry in industry.' The second section 'The application of some newer analytical technique in industry', had as congress lecturer Dr. E. B. Hughes, chief chemist, J. Lyons and Co. Ltd., who gave a paper on 'Analysis and food.' The third section was on 'Developments in analysis for new problems in industry'. The congress lecture, by Professor G. F. Smith, Illinois University, US, was on 'New analytical reagents and their applications in industrial plant control operations'.

Chairmen for the various sessions were personalities in chemistry with international reputations. They were: Monday, Professor E. L. Hirst, F.R.S., Edinburgh University; Tuesday, morning, Dr. H. W. Melville, F.R.S., Department of Scientific and Industrial Research, afternoon, Dr. D. Traill, research department, ICI Nobel division; Wednesday, morning, Dr. R. Belcher, Birmingham University, afternoon, Professor D. H. R. Barton, F.R.S.; Thursday, morning, Dr. C. L. Wilson, Queen's University, Belfast, afternoon, Dr. D. W. Kent Jones, past president of both the Society for Analytical Chemistry and the Royal Institute of Chemistry; Friday, morning, Dr. Magnus Pyke.

The congress organising committee comprised: Dr. Magnus Pyke, B.Sc., Ph.D., F.R.I.C., F.R.S.E., chairman; J. Brooks, M.A., A.R.I.C.; H. C. Moir, B.Sc., F.R.I.C.; A. F. William, B.Sc., F.R.I.C.; and J. A. Eggleston, B.Sc., F.R.I.C. (Boots Pure Drug Co. Ltd., Airdrie), who was the congress secretary.

SPECIAL CA REPORT OF THE MODERN ANALYTICAL CHEMISTRY CONGRESS

ANALYTICAL CHEMISTRY'S THREE MAIN CHANGES — DR. PYKE

THREE main developments that have taken place in analytical chemistry were described by Dr. Magnus Pyke, F.R.I.C., F.R.S.E., chairman of the Scottish section, in his opening address on Monday on the theme 'Analytical chemistry in the modern context.' These were: 1, the unfolding by the physicist of the nature of atomic structure; 2, the growing use of physical instruments to measure chemical reactions—a trend which would make less demands on the skill of the individual; 3, the great changes taking place in the chemical industry, particularly the breaking down of complex reactions into the unit processes.

Dr. Pyke declared that the separation of the Association of Public Analysts from the society and the change of name from the Society of Public Analysts and Other Analytical Chemists in 1954 was a sign of the change and development taking place in analytical chemistry. Science did not stand still, however, and much had happened since 1954. As he saw it there were three main trends to be distinguished.

'The underlying basic change', said Dr. Pyke, 'is the movement of the slow glacier of knowledge of the physical world. The increase in the numbers of the different chemical elements to the present 101 has not, as might be

Illustrated above is the quadrangle of St. Salvator's College. Entrance to congress lecture hall is on the right

Giving the opening address is Dr. Magnus Pyke. Left is Dr. James Craik who gave the first paper and right is Professor E. L. Hirst, congress chairman for the first session

imagined, led to complexity and confusion for the modern chemist. On the contrary, the unfolding by the physicist of the nature of atomic structure—a remarkable intellectual achievement of our generation that has, in truth, shaken the world—has brought beautiful simplicity to the understanding of the diverse elements with which chemists deal.

'We retain, it is true, the diverse chemical substances of our science but, at the same time, see their diversity as a unit, and find that all the 101 different elements are made up of the same stuff. All are composed of electrons in varying numbers circling round their nuclei and by appropriate means one element may be converted into another.

'The second general change in analytical chemistry is surely the growing use of physical instruments to measure the progress of chemical reactions. Nessler tubes matched by eye have become obsolete. The Klett colorimeters with which we matched the colours of two contiguous semicircles with a practised eye are following the Nessler tubes into oblivion, to be superseded by photoelectric absorptiometers.

Modern Tools

'The polarograph, the automatic titration apparatus and the direct-reading *p*H-meter are modern analytical tools that avoid altogether the need for skilled and delicate matching of colours. Ultraviolet and infra-red spectrophotometers in their modern form are complex and expensive instruments. Their use needs to be *supervised* by a qualified analyst, fully understanding the principles of their operation and the chemistry of the reaction they are to interpret, but their *manipulation* can safely be entrusted to a young girl.

'At a recent discussion of the training of chemists, Professor Wheeler caused considerable comment by suggesting that it might not be essential, in the modern environment of science, for an Honours graduate to possess any high degree of manipulative skill in the laboratory. Traditionally, the analyst has prized his technical dexterity at the bench. Yet there are today clear signs for all who are prepared to read them that increasingly we shall find analytical techniques being carried out automatically. Already there are automatic spectrographs for steel analysis, automatic analysis assemblies for determining dissolved oxygen designed by the Water Pollution Board, and even general-purpose automatic analysis equipment commercially available for those who wish to arrange for routine operations to be done by machine rather than by shift chemists.

As this kind of apparatus becomes more common, clearly, skill and dexterity in the laboratory arts will be less in demand.

The third change in analytical chemistry comes from the changes occurring in chemical industry itself. Analytical chemistry is of service to almost every branch of scientific research and it is employed in almost every kind of industry. But it is most intimately concerned with the chemical industry. And it is in chemical industry that we are seeing the most dramatic progress. No longer is it expected that the laboratory apparatus in which the research chemist first prepares a few hundred milligrams of his new discovery will be blown up to a plant scale to supply, by the same stepwise series of batch processes, the factory's production.

'The application of the basic principles of chemical engineering has, in the US, yielded immense dividends in productivity. In Great Britain too, the adoption of these same principles of breaking down complex reactions into so-called "unit processes", first promulgated in this country by George Davis in 1887 in his lectures at the Manchester Technical School, is also leading to a streamlining of chemical manufacture and an inevitable trend towards continuous operation and automation control. This is the context within which the modern analytical chemist must develop his branch of chemistry.

'The lectures that we are to hear have been arranged in three groups. First, are those dealing with the present methods that are used in modern industry—in steel making, in the electrical industry, in the manufacture of pharmaceuticals. Next, is a series of papers reviewing newer analytical techniques. Finally, there is an exciting section in which we are to learn of developments in analysis for the new problems of industry. And here we are happy to be able to hear from two distinguished chemists from abroad: from Professor Smith from the US and from Dr. Keulemans from the Netherlands'.

ENORMOUS BENEFIT FROM A FEW NEW TECHNIQUES

CONGRESS LECTURE By Dr. J. Craik

THE DISCOVERY of new techniques and the development of instrumentation in particular have immensely aided analysis and analytical research. This, and the importance of analysis to industry, was the theme of Dr. J. Craik's congress lecture entitled *'Analytical chemistry in industry.'*

Dr. Craik (chairman of the Nobel division of ICI Ltd.) declared that because of limited manpower, it was essential to keep abreast with new techniques in analysis, particularly those which involved instrumentation. Techniques such as those involving the use of radiochemistry, chromatography and polarography often enabled problems to be solved in analytical chemistry which could not be solved by more classical procedures.

Since a small error might involve substantial amounts of manufacturing material, great accuracy was required in an analysis. Often an accurate method was not available so that the best had to be made of the existing method while research continued in order to improve it. Dr. Craik then referred to glycerol, which was an important raw material used in the manufacture of blasting explosives. Until recently, the determination of glycerol was carried out by a fairly involved procedure involving the determination of acetyl value. The analysis could now be carried out in a fraction of the time originally taken by using sodium metaperiodate which involves only a single titration. There were many important raw materials of industry which demanded, from the economic aspect, that high degree of accuracy. Thus, a tremendous amount of effort had been devoted to the accurate determination of sulphur in pyrites for sulphuric acid manufacture.

Dr. Craik emphasised that simple empirical tests could be very valuable to industry, as in the case of glycerol for nitroglycerol manufacture where a simple test for reducing impurities based on ammoniacal silver nitrate was carried out, and in addition, a 'heat test' was applied to the finished nitroglycerine. It was essential that these tests should be carried

out very carefully and although simple they supplied a great deal of information. In industry generally, such tests were usually done by young people who might be studying for chemical qualifications and, though they did not acquire a deep fundamental knowledge through use of such methods, did acquire familiarity with the many different products and raw materials of industry and thus became well fitted for work on the manufacturing side of industry.

In the post-war period many demands had been made of the analyst with respect to fuel and effluent analysis. It was, however, very difficult to find a universal chemical method for oxygen which would be completed in a reasonable time, Dr. Craik remarked.

There were a number of relatively simple methods of analysis where it had been more or less accepted that no improvement could be made in basic procedure. Dr. Craik instanced the case of sulphuric acid which was still usually determined by titration; the only change that might have been made was in the method of locating the end point. This was now often done electrically with electrical control of the addition of titrant. In Dr. Craik's own division of Imperial Chemical Industries Ltd., a considerable amount of work had been done on the determination of nitric acid and nitrocompounds by potentiometric titration using ferrous ammonium sulphate. Employing an electronic end-point detector, the personal judgment of the operator was not required at all.

Immense Value

The striking thing about analytical chemistry today was the enormous benefit derived from a few important techniques descovered in recent years, coupled with modern instrumentation. For instance chromatography, the elegant paper strip technique devised by Martin and Synge, applied to the one problem of the separation of the amino-acids, has proved of immense value to industrial and medical research. It was now common for a constituent to be separated by a chromatographic method and determined by another procedure such as one employing spectrography or polarography.

With the growth of new techniques, to some extent the use of classical chemistry in analysis was becoming a dying art. Determinations of tantalum and niobium in certain alloys were now usually carried out by a fairly simple chromatographic method whereas hitherto the only procedures available were those involving classical methods which required considerable skill. Dr. Craik said he was of the opinion that it would become important in the future training of analysts that, with the advent of more instrumentation and simpler methods, provision was made to avoid neglect of these important classical procedures.

Analytical technique had stimulated research into the behaviour of existing instruments thus effecting a better understanding of them which in time had led to improvements in their construction. When gas chromatography began to come into popular use and thermal conductivity cells were employed as a

E. S. F. Rogans (Tate and Lyle Ltd.) and Mrs. Rogans on the point at St. Andrews

method for detection, very little was known about their behaviour compared with the state of knowledge now existing. Much of this advance in knowledge was due to the efforts of specialists such as Dr. Keulemans who would be lecturing at this congress.

Dr. Craik considered that in a large industrial organisation there seemed to be a necessity for an active analytical research section since problems were always arising in analysis to which there was no standard solution and a new technique might need development. In addition it seemed to be wise to keep up to date with new procedures although they might have no obvious direct use at the time.

There were many representatives attending the congress from universities, technical colleges and Government laboratories and Dr. Craik felt that industry owed a debt of gratitude to those in charge of all the excellent analytical schools which had grown so much in the post-war years.

Dr. G. R. Davies on Analytical Research at DSIR

ANALYTICAL methods had to be used by many of the DSIR stations and therefore these had to carry out some analytical research, said Dr. G. R. Davies (Chemical Laboratory, DSIR) in his paper dealing with '*Analytical research in the DSIR in relation in industry*' on Monday morning. He instanced the Building Research Station which with its large interest in silicate minerals, had made considerable use of differential thermal analysis in the study of building materials.

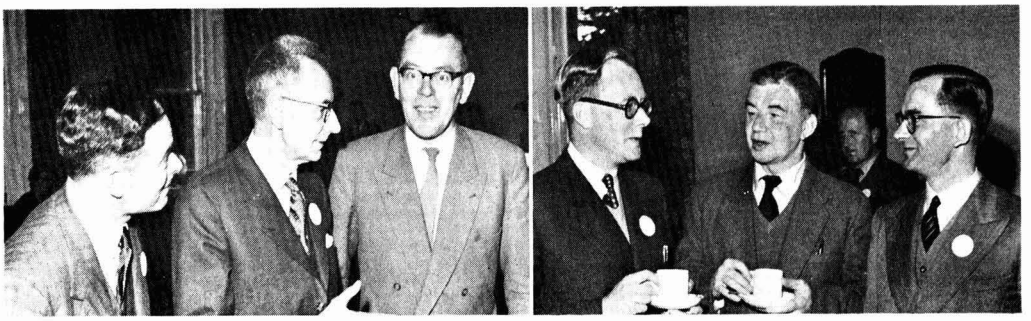
The Water Pollution Research Laboratory had been investigating, since the passing of the Rivers (Prevention of Pollution) Act of 1951, suitable standard methods of analysis. One of the most important measurements required was that of dissolved oxygen which provided a good indication of the degree of pollution of a river etc. The WPRL had found, using the Winkler procedure, that the most sensitive method of determining the end point in the titration was by a simple amperometric method using a platinum and a coloured electrode. For a continuous determination it was felt that a colorimetric method would be more convenient, the intensity of the colour of the iodine being measured photoelectrically.

Various polarographic methods for the continuous measurement of the oxygen content of aqueous solutions had been tried by the WPRL. Recently, the laboratory had succeeded in developing a type of dropping mercury electrode which did work continuously and which appeared to be remarkably free from trouble. Delivery of mercury by means of a motor driven syringe was now being examined. The equipment had been tried out for long periods in sewage effluents containing colloidal and suspended matter and had given no trouble. To economise in mercury, the equipment was switched on automatically every 15 minutes for a period of three minutes. Results obtained agreed very closely with those obtained by the Winkler method.

Inorganic chromatography was of interest to the Chemical Research Laboratory and considerable research effort had been directed to the possible use of this method of analysis for uranium, thorium, niobium, tantalum and similar elements and a fair amount of work had been carried out on the noble metals.

Application of inorganic chromatography to uranium had now been well standardised and was fairly widely used. As the paper strips limited the amount of material which could be used, columns of cellulose had been tried. Diethyl ether containing 5 per cent by volume of nitric acid (dilution 1.42) was used in preference to the cyclic ethers used with paper strips.

General view of the crowded hall at the opening ceremony



At the congress reception, l. to r. J. Brooks, congress committee, J. A. Eggleston, congress secretary, Dr. A. J. M. Keulemans (Koninklijke/Shell Labatorium), one of the lecturers, E. G. Brown (British Enka Ltd.), W. E. Bibby (British Industrial Solvents) and J. N. Fewster (ICI Billingham division)

Appreciable movement on the columns was shown by gold, mercury, selenium, arsenic, antimony, bismuth, cerium, thorium, zirconium, scandium, tin, vanadium and the platinum metals; phosphates and molybdates could move under certain conditions.

The analysis of many low grade ores for uranium also required the determination of thorium in such ores and Dr. Davies said that a development of the uranium method could be used in which thorium was extracted with ether containing 12.5 per cent nitric acid. Phosphate interfered with this method when a cellulose column was used, even after adding ferric iron, but this interference could be overcome by employing a mixed column of alumina and cellulose. This method had been used for micro amounts of thorium for chromatographic procedure and it even enabled traces of thorium to be separated in high purity.

For analysis of tantalum, separation was effected with methyl ethyl ketone saturated with water if the sample solution contained 25 per cent by volume of 40 per cent hydrofluoric acid. While recovery of tantalum and niobium was good, some titanium, tin and zirconium were also extracted with the niobium and were troublesome.

If water was absent, niobium could be extracted using a higher concentration of acid. Under these conditions tungsten was also extracted and a new technique was, therefore, devised. Tantalum was extracted using the organic solvent saturated with water. The column was conditioned with dry methyl ethyl ketone containing 1 per cent hydrofluoric acid (400 ml) so that the cellulose column retained titanium, tin and zirconium. Niobium was extracted with 400-500 ml of solvent containing 12.5 acid.

The CRL had also been carrying out work on chromatographic methods of separating the platinum metals. By suitable choice of solvent working at 25°C and maintaining iridium in an oxidised condition (adding H_2O_2 to the n-butanol-HCl mixture) so that it moves with the platinum, quantitative analysis of mixtures of platinum, rhodium, palladium and iridium was possible in the presence of many base metals.

A column technique for separation of these four metals had also been developed. A suitable solvent was *iso*-butyl methyl ketone made up of two solvents by adding three per cent by volume of concentrated hydrochloric acid, acid solvent; oxidising solvent, containing acid plus chlorine dioxide (100 ml of ketone containing 4 per cent of concentrated hydrochloric acid to 4g of sodium chlorate and 12g of cellulose powder).

Iridium moving with platinum was collected in the first eluate fraction. These metals could then be separated by reducing iridium by adding stannous chloride to the sample solution and also to the acid solvent mixture. Platinum is then eluted as before. Separation of the platinum metals from base metals is achieved by the nitrite process. Palladium could be precipitated with dimethyl glyoxime.

L. to r. F. G. Spruit (NV Philips-Roxane, Amsterdam), Mrs. Spruit, G. A. Vaughan (Coal Tar Research Association), Mr. Vaughan and Miss D. L. Mermikides
(CHEMICAL AGE)

Mr. G. Nicholson (Lever Bros., Port Sunlight) who wanted to know where he could obtain more detailed information on the dissolved oxygen technique, was advised to write to DSIR or to visit the Water Pollution Research Laboratory.

Dr. A. B. Densham (North Thames Gas Board), referring to differential thermal analysis, asked whether this had been found suitable for estimating the peak area quantitatively.

In reply, Dr. Davies said it was suitable for such a determination. This method was more reliable than X-ray methods, but not for everything. It was difficult to define peak area.

Asked whether he could say anything on the effect of particle size, Dr. Davies said it was only important where gases were concerned.

Choice of Solvent

Dr. K. D. Luke (Canadian Industries Ltd.) referred to the cellulose chromatographic work and choice of solvent for extraction. In reply to his question of whether any principles were laid down regarding a choice of solvent, Dr. Davies said it was a matter of trial and error.

Mr. J. V. Martin (DSIR Chemical Research Laboratory) affirmed that choosing a solvent was mainly empirical, but he thought that after working with solvents etc., the chemist got a 'feel' about them and that one could make deductions from solvent extractions. He instanced uranium and thorium where it was, he added, now known that extraction was possible through their nitrates.

Dr. J. H. Hammence, president, Society for Analytical Chemistry, wished that the whole business could be put into systematic order. He confessed that with paper strip methods, solubility played a large part, particularly where one substance was more soluble.

Mr. N. T. Wilkinson (ICI alkali division) asked whether work had been done on cyanide/thiocyanate separation. Cyanide effluent was toxic, but he believed that thiocyanate was not. He referred to the fact that cyanide could be determined by Aldrich's method and asked whether the DSIR had carried out any work on chromatographic separation of cyanide, thiocyanate, ferro- and ferricyanide. The answer was 'No'.

Mr. D. R. Curry (Services Electronics Research Laboratory) wanted to know about DSIR work with differential thermal analysis. Was it, he asked, quantitative? It was stated in reply that the Ministry of Supply had investigated it for its quantitativeness.

A final speaker suggested that polarographic monitoring methods were suitable for cyanide determination.

Iron and Steel Analysts Meet Exacting Specifications

BY

B. BAGSHAWE

RECENT developments in the iron and steel industry, particularly the analysis of complex alloy steels were reviewed by Mr. Bagshawe (Brown-Firth Research Laboratories) in his paper entitled '*Modern analytical methods in the iron and steel industry.*' He showed how the most exacting specification requirements for essential alloying elements and incidental trace elements were being met.

Co-operative analytical research within the industry and the development of British Standard methods was considered as was the modification, adaptation and integration of such methods into the pattern of works control practice. Applications of absorptiometric methods in building up composite schemes for the determination of various element groupings from a single sample were shown.

Specific Reagents

Mention was made of the corresponding development in specific reagents which had made many of these absorptiometric methods possible. Fifty years ago α-nitrose β-naphthol for cobalt was the only organic reagent in general use in steel analysis. About 30 years ago there were only three, dimethyl glyoxime and cupferron having come into use. In the last 25 years reagents such as diphenyl carbazide for chromium, quinalizarin and dianthrimide for boron, nitroso-R salt for cobalt, dithiol for tungsten and molybdenum and 2-2′ diquinolyl for copper had all come into general use, mainly as the basis of absorptiometric methods.

The nitroso-R salt method said Mr. Bagshawe raised a topical issue in connection with recent atomic energy specifications which were setting maximum cobalt limits in ultra trace ranges. Only a few years ago it would have been impossible to determine cobalt to parts per million limits. It might have been done on plain and simple steels by a concentration procedure using an ether separation to remove most of the iron from a 10, 20 or 50 g. sample, but certainly not on alloyed steels containing chromium and nickel. The BS nitroso-R salt method was no answer to this problem as the iron concentration the cobalt reaction would tolerate limited sensitivity in trace ranges and even if iron was removed, for example, with ether or amyl acetate, there was marked interference from nickel and copper and, to a less extent, from chromium.

Some use had been made of the tetraphenyl arsonium chloride method, but excellent results had recently been obtained using a zinc oxide separation to remove iron and chromium followed by precipitation of cobalt, with α-nitrose β-naphthol together with 5 mg. of iron to act as carrier and finally absorptiometric determination with nitroso-R salt. This had the advantage that the final determination was made in a pure concentrated solution free of interfering elements.

Recently 2-2′ diquinolyl had been adopted as the basis for a standard method for copper. For plant control purposes this looked likely to supplant the longer volumetric methods based on preliminary separation as sulphide or thiocyanate, and also the dithiocarbamate colour method.

Diänthrimide was another reagent which was being adopted in the steel industry as the basis for boron determinations. Usually only traces of boron were added to steel, of the order of 0·05 per cent and even these small amounts had a marked influence on the hardenability of the steel. A BISRA sub-committee had recently issued a procedure based on the blue colour given with 1:1 dianthrimide after first removing interfering elements on an ion-exchange column. The excellent performance of the method was shown by the results obtained by a BISRA subcommittee on a range of steels prepared for use as spectrographic standards.

Discussing carbon determinations, Mr. Bagshawe said these had received some attention in recent years, mainly on account of certain specialised developments calling for third figure accuracy in ultra low ranges, e.g. 4 per cent silicon transformer iron where the carbon must be below 0.01 per cent and certain types of stainless steel where the maximum carbon limit was fixed at 0.03 per cent. The conventional gravimetric combustion method which normally worked to a tolerance of ±0.01 in normal carbon ranges was not sufficiently accurate for these special purposes.

The problem was being met by using an enlarged version of the conventional procedure, or by utilising refined methods of measuring carbon dioxide, or by measuring the charge of electrical conductivity after absorption in barium or sodium hydroxide.

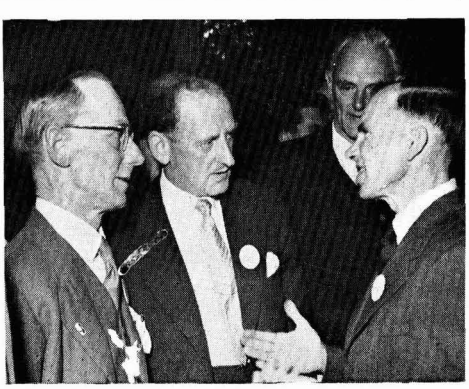
For general daily routine his company had, for some years, used a large scale type of combustion procedure in which charges of up to 16 g. of steel were fluxed at 1,200°C and the carbon dioxide absorbed in a semi-micro soda asbestos tube and determined gravimetrically. This procedure had the virtue of operational simplicity, and it was ideal for works laboratory routine, e.g. 50 to 100 determinations per man day and it gave consistently a reproducibility of ±0.002 per cent.

If higher accuracy was required, the low pressure methods could be operated to within ±0.005 per cent but they were generally less adaptable to large scale routine. Most of these methods were developments of the original Yensen procedure, but Well's simplified procedure, or a more recent modification by Cook and Speight, were the ones now generally used.

SPECTROGRAPHY SPEEDS STEEL ANALYSIS SAYS MR. D. MANTERFIELD

DEMANDS for speed, greater precision and the manufacture of more complex alloy steels during the past 15 years or so had created problems for the steel works chemist declared Mr. D. Manterfield (Steel, Peech and Tozer Ltd.) in his paper, '*Steel works analysis using spectrographic methods,*' presented at the first session on Monday. He stated that the development of spectrographic techniques had progressed simultaneously enabling the laboratory to meet those demands by replacing and supplementing wet chemical methods by spectographic analysis.

Photographic work consisted of comparison of selected spectral lines with internal reference standard lines (usually



Two steel industry congress lecturers, D. Manterfield (Steel, Peech and Tozer), Dr. Bagshawe (Brown-Firth Research Laboratories) left, with A. F. Williams (ICI Nobel division, research department), a member of the organising committee; behind is W. S. Sykes (Steel, Peech and Tozer)

L. to r. at the congress reception on Sunday: P. K. Mattli (BSA Group Research Centre), T. Hooper (English Steel Corporation Ltd.), W. R. Nall (Bragg Laboratory, Naval Ordnance Inspection Department), L. Kidman (English Steel Corporation) and Dr. K. Wheatley (Safety-in-Mines, Research Establishment)

iron), the measurement of their densities and conversion to percentage by precalibration. Working curves were prepared from standards covering the desired range. Steel of all types, slags, some refractories and other oxide systems could now be rapidly analysed. Mr. Manterfield referred to briquetting and solution techniques for slag and similar materials.

In more recent years, direct reading instruments had become more generally used. The photographic plate was replaced by a number of photomultiplier tubes. The current generated from those tubes by special radiations was converted to percentage concentration by precalibration. That eliminated the errors of photographic methods and reduced the time of analysis. The actual analytical time was about one minute.

A typical instrument, the Quantometer was described and results and accuracy discussed. Sources of error were considered, the most important being, perhaps, samples and their preparation.

Mr. Manterfield then discussed some disadvantages in spectrography, such as limitation of scope, but he stressed that the advantages of speed and comparable accuracy far outweighed any disadvantages for many applications. In addition, the use of spectrographic methods enabled close control to be exercised during manufacturing processes.

Mr. G. Mattock (Electronic Instruments Ltd.), asked whether coulometric analysis had been used for steel analyses.

Mr. Bawshawe in reply said that he did not think it had yet been used in this country, but he thought Sweden was possibly using this method.

D. J. C. Milner (UKAEA, Harwell), said that Smythe had done a certain amount of work on coulometric analysis but not on chromium in steel. He was grateful to see that steel chemists had agreed with Smales regarding cobalt estimation and to learn that use was being made of tracer techniques. Referring to the thiocyanate reaction for niobium, he said that this, when first announced, had been criticised. There had been a lack of realisation of the tricky nature of the experimental conditions. They had now however, established conditions for a stable niobium thiocyanate.

Mr. W. Drummond (English Electric Co. Ltd.), said that as a user of steel he would like to know how spectrographic analysis was of use when the samples were so small. Were the results representative of the whole?

Mr. Manterfield answered that the heterogenous nature of steels was known. More than one sample was taken and further samples were taken throughout processing. He stated that aeronautical inspectors claimed that a sample taken at teeming was representative of the steel as a whole.

BROAD BASE OF CHEMISTRY IN ELECTRICAL MANUFACTURING

By

R. C. Chirnside

MANY of the activities of the electrical manufacturing industry are based on recent scientific advances and the successful application of that knowledge calls for intensive studies in the fields of physics, chemistry and engineering. This was stated by Mr. R. C. Chirnside (GEC research laboratories) on Tuesday in his paper on '*Chemical problems in the electrical industry; the contribution of analysis as a research service.*'

Other industries were also involved in the production of many of the materials and components used in electrical manufacture, but because those materials had so frequently to meet specialised needs, they were often made by the electrical industry itself. Of these, glass and ceramics and some metals and alloys represented major interests, but there was a variety of other materials, e.g., fluorescent materials, thermionic coatings, ceramic dielectrics, non-metallic magnetic materials, semiconductors, etc., that had been developed and were made only by the electrical industry.

In those circumstances, the chemist was on a much broader footing than the works analyst of old. Materials had still to be selected, developed and controlled but they had also to perform specialised functions. A knowledge of satisfactory composition and purity was not enough to guarantee performance or even control of manufacture and a new and wider conception of the objects and scope of analysis had had to be evolved of which composition was but one aspect.

Mr. Chirnside gave examples of a wide selection of materials and products over the whole range of the industry's activities. These served to illustrate the wealth of the techniques now available to the modern analyst.

Mr. G. M. Holmes (London and Scandinavian Metallurgical Co.) said Mr. Chirnside had mentioned that techniques had shown impurities in tungsten; had they also shown grain growth at the reduction stage.

It was believed by metallurgists, said Mr. Chirnside, that impurities were responsible for grain growth. He mentioned flame photometry and spoke of effects at 3,000° C. (not, in fact, the temperature at the reduction stage.)

Dr. Magnus Pyke, Scottish section chairman, left, and Dr. J. H. Hamence, SAC president, prepare to receive guests at the Sunday reception

Congress Tribute to Dr. L. H. Lampitt

DR. E. B. HUGHES arrived on Tuesday to give one of the three congress lectures. Chief chemist of J. Lyons and Co. Ltd., he was taking the place of Dr. L. H. Lampitt, a director of the company, who died early in June.

Before beginning his paper, Dr. Hughes read part of an appreciation of Dr. Lampitt by Mr. B. G. McLellan, formerly Rowntree's chief chemist and later associated with the Sea Weed Research Association, but who is now retired.

Mr. McLellan said:

'In the course of his life Leslie Lampitt rendered a supreme service to the science of food—he caused it to be used.' Just before the first world war 'chemists were not universally employed in the industry and, where they were, they were expected to keep to their so-called laboratories. What a change has taken place since then and for that change we place Leslie Lampitt right in the forefront of those who have brought it about.

What is the position now? In many enlightened firms the chemist is no longer the back-room boy, confined to his laboratory, but is taking a leading part in the development of his firm's products and in controlling the destiny of the company. This was indeed a major part of Lampitt's life work, the emancipation of the food-chemist.

GAS BOARD CHEMISTS DISCUSS NEW METHODS

By A. B. Densham and G. Gough

WORK IS in hand to develop physical methods for the control of plant for conversion of hydrogen sulphide and sulphur, for the manufacture of purifying materials and for the treatment of effluents. This was stated by Mr. A. B. Densham and Mr. G. Gough (Fulham Research Laboratory of the North Thames Gas Board) on Tuesday morning in their paper on '*The application of physical methods of analysis in the gas industry*.'

Mention was made of a double beam apparatus which has been described by Mr. C. M. Cherrier for the determination of sulphur dioxide and other gases in air. This required a continuous light source with an interference filter to select the right wavelength. Densham and Gough stated that they were investigating the possibility of using a similar device for controlling the SO_2/H_2S ratio in connection with a Claus kiln for the production of sulphur.

To determine less than 1 p.p.m. of hydrogen sulphide in purified gas, these authors reported, 2 cu. ft. of gas were passed through a specially selected filter paper impregnated with lead acetate. The blackening was then measured photo-electrically in an apparatus developed in co-operation with Evans Electroselenium Ltd., which gave the result directly as p.p.m. of hydrogen sulphide.

With regard to quantitative analysis of tar fractions, content of o-cresol in the m,p-cresol fraction from coal tar could be determined accurately. The presence of xylenols boiling in the same range was stated to make the determination of the m- and p-cresol contents less accurate.

Residual Toluene

Densham and Gough reported that it was possible to measure 0.01 per cent of residual toluene in sulphur extracted from spent oxide with pyridine. For this purpose the sulphur was dissolved to form a 25 per cent solution in carbon disulphide, and the absorption was measured at 13.14 microns, in a cell 0.8 mm. thick. It was stated that for group analysis of mineral oils they were using infra-red absorption to check other methods of analysis.

The authors said that infra-red gas analysers of the non-dispersive type with selective detectors were finding increasing use for the determination of carbon monoxide and carbon dioxide in products of combustion. It had been found that with careful attention to drying of the products to be analysed, calibration did not change significantly between weekly checks. Advantage of this analyser was that a reading could be taken on less than ½ in. litre sample, but it could not be used, however, with damp corrosive gases as the cell walls tarnished and the reduced reflection from the walls caused an increasing drop in sensitivity.

Concentration of the carcinogen, 3:4-benzpyrene, in gas had been investigated. Fluorescence of condensed hydrocarbons removed from a gas stream by a solid CO_2 trap was photographed with a quartz Raman spectrograph using a three-hours exposure. No benzpyrene was detected and it was shown that if benzpyrene was evaporated into gas it was completely burnt in a flame.

Leak detection from an underground tank was of importance. While fluorescence spectroscopy had been used to increase the sensitivity of the fluorescein method, more recently radioactive sodium carbonate as a tracer had been used. However, this method could only be relied upon when the test was positive, as the sodium might be selectively removed by concrete or soil as the result of ion exchange.

Isotopic dilution techniques had been used, the authors said, for the determination of small amounts, 0.01-0.1 per cent, of ammonium chloride in tar. Thiosulphates in aqueous liquor produced when gas was made by the catalytic reaction of steam with heavy oil, and the main cause of oxygen absorption of this effluent, could be determined accurately polarographically. Polarographic methods investigated as a measure of dissolved oxygen in aqueous effluents did not appear to be reliable at the low *p*H values sometimes encountered due to lowering of the hydrogen over-voltage.

Densham and Gough hoped to obtain more success with the recording dropping mercury electrode recently developed at the Water Pollution Research Laboratory. Polarography was stated to provide a useful check on other methods of analysis for determination of lead content for pitch creosote fuel. Lead could be determined in a one gram sample after combustion in a bomb.

Mr. W. H. Topham (BP Refinery (Kent) Ltd.) asked whether the authors could give any idea of the sensitivity for sulphur dioxide and hydrogen sulphide.

Mr. Gough said it was not suitable for low concentrations, unless an extremely long gas cell was used. It was less than the I-R method.

Dr. H. A. van Vucht (Staatsmijnen in Limburg) enquired if the vapour phase method for determination of naphthalene was a better method to use for high contents of naphthalene by passing N_2 through wash oil.

Mr. Gough said theirs was a simple method. They were interested in determining 5 to 10 per cent, in fatc even 3 to 7 per cent.

G. Russell (Ilford Ltd.) referred to the slide indicating tetra and pentathionate. Were the authors interested in determining these? There appeared to be excellent separation on the diagram. He suggested the use of paper chromatography.

Mr. Durham said they knew of the work using this method but had not investigated it.

Mr. B. W. Stannard (Bexford Ltd.) asked which indicator was used to determine dihydrophenols by paper chromatography in ethanol.

It was stated that the reagent used was 2:6 dichloroimide in ethanol.

GOVERNMENT CHEMIST'S OFFICE HANDLES 470,000 SAMPLES A YEAR

DISCUSSING the '*The work of the department of the Government Chemist*' of which he is head, Dr. G. M. Bennett, said it existed to provide chemical advice and services to all other Government departments. A large part of its work was analytical and consisted of involved examination of some 470,000 samples a year on behalf of the board of Customs and Excise, the Ministry of Agriculture, Fisheries and Food, the Ministry of Health, the War Office, Ministry of Works and other departments.

The Customs and Excise work was essential to the assessment of payments of duty which together constitute some 30 per cent of the national revenue. On the other hand the department's function in relation to food, agriculture and public health, although it involved a smaller number of samples, was nevertheless of equal importance. Moreover many problems were dealt with which involve short or long term investigations of the most diverse subjects.

The Government Chemist, said Dr. Bennett, had the duty under several Acts of Parliament to act as official referee where there had been a conflict of analytical evidence in the courts. Such cases were few but they entailed the most careful and critical work.

Spectrographic methods (visible, ultra-violet and infra-red) were widely applied in determination of metals, drugs, vitamins etc. X-ray diffraction was used to estimate free silica in dusts in connection with the silicosis survey. Chromatographic methods of separation were also of increasing importance

Brief mention was made of a few specific examples of recent work in the department: a convenient method with simple portable apparatus for detecting and determining traces of toxic-gases in the air of factories; the analysis of a sheep-dip of complex composition; the determination of traces of metals and other poisonous materials in foods. The identification of the cause of the outbreak of food poisoning at Pontadawe, S. Wales, last year was a particularly interesting example.

Reference was also made to a simple apparatus for gas chromatography which made possible the detection and estimation of minor components of liquid mixtures.

(*Continued in p.* 1105)

PEOPLE at St. Andrews

● OVERSEAS congress members totalled 26 and included two lecturers, Professor G. F. Smith (Illinois University, department of chemistry and chemical engineering), and Dr. A. I. M. Keulemans (Koninklijke/Shell Labatorium, Amsterdam). The strongest contingent came from the Netherlands. Among overseas visitors were Dr. Max Berl, of the Government of Israel Purchasing Mission, Dr. R. Arnold (Capetown University); Dr. L. Blom, Dr. T. Van Hoek, Dr. T. H. Veerkamp and Dr. H. A. van Vucht (Staatsmijen in Limburg); Dr. S. F. Bohlken and J. B. van den Klooster (Mekog, Ijmuiden), Dr. E. A. M. F. Dahmen and Dr. G. W. Nederbragt (Koninklijke/Shell Labatorium); Mr. H. Hamilton (Magadi Soda Co. Ltd., Kenya); Mr. G. Jefford (Geological Survey of Nigeria, Kaduna); Dr. B. P. Knol (Centraal Technisch Instituut, TNO, The Hague), Dr. K. D. Luke (Canadian Industries Ltd., Quebec); Mr. T. McWilliam (ICI Australia and NZ Ltd., Ascot Vale, Victoria); Mr. M. J. Murray (Universal Oil Products, Des Plaines, Illinois); Dr. F. A. Pohl (Allgemeine Elektricitats Gesellschaft, Mohne); Dr. F. G. Spruit (NV Philips-Roxane, Amsterdam).

● Professor E. L. Hirst of Edinburgh University, one of the congress chairmen, was warmly congratulated by many friends at St. Andrews on the CBE awarded him in the Queen's Birthday Honours List.

● Last minute illness prevented Mr. A. A. Smales from presenting his paper on the uses of radio-isotopes. It was, however, given by a colleague of his at the Harwell Atomic Energy Research Establishment, Dr. D. J. Ferrett.

● MANY former St. Andrews graduates among congress members were able to meet again Dr. Ethi M. Steele, former chemistry lecturer and now warden of McIntosh Hall, the women's hall of residence. Dr. Steele worked with the late Sir James Irvine for 35 years both as his personal secretary and as a lecturer. She retired from lecturing last September. Among former students she met Dr. J. Allan (Cooper Technical Bureau, Berkhamsted), a student of St. Andrews for nine years, Dr. James Craik (chairman, ICI Nobel division) and Dr. D. Traill (ICI Nobel division). Professor E. L. Hirst (Edinburgh University), a former St. Andrews' man, was a lecturer in chemistry for a number of years.

● DR. MAGNUS PYKE, chairman of the Scottish section, Society for Analytical Chemistry, which organised the notable congress at St. Andrews this week, has broadcast frequently and has the distinction of being one of the two scientific contributors whose works appear in the memorial volume 'From the Third Programme.' He is the author of some fifty scientific and technical publications and of 'The Manual of Nutrition (HMSO, 1945); 'Industrial Nutrition' (McDonald and Evans, 1950); 'Townman's Food' (Turnstile Press 1952); 'Automation, its Purpose and Future' (Hutchinsons 1956). His newest book, 'Nothing Like Science,' is being published by John Murray this summer.

Dr. Magnus Pyke

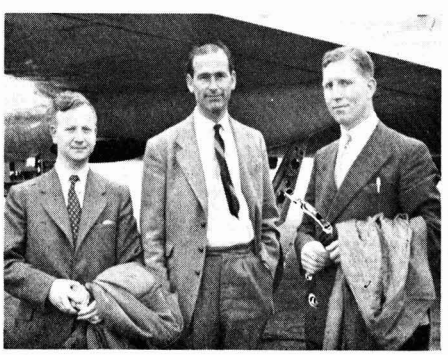
Papers presented on Thursday and Friday, with further congress photographs will appear in the next issue of Chemical Age

Manager of the Glenochil Research Station of the Distillers Co. Ltd., at Menstrie, Clackmannanshire, he worked with Sir Jack Drummond during the war in the Scientific Adviser's Division of the Ministry of Food and in 1945-46 served as nutrition adviser to the Allied Commission for Austria in Vienna.

His other claims to distinction are: member of the council, Royal Institute of Chemistry, 1953-56, chairman Stirlingshire section 1956; chairman of Scottish group committee, Nutrition Society, 1954-56; chairman nutrition panel, Food group, Society of Chemical Industry, 1948-51.

● DR. MAX BERL, of the Israel Government Purchasing Mission, who travelled from Haifa to attend the congress, told us that Government research laboratories, particularly the Weitzman Institute, were among the finest equipped in the world. There was a high degree of instrumentation and many of their instruments, Dr. Berl added, are bought in the UK. With his wife, he will go on next month to the Paris conference of the International Union of Pure and Applied Chemistry.

● FOURTEEN congress members were delayed three hours at London Airport last Saturday when their Edinburgh-bound BEA Viscount developed technical trouble. They included a party of four Dutchmen headed by congress lecturer Dr. A. I. M. Keulemans (Koninklijke/Shell-Laboratorium), Mr. H. R. Munden, Mr. A. S. Smith and Mr. G. F. Price (British Nylon Spinners), congress lecturers, Dr. J. C. Milner (AERE, Harwell) and Dr. D. J. Ferrett (AERE, Harwell), Mr. J. H. Parkinson and Mr. B. W. Samuel (British Petroleum Co. Ltd.), and Mr. D. R. Fellows (Standard Telecommunications Laboratories Ltd.). Eventually they joined a London-Aberdeen train at Edinburgh on which were about 40 other congress members.



After a three hour delay, three congress members wait to board their BEA Viscount at London Airport. They are, l. to r., A. S. Smith, H. R. Munden, chief of research section, and G. F. Price of British Nylon Spinners Ltd.

Infra-red Spectroscopy

Continued from p. 1108

useful means of increasing the sensitivity. Efforts, said Dr. Martin, were being made to extend the useful range of spectrometers beyond the limit of 25mu accepted by most infra-red workers. A promising approach appeared to be the application of very coarse diffraction gratings.

He then mentioned a few analytical determinations, referring to the determination of water in Perspex sheet. In equilibrium with normal air, Perspex could take up to 1 per cent of water, and this was easily determined by measuring the transmission of $\frac{1}{8}$ in. sheet near 2mu. Less than 1 per cent monomer in Perspex could be determined at 1.7mu and as little as 0.1 per cent could be detected in a sample $\frac{1}{2}$ in. thick.

Impurities in high quality phenol could, after concentration, be identified spectroscopically. He instanced two cases; in one the presence of naphthalene in phenol from coal tar was shown conclusively and in the other diphenyl ether was found when chlorobenzene was the starting material. The infra-red spectrum, Dr. Martin said, afforded a useful method of checking the purity of toluene and benzene. A topical example was the analysis of heavy water. Here different ranges had to be covered, e.g., small quantities of H_2O in D_2O, and vice versa. For the former analysis the HOD band at 2.95mu was used, while for the latter the HOD band near 4mu was employed since intense absorption by normal water made the 2.95mu band unusuable.

Dr. Bennett said that tobacco, wines and spirits were the main samples passing through his department. Fluorination of water was just getting under way and would be investigated.

On sugar determinations, reference was made to the colour of crude sugar solution. Lead acetate was formerly used to clean it—but excess lead acetate had led to error. Unfortunately the part required was at the flat minimum. A conventionalised method of clarification was used and lead was ignored. The error was in favour of the customer. Photoelectric polarimetry for sugar determinations could be advantageous but had not been generally adopted.

Work carried out for the factory inspectorate involved field devices for testing for toxic gases and vapours such as mercury.

Flour surveys were of importance and samples were obtained from some 300 milling establishments for determination of nutrients.

At present, work was being carried out on the presence of mercury on apples. Mercury estimations of 0.01 p.p.m. were now made with certainty and the department was confident that mercury could be detected on apples.

Herbicides contained impurities which were not agriculturally valuable said Dr. Bennett. Using ^{36}Cl the acid required was isolated and, by radioactive techniques, the amount of acid in herbicide could be obtained.

Ion Exchange

Lead and zinc residues in food could be usefully estimated by ion exchange. 'Liquid' glucose was another substance which was of interest for duty purposes. Classical methods of estimating liquid glucose only were available until recently; chromatography was now used, a solid calcium carbonate column being employed. There was an important temperature factor in elution. The absorbing material had to be standardised and one had to know the temperature effects.

Gas chromatography was being explored, and reference was made to a flame photometer adapted by the department. The apparatus could be put together by anyone with intelligence. The only costly part was the recording potentiometer (about £200).

Dr. E. F. Hersant (May and Baker) asked if there was a possibility that the Government would consider another method of recording proof spirit since the present one gave rise to so much difficulty.

Dr. Bennett could not hold out much hope of a change. He said the Board of Trade preferred to continue in the same way.

Mr. A. E. Brookes (Boots Pure Drug Co.) asked whether there was a possibility of speeding up excise work on ethyl alcohol determination particularly with reference to methanol present as impurity by using the gas chromatographic method for methyl alcohol, ethyl alcohol and propyl alcohol.

Mr. W. J. Gooderham, North Thames Gas Board, asked if Dr. Bennett could say whether mercury or other insecticides were located in the skin of apples or onions and could these therefore be got rid of by peeling the apple or onion.

Mr. W. H. Stevenson (Boots Pure Drug Co.), thought he could throw some light on the last enquiry. They had investigated the amount of mercury on skin peal of apples. Mercury did not readily penetrate the pulp but with tomatoes mercury was preferentially absorbed by pulp. *Mr. A. A. Lea,* (Pilkington Bros. Ltd.), said he would like more details on the home-made flame photometer referred to by Dr. Bennett. Replying to this Dr. Bennett said Dr. Scott of his department who produced the instrument had given the account of it to an electrical engineers meeting in London recently. He thought that there would be a paper on it in due course.

Dr. H. C. Lockwood (Cadbury Ltd.), enquired whether moisture determinations mentioned by Dr. Bennett for tobacco were similar to the Imperial Tobacco Company's results. If so, he had a comment to make. *Dr. Lockwood* also enquired about the oven lid. Was this jacketed or had it steam passing through it?

Dr. Bennett said that his department had exchanged views with ITC. Both had had similar ovens although these had been designed separately. On the second part of the question, Dr. Bennett said if the oven had a suitable height only a lagged jacket lid was required.

Dr. Lockwood then commented that in carrying out tests in conjunction with Fry's their oven having a jacketed lid, first results were identical, but later Fry's results were lower. The reason was that the dew point of air entering the oven was less than that of air coming out. Therefore, the water must have been damping the lagging.

Dr. Bennett suggested there had been a defect in the wall of the oven.

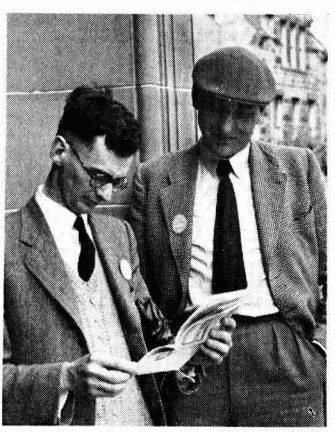
Vital Role of the Food Analyst, by Dr. Hughes

IN HIS congress lecture on *'Analysis and Food'*, given on Tuesday, Dr. E. B. Hughes (J. Lyons and Co. Ltd.) did not confine himself to new methods. He wished to show how important and useful analysis was to the food industry. Analysis was the backbone of the industry.

At first the chef had resented the intrusion of the analyst, but today they worked closely together. No food manufacturer could now carry on without the assurance of the analytical laboratory. The buyer's work was simplified by specifications laid down or samples available.

Compliance with food laws was important. It was necessary to have specialist chemists because of the wideness of the field. In his company there was even the entomologist. The fundamental requirement was analytical knowledge.

It was essential that there should be no variation in the goods, or working of the plant. This procedure formed a useful stock control. Dr. Hughes illustrated a dissection of chemists' hours in laboratory work for costing purposes (1956 figures): Analysis of samples took 49 per cent of time; inspection of process took 9½ per cent; investigational processes and hygienic control, development and research work, took 41½ per cent.



From Albright and Wilson Ltd. are Dr. W. A. Forster, left, and S. Greenfield

A scheme for a continuous mixing and freezing plant for ice cream was shown as well as the control panel for the process. Analyses for this process were carried out every half hour; in addition, bacteriological control was provided.

In the bakery, materials had to be closely controlled before being used. The importance of this could be realised when 24 miles of Swiss roll were produced in a day.

He referred to Dr. Bennett's mention of micro-biological methods for B group vitamins. This test was much used in his company, which preferred that the micro-biologist (or bacteriologist) should be a chemist.

Work was being carried out in Dr. Hughes' laboratories on controlled humidity for micro-ecological work. It was shown that with increased humidity there was marked growth of organisms such as *Escheria coli, Salmonella typlie murium, staphylococcus pyogenes.*

From such work, factors were obtained which affected formation or preservation of protective surface layers in perishable goods: (a) atmospheric humidity, (b) air velocity over food, (c) nature and structure of food.

Passing to paper chromatography, Dr. Hughes said that substances in green tea could be detected by this method.

A butanol extract of a black tea infusion produced thearulugins and theaflavins—these gave body, thickness and flavour, mildness and brightness of tea.

Dr. Roberts of Lyons and Co. had devised a test from this determination to give, it was believed, a more accurate and better assessment of tea than a taster might do.

The tea could be assessed by means of a spectrometer.

Chromatography was one of the most valuable methods available to the food industry, Dr. Hughes stated. Identification of food colours was now to be limited to about 15 colours. Here again chromatography would have to be employed.

X-ray cameras were used in routine analysis and in research. Advantages of the X-ray camera for routine analysis of unknown material in foods were great.

Struvite (magnesium ammonia phosphate) which occurred in prawn and crab could be quickly determined or aluminium in an ice cream cup. It could trace if there was lubricant or foreign body contamination from plant used in processing. Sodium diacetate was shown to be a definite compound by this method.

Using the oscillating and Weissenberg cameras the structural formula of a substance could be found. By means of an electric computer Mrs. Wright at Lyons had produced a model of the glutathione molecule which had been worked out in 40 hours instead of five years which would have been required to find the formula that had been obtained from the model.

Good Opportunity to Apply New Techniques to Pharmaceuticals

By

Dr. D. C. Garratt

ANALYSTS in pharmaceutical control, because of the wide range of chemical substances used in the medicinal field, had an exceptional opportunity to apply newer techniques to their own needs. This was stated by Dr. D. C. Garratt (Boots Pure Drug Co. Ltd.) in the paper he gave on Tuesday on '*Analytical developments in a pharmaceutical laboratory*'.

The range for which accurate and rapid determination was possible had been increased by the development of emission spectroscopy by solution techniques, particularly flame photometry with the use of automatic recording units and the porous cup process. More volatile elements in certain cases could be assayed with the hollow cathode directly in the presence of organic matter. A chemical determination of mercury by distillation as metal was also applicable to a wide range of pharmaceutical products.

In quantitative chromatography, the column technique together with ion-exchange materials used similarly had given rapid assays of complex galencials; an assay of insulin preparations was being developed with paper chromatography.

Infra-Red

Dr. Garratt said that the use of infra-red for routine control continued to expand. Other interesting developments included the production of a sensitive fluorimeter, an assessment of insecticides using flies as single biological units, and a chemical assay of morphine applicable to opium and standard preparations containing the alkaloid.

Aluminium in the presence of magnesium or calcium was effectively masked by complexing with triethanolamine providing the titration was carried out without delay.

Other uses had been found for this technique and conditions had recently been obtained for the titration of mercury salts; titration was possible with EDTA at pH6. Its high salt concentrations from usual buffer solutions gave a poor end point; hexamine was used for adjusting the pH. PAN (pyridyl azonaphthol) was a suitable indication alone or screened with methylene blue.

A new metal indicator had been obtained by Dr. Pribil—xylenol orange—a sulphonphthalein derivative giving an orange colour in solution and forming a blue complex with metals.

Under conditions used for PAN, adjusting solution to pH6 with hexamine, a sharp end point was obtained. Halide ions interfered with the direct titration, precipitation occurring when neutralising the solution due probably to the formation of an insoluble hexamine mercury halide complex.

A back titration at pH^{10} was satisfactory using either zinc chloride or calcium chloride as titrant with cresolphthalein complexone as indicator stated Dr. Garratt. Similarly sulphate and nitrate were tolerated unless in high concentration.

The method was suitable for the assay of mercuric oxide, mercuric chloride, calomel and ammoniated mercury. It was unlikely to be of much practical value for determination of mercury in compounded preparations.

Because of the sharpness of the end point in the direct titration of mercury using xylenol orange, it was thought that semi-micro scale determination of mercury might be possible. Using N/100 solution quantities of the order of 2 or 3 mg of mercury might be accurately determined and the end point was still very clear.

Determination of macro-quantities and traces of mercury and lead had proved a stumbling block. Dr. Garratt then mentioned the successful method evolved for mercury using in principle the technique used over a century ago—namely distillation in the presence of lime (for atomic weight of mercury). His section had made a thorough study of the process and had developed a technique which could be applied be a large number of mercury products.

Favourable results could be obtained on a powder containing any compound of mercury in about one hour, by an inexperienced worker. Full recovery had been obtained with a selection of mercury salts and such organic mercuriats as methyl mercury chloride, mersalyl, ethyl mercury phosphate, mercurochrome etc.

No interference was caused by extraneous compounds—e.g. 1 g. sulphur, 1 g. iodine, 1 g. sodium bromide, 2 g. benzene hexachloride and 5 g. lead arsenate.

Professor E. L. Hirst (Edingurgh University), right, one of the congress chairman chatting with J. B. Attrill, editor of 'The Analyst'

The technique used had been applied to a number of tablets and pills with favourable results. A few ointments had been tried and, according to Dr. Garratt, possibly the method could be extended to cover this large field of mercury preparations, thus avoiding the multiplicity of methods.

On semi-micro scale determination of mercury, the thiocyanate titration end point was reported to be good when titrating with N/100 thiocyanate in total volume of less than 50 mls.

Hollow Cathode

The hollow cathode had been used for excitation of halides. Work referred to by Dr. Garratt was still in early stages, but it suggested it might be useful for determining traces of elements having volatile oxides, although this problem has been partly solved by the porous cup technique. The use of a bomb calorimeter for complete combustion in 30 atmospheres of oxygen for recovery of traces of volatile elements, not received enthusiastically by a society meeting in October 1953, nevertheless gave good recoveries and it had been found of value.

Microbiological methods had also proved of value in the determination of small amounts of organic mercurials where the chemical assay was complicated and tedious.

Referring to Robinson and Febr's work in 1952 on quantitative separation of insulin from protamine in protamine

ACKNOWLEDGEMENTS

Many of the summaries in this special report of the St. Andrews congress were specially prepared by the authors for Chemical Age. Our thanks are particularly due to them and to the organisers for their co-operation in preparing this report. The congress papers and discussions will be fully recorded in due course by The Analyst, the Society's official journal

zinc insulin by means of paper chromatography. Dr. Garratt said the method had been applied to assess activity of freshly prepared samples of this insulin, insulin solutions and insulin zinc suspensions. The adsorbed colour was critically dependent, he opined, on physical conditions prevailing during steaming. A standard solution was therefore run at the same time to ensure identical conditions.

Oxidised cellulose as a carboxylic cation exchange medium had been used successfully for the quantitative separation of alkaloids. Only 1 gm. was needed for a column and thus could be used for a number of determinations.

This method had applications in pharmaceutical preparations containing strychnine and brucine. Basic non-alkaloid impurities affected strychnine but with use of oxy-cellulose an extract of high purity was obtained. The method was sensitive to 0.16 mg. strychnine.

In classical separation of strychnine from brucine by oxidation with nitric acid, complete destruction of brucine occurred, and no strychnine was lost. This work is to be reported in detail.

Dr. F. G. Spruit (NV Philips-Roxane) asked if the paper chromatography method described by Dr. Garratt for insulin was suitable for crude insulin.

Dr. Garratt said it was usually used on samples returned and said to be inactive, but he thought it might be applied.

Mr. N. T. Wilkinson (ICI Ltd.) said the determination of mercury in apples was mentioned by Dr. Berment; was it, he asked, the method mentioned this afternoon for determination of mercury on apples.

This was not the case, but the method is to be described in a paper to be sent to *The Analyst*. It was sensitive to 2-3 mg. of mercury.

RECENT APPLICATIONS OF PHYSICOCHEMICAL METHODS

By Dr. R. L. M. Synge

APPLICATIONS in recent years of some of the more refined physicochemical methods, many of which had already proved useful for analytical separations of smaller molecules to substances of higher molecular weight were discussed by Dr. R. L. M. Synge (Rowett Research Institute). His paper, entitled '*Recent progress in separating substances of high molecular weight*,' was presented on Wednesday morning.

These methods included counter-current distribution, chromatography based on liquid-liquid partition, on the use of ion-exchangers and adsorbents (including molecular-sieve effects), a variety of electrophoretic precedures and a number of procedures depending on differences in diffusion behaviour or on selective permeability in membranes.

Dr. Synge illustrated his paper with examples from among high-molecular substances of biochemical interest. The conclusions would, he suggested, be applicable to polymers of industrial interest.

Dr. Garratt (Boots Pure Drug Co.), said he had a problem regarding gelled insulin, which was not separated by paper chromatography. Insulin was a simple molecule and gelled insulin a polymer. Electrophoresis had not proved of value. Answering, Dr. Synge said each protein was a special problem. All work was by trial and error. He mentioned work by Sleighterman, who could not get separation but he had had success with acetyl insulin on paper using carrying 50 per cent acetic acid. *Dr. Garratt* then asked whether dialysis was of any use. *Dr. A. T. James* (Medical Research Council), said Craig had suggested dialysis for high protein.

Mr. E. A. Taylor (Lankro Chemicals Ltd.), asked whether the method mentioned could be adapted for the separation of ethylene oxide condensation products of different molecular weights. Dr. Synge said diffusion seemed as if it would be the best possibility. *Dr. F. G. Spruit* (N. V. Philips-Roxane) wanted an opinion on double spotting exhibited by single substances. Dr. Synge said he knew of the occurrence of double spotting. It was usually due to other distributing substances such as water. There were instances reported in the literature he recorded that trinitrotoluene was upset by water. Another speaker said double spotting had been found when the chromatography paper was damp. Drying prior to chromatography ensured absence of double spotting.

Mr. F. C. J. Poulton (Dunlop Rubber Co.), asked whether any of the methods mentioned by Dr. Synge were uses where polymer weight was disproportionate. That was, where there was picking up of minor constituents what was the sensitivity of the method? In reply Dr. Synge said the methods were satisfactory for minor compounds where these were well separated from the major constituents, as for example in the work of polysarcosines, but where minor constituents gave a peak close to the main one as shown by Caessons, unsatisfactory results for the minor constituents would be obtained.

Mr. R. C. Chirnside (GEC) said he was particularly interested when Dr. Synge had mentioned separation of viruses. He would like to know of any analogy with this work and its possible application in mineral flotation. Could Dr. Synge say what happened on the surface of molecules?

Dr. Synge in reply said the anology was based on the idea of the difference in free energy between molecules adhering to surfaces and the free energy in solution, and was the extension of the theory of surface tension and energy application to smaller particles. He referred to the work on uranium ore of W. E. I. Dubberly in Melbourne who was using counter current pulp chromatography. The ore particles moved upwards and resin particles stayed where they were.

Typical 'Flow Sheet' of Medical Research

IN his paper, '*Analysis in medical research*,' presented on Wednesday, Dr. A. T. James (Medical Research Council) said that the term 'medical research' could be taken to cover biochemistry, physiology, bacteriology, pharmacology, histochemistry and clinical research. Except for the hospital laboratory where routine analyses of blood, urine, etc., were carried out, few analysts were found in medical research.

Each worker carried out his own analytical work since this varied from problem to problem. Generally, the type of problem was very different from that encountered in the chemical industry. A typical 'flow sheet' of one type of research would be:

1. Discovery of a specific physiological effect produced by an extract of biological origin.
2. Purification of the active substance using, where possible, a chemical rather than a physiological test for following the fractionation.
3. Determination of chemical structure of the substance.
4. Synthesis of the substance and an attempted correlation of chemical structure and physiological action.

J. A. Eggieston, congress secretary, checks in A. F. Pyrah (Mobil Oil Co.) left and Dr. K. W. W. Hager (Ministerium für Chemische Industrie, Leipzig)

SPEED IS PRIME ADVANTAGE OF SPECTROSCOPIC METHODS

By M. Milbourn, A.R.C.S., B.Sc., F.Inst.P.

EMISSION spectroscopy is one of the best established physical methods of analysis and has played a considerable part in the evolution of more rapid and simpler techniques for industrial analysis. This was stated by Mr. M. Milbourn (ICI Ltd., metals division) in his paper entitled '*Emission spectroscopy in industrial analysis*.' Modern developments were stimulated during the war by the necessity to control production of metallic materials, and by the use of photo-electric devices for measuring light intensities.

Congress lecturer Dr. J. Haslam (ICI plastics division) and Mrs. Haslam on the steps of McIntosh Hall

Sensitivity was such that small traces of most elements could be detected today, particularly the metals, although special instruments had been developed for the detection of other elements. Precision depended, said Mr. Milbourn, on the type of equipment available and the material being analysed, but it could be at such a level that complete analysis of complex steels or copper alloys was possible. Accuracy depended mainly on standardisation, in that analysis was effected by comparison of results from samples of known and unknown composition, which should match each other closely in their chemical and physical states.

Speed was the outstanding advantage of modern spectroscopic methods. A substantially complete analysis of a single sample could be effected in two or three minutes, when standardisation and calibration had been carried out previously. They were therefore best suited for routine control, and had been most widely applied in the metallurgical industry. They had also been used for materials encountered in glass making, heavy chemicals and agriculture.

An adequate combination of precision, versatility and speed might only be obtained by expensive instrumentation, except for limited applications said Mr. Milbourn. Techniques had generally been developed for defined problems by careful attention to all factors likely to influence the validity of comparing empirically results obtained from standard and from unknown samples. Major improvements in speed and precision had resulted, however, from the use of electron multipliers. The consequent reduction in measurement errors had made it evident that those arising from sampling and from excitation were now mainly responsible for limitation of precision.

Advances in instrumentation Mr. Milbourn emphasised, indicated that a more widespread appreciation of its physical background might be needed. Improved methods of excitation were also required.

D. R. Curry (Services Electronics Research Laboratory) asked about the three channel flame photometer. With regard to calcium, what was the maximum sensitivity obtainable if a filter was used? Was Mr. Milbourn using a single calcium line or band? Mr. Milbourn answering said that band light was not so sensitive as the line. There was greater sensitivity because of more light. Sensitivity depended on the level of emission from the band. If you used a dry band you may still get background.

Dr. Mitchell said that with calcium they had used the 4227 band for 5-10 parts per million in solution. They had not pushed it further as calcium was abundant. Aluminium interfered and calcium was very readily interfered with. This could be avoided by the use of 100 times as much strontium.

Mr. Chirnside said Mr. Milbourn had had much experience and in his paper had warned off people from using the spectroscope for the *ad hoc* job. Would he also caution people regarding the limitation of spectroscopy? Mr. Milbourn in reply agreed that was most certainly so. There were quite a number of instances where spectroscopic method was not the most sensitive. The most sensitive was not the most obvious. The eye was more sensitive to lithium. He recommended that for lithium the ordinary student spectroscope was most useful.

Infra-Red Work Needs Universal Means of Sample Determination

By Dr. A. E. Martin

A UNIVERSAL means for sample examination was still sorely needed in infra-red work stated Dr. A. E. Martin (Grubb Parsons and Co. Ltd.) on Wednesday afternoon, in his paper '*The analyst and infra-red spectroscopy*.' He added that a method which had not been greatly explored was that using the reflection spectrum which had the advantage that it could easily be applied to organic powders.

Dr. Martin mentioned the production of simplified and less expensive infra-red spectrometers of limited specially suitable for analytical use. Instruments for process control, including the infra-red gas analyser and monochromators employing gratings or interference filters were discussed.

One of the most important of the newer developments of infra-red spectroscopy was the use of the reflecting microscope suggested Dr. Martin. He reported that some progress had been made in examination of aqueous solutions with infra-red spectroscopy by placing the sample between barium fluoride plates and working between 6.5 and 11mμ with double-beam equipment.

From Kodak Ltd., are, left, W. Sebborn and H. J. Bridger

The use of difference spectra was a technique which was of value in analytical work. To exploit difference spectra fully, it was necessary to match carefully the absorption of sample and reference material. This, Dr. Martin suggested, was best accomplished by using a fixed cell in combination with a variable path cell or two variable cells. It was economical to have a range of fixed cells for the sample and to keep the expensive variable cell for reference material. A novel use for difference spectra was to establish the complete identity or otherwise of two samples. If two samples are identical, when compared one against the other a straight line should result, with small bands shown if impurities are present. If, however, the compounds are not identical there will be small frequency differences between similar bands, and the effect on the record will be to show a characteristic differentiated band with half above the line and half below. A band with this appearance clearly shows that the compounds are not identical.

A device of interest in analytical work was an expanded absorption scale in which the range 0-10 per cent was made to occupy the full chart width. For determination of small amounts of minor components scale expansion afforded a

(Continued on p. 1104)

A. R. Powell Discusses Rapid Methods for Rarer Metals

INCREASING importance of so-called rarer metals in industry had necessitated the development of rapid methods for their separation and determination in ores, minerals and refinery products. This was stated by Mr. A. R. Powell (Johnson Matthey and Co. Ltd.) in his paper entitled *'Modern analytical chemistry and the rarer metals,'* which was presented on Wednesday afternoon. These methods involved:

Flame photometry for the alkali metals.
Spectrophotometric methods for Be, Re, rare earths, Pt metals.
Polarographic methods for Eu, Yb, U.
Solvent extraction for U, Th, Ga, In, Tl.
Chromatographic methods for U, Th, Nb, Ta etc.
Distillation methods for Ge, Re, Se, Os, Ru.
Ion-exchange methods for rare earths.
For several of the rarer metals homogeneous precipitation methods effect more rapid and complete separation.

Purity of rare metals, said Mr. Powell was often of great importance in their application. There were some rapid techniques for detecting trace impurities. For the detection and determination of minute traces of As in Ge and its compounds the Ge was first converted into germano-oxalic acid and the As then extracted from a 20 per cent hydrochloric acid solution of the complex by shaking with a $CHCl_3$ solution of diethylammonium diethyldithiocarbamate.

Extract Evaporated

The extract was evaporated with $HClO_4$ and H_2SO_4 to destroy organic matter, the resulting H_3AsO_4 reduced to As_2O_3 with SO_2, and the solution then reduced by nascent hydrogen evolved in an electrolytic cell from a Zn-plated platinum cathode; the gases were passed through a capillary containing cotton thread impregnated with $HgCl_2$, the thread was then dipped in dilute $AgNO_3$ solution and the length of the black stain compared with a series of standards (modified Gutzit test). Starting with a 5 g. sample as little as 0.02 p.p.m. of As could be determined, said Mr. Powell.

For the rapid determination of oxygen and sulphur in electrolytic chromium the metal was heated at about 900°C in vacuo for one hour and then dissolved in dilute HCl. All the oxygen remained as insoluble Cr_2O_3 while all the sulphur was evolved as H_2S which could be determined by the usual method of collecting it in cadmium acetate solution and titration with standard iodine solution.

For the rapid determination of platinum in palladium the metal was dissolved in aqua regia and the solution gently boiled down with HNO_3 to destroy free HCl. The platinum was converted to soluble NO_2PtCl_6 while the palladium crystallised out from the concentrated HNO_3 as anhydrous $PdCl_2$. The crystals were collected in a porous glass filter crucible and washed with concentrated HNO_3. The filtrate was evaporated to dryness, the residue boiled with HCl to destroy nitrates and the remainder of the palladium precipitated from the cold diluted solution with dimethlglyoxime; the excess of the latter in the filtrate was destroyed by boiling with bromine and the platinum precipitated by adding $HgCl_2$ followed by NaH_2PO_2 to the boiling solution. Ignition of the ppt. afforded platinum for weighing.

Impurities in rare metals which influenced their properties were hydrogen, oxygen, nitrogen, carbon and silicon. Carbon was determined by a combustion process modified to suit the metal being tested, hydrogen, oxygen and nitrogen by a vacuum extraction technique using molten Fe or platinum in a graphite crucible in vacuo to expel the gases. Nitrogen alone would be determined in many metals by dissolving the metal in a suitable acid and the distilling off the NH_3 in the usual way. Silicon could generally be determined spectrographically on a 20 mg. sample which was completely burned in the arc.

ICI NOBEL DIVISION'S NEWER METHODS — by A. F. WILLIAMS

ANALYTICAL research in the Nobel division of ICI Ltd., the subject of the paper presented by Mr. A. F. Williams, is carried out to a pattern that is related to a number of main products. For the purposes of the paper, Mr. Williams reduced these to blasting explosives, propellents, pentaerythritol, sodium carboxymethyl cellulose and silicones. A number of new methods were described.

Glycerol was, of course, the raw material for the manufacture of nitroglycerine. In the manufacture of glycerol by the fermentation process, analysis of the plant liquors was difficult because of the presence of sugars which underwent similar reactions to glycerol when sodium metaperiodate was used for the final estimation. The difficulty had been overcome by using a chromatographic method for the initial separation.

In the analysis of nitrocellulose for propellent manufacture, the specific determination of residual stabiliser, namely, diphenylamine, had proved difficult by classical procedure because of the presence of the nitro-derivatives formed from the diphenylamine. A chromatographic method based on extraction with petroleum ether-methylene chloride on a silica gel-celite column enabled the diphenylamine to be extracted free from other compounds so that it could be subsequently determined by bromination. A similar method could be used, Mr. Williams stated, for the separation of 2.4 di, 4.6 di- and trinitroresorcinols from mononitroresorcinol which had to be of a certain standard of purity when used in detonator compositions. After separation, the compounds were readily determined on the polarograph. He then described a paper strip procedure as an alternative method of separation.

As sodium glycollate might be present as an impurity in sodium carboxymethyl cellulose it was desirable to have a method for its determination. However, because of the close resemblance of glycollic acid to part of the carboxymethyl cellulose molecule it had been found extremely difficult to find a chemical procedure for its determination. A method had been developed, reported Mr. Williams, whereby the glycollic acid was first separated on to an ion-exchange resin together with other low molecular weight acids. A small part of these acids was transferred to a paper strip and, after running in a solvent of ethyl acetate-formic acid solution, separated glycollic acid was leached from the paper and determined colorimetrically using chromotropic acid.

Impurities which occurred in pentaerythritol liquors were mainly of an oily nature and comprised reaction products of pentaerythritol and formaldehyde. Considerable success had been achieved in their analysis by employing the gradient elution technique of chromatography.

In the manufacture of the methylchlorosilanes, the first stage of the manufacture of silicones, composition of the crude product was important, particularly with reference to the ratio $ClSi(CH_3)_3$: $Cl_2Si(CH_3)_2$: $Cl_3Si(CH_3)$. A high yield of the dichloro compound was required and in one stage of the process it was necessary to fractionate in order to produce the compound in high purity. Owing to the close resemblance of the three compounds, analysis was difficult and the mass spectrometer was the only reliable means of analysis. Mr. Williams said that a method had been developed which was based on the use of vapour phase chromatography. Liquid paraffin was used as adsorbent employing all glass columns and katharometer and the sample was added either in a nitrogen dry box or sealed capillary.

Modern Analysis and Plastics

PROBLEMS discussed by Dr. J. Haslam (chief analyst, ICI plastics division) on Wednesday afternoon, included work on the chemical examination of the products of hydrolysis of nylon and related polymers as well as their chromatographic separation, the examination of complex plasticisers in p.v.c. compositions, and the spectrophotometric determination of lead in p.v.c. products. His paper was entitled *'Modern analytical chemistry in relation to the plastics industry'*.

The application of gas liquid chromatography in the work of a plastics analytical laboratory was described and Dr. Haslam drew attention to the improvements in general laboratory work which had followed the introduction of automatic titrimeters.

Productivity and Automation in Relation to Process Control

'Lack of Reliable Quality Control Instruments'

By

Dr. B. W. Bradford

CONTROL of process operation in chemical manufacture and control to specification of chemical products with special reference to economics and organisational factors, particularly as they operate in large-scale processes was the main theme of the address by Dr. B. W. Bradford (ICI Billingham division) on '*Process analytical control; the problems of manpower, productivity and automation*', given on Thursday morning.

The author suggested it was rarely found that analytical services were as well planned and organised as the maintenance services. There was no reliable data on the number of analytical chemists in this country, nor was there any information on the cost of analytical work in relation to cost of production generally. He estimated that the total number of professional analysts in this country was about 5,000, of whom half were engaged in manufacturing laboratories and in practice. Associated with these senior analysts was a large body of assistants and juniors. The total of this body could only be guessed, but he put it at 30,000, of whom some 20,000 might be engaged directly in manufacturing control.

Total annual cost of analytical control services in salaries, wages and laboratory overheads could not be less than £15 million. In the chemical and allied industries the cost of analysis was around one per cent of the cost of production.

There was today the serious problem of the supply of large numbers of junior analysts and assistants, and it was one of the main reasons for the developments in analytical instrumentation. The next stage was the extensive coming into being of continuously operating process stream quality control instruments ultimately used to direct integrated automatic control systems.

Billingham Approach

Dr. Bradford discussed the scope of process analytical control operations, by dealing with the approach that had been made to these problems at Billingham, which employed over 300 analytical control personnel of all grades.

Advantage had been taken of the developing scope of dispersive optical spectrometry and mass spectrometry as routine laboratory analytical methods. Some three years ago a survey had been taken regarding further increases in speed and productivity of analytical immediate and final control methods for processes. The survey showed that major analytical operations in order of importance, so far as expenditure of manpower was concerned were titration, gas chromatography, spectrophotometry, colorimetry, vapour pressure measurement, analytical distillation, specific gravity measurement and crystallising point measurement.

It should be noted, he said, that although a wide variety of instruments was now being made, there was still a scarcity of reliable quality control instruments and a failure on the part of many instrument makers to appreciate either the potentialities or the difficulties in this field.

Dr. Bradford said that prototype fully automatic titrators had been developed at Billingham. One such instrument was used to determine the ammonia content of the wash water in an ammonia scrubber for the control of water rate. Manual determinations in the control laboratory previously had taken 20 minutes and were carried out at hourly intervals. Results were now available in four minutes and at four-minute intervals.

Use of infra-red and ultra-violet spectroscopy for petroleum analysis and the use of the mass spectrometer for leak detection with control of isotopes concentrations had been one of the main factors in the rapid post-war expansion of the production of so many new industrial chemicals based on petroleum. Application of infra-red and ultra-violet spectrometers to process streams was developing rapidly, especially in the form of the non-dispersive gas analyser. Many such instruments were in use on Billingham plants for continuous measurement of carbon monoxide, carbon dioxide and hydrocarbons.

The ultra-violet spectrometer was being used in the new Billingham butadiene plant, very close control being achieved by simultaneous use of infra-red analysers to monitor mono-olefines and ultra-violet analysers to monitor di-olefines.

Two Metropolitan-Vickers MS3 mass spectrometers installed in the olefines plant control laboratory now handled an average of 200 samples a day instead of 36 assistants who would have been required. A single MS3 operated on continuous shifts gave 96 per cent average on-stream time.

Although almost unknown on full-scale plants, the process monitoring mass spectrometer could be valuable on pilot plant scale reducing the time for which the plant had to operate to determine full-scale operating conditions.

The most spectacular improvements recently had been made by the use of gas chromatography. For speed it equalled spectrometry. It had been in use on gas streams and now on the more difficult problem of automatic sampling of a liquid stream.

Other physical methods of control analysis included the radioactive determination of potassium, X-ray absorption for determination of lead or sulphur compounds in liquids and use of beta-ray back scattering for the measurement of C/H ratios in hydrocarbons. Improvements could be expected in the use of nuclear magnetic resonance phenomena as well as from the extension of existing optical spectroscopic ranges.

Incorporation of optical and mass spectroscopic equipment, as a part of routine analytical control organisation, had reduced by about 50 per cent, the analytical manpower required to handle the control work associated with certain production sectors.

Direct application of quality control instruments to process streams was being sought for further manpower saving. This would bring process analytical data into line with physical operating data which were continuously measured and recorded. The way would then be opened to integration of quality control with automatic operation of chemical plants, a direction in which there had so far been little progress.

Three Lines of Geochemical Approach Discussed by Professor Davidson

THREE lines of geochemical approach were described by Professor C. F. Davidson (department of geology, St. Andrews University) in his paper, '*The geochemical approach to prospecting for minerals,*' which was the last to be presented.

First he mentioned, routine analysis of soils, groundwaters, streams and vegetation by techniques designed to give rapid results under field conditions, which might reveal anomalous distribution patterns in metal contents, reflecting the presence of a subjacent or nearby ore body.

Second, in a region of known geology fundamental knowledge of the geochemical peculiarities of different rock types might suggest which was most likely to be pregnant with ore.

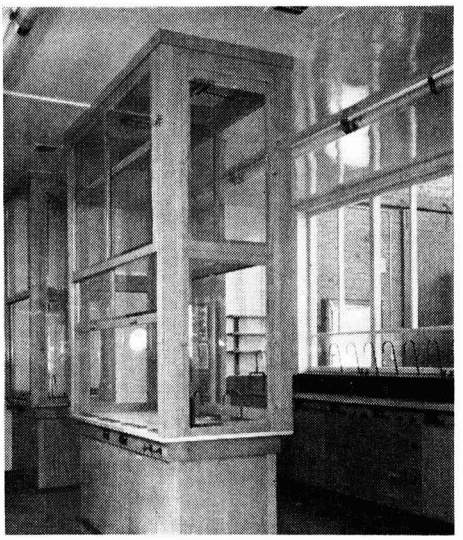
Third, a geological province hospitable to mineralisation might be delimited in some cases by a spectrographic study of trace elements in silicate and sulphide minerals, in others by mass-spectrographic studies of absolute age. He then reviewed some recent successes in mineral exploration arrived at in those different ways.

Professor Davidson pointed out that in prospecting for mineral deposits, the likelihood of making useful discoveries by the recognition of outcropping mineralisation became increasingly remote as more of the earth's surface was explored. Consequently, the economic geologist was now directing much of his attention towards sub-surface ore bodies, hidden beneath deep tropical soils, peat bogs and other covering. In this work he was becoming more dependent on geochemical aids.

LABORATORY PLANNING

Standard Units Cut Costs, are More Flexible

By
E. W. Dobson
Baird and Tatlock
(London) Ltd.



B R P R A radio - chemical laboratory at Welwyn Garden City, Herts

THE LABORATORY furniture manufacturing industry of today has grown from two main roots; the apparatus maker, whose wide contacts with the scientific world early showed him that there would be a growing market for laboratory furniture, and secondly the domestic or office furniture maker, entering the industry rather later as a result of seeing an opening for the fuller utilisation of existing plant and machinery. Through the years the two groups have come closer together and each has learned something from the other; the apparatus maker has been influenced by the production techniques of the furniture maker, who in his turn has gained knowledge of specialised design and functional requirements from the other man.

There is a market for a wide variety of price ranges, from the simple but strong furniture of the junior school laboratory to the complicated, almost apparatus-like, furniture needed for some specialised research laboratories, and the manufacturer must find from experience which type of market he can best satisfy. At one end of the scale price considerations are all-important, at the other end, advanced design and sometimes special quality take precedence.

Better Service

Having found his market, the manufacturer must hold and if possible increase it, by giving better quality or service than do his rivals in the same price range. He may do this in a number of ways; improved techniques may enable him to manufacturer more economically, or new designs enable him to meet newly emerging requirements.

Before dealing with some of the joint laboratory planning problems of both manufacturer and user, some of the dangers may be noted of requests for 'spot' competitive quotations based on inadequate information. Each manufacturer will inevitably interpret such details as are available in a slightly different way. This will affect his quotation, and the purchaser will have no way of determining whether a low price is due to efficiency of production, an inadequate quality, or a misinterpretation of requirements.

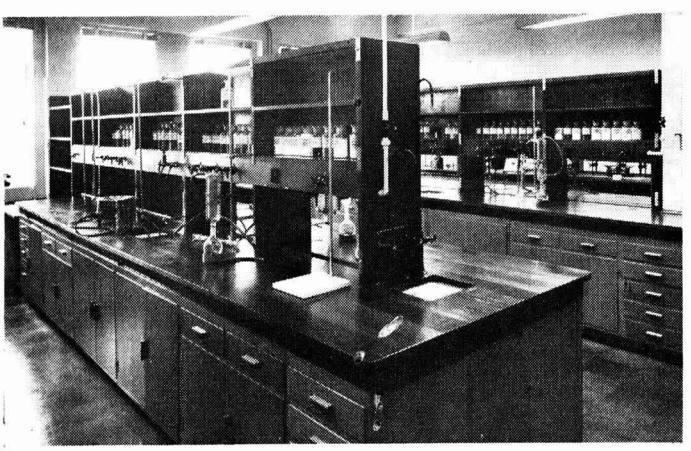
This can cause endless friction, and if a 'spot' quotation has to be obtained it should be confirmed, before contracts are fixed, by a detailed specification and drawings. A rapid spot quotation for inclusion in a bill of quantities as a provisional sum, or to determine likely capital allocations, is not subject to the same danger, since the figures are intended only to provide a reasonable guide and do not form the basis of a contract.

With rare exceptions all laboratory furniture falls into one of three design groups.

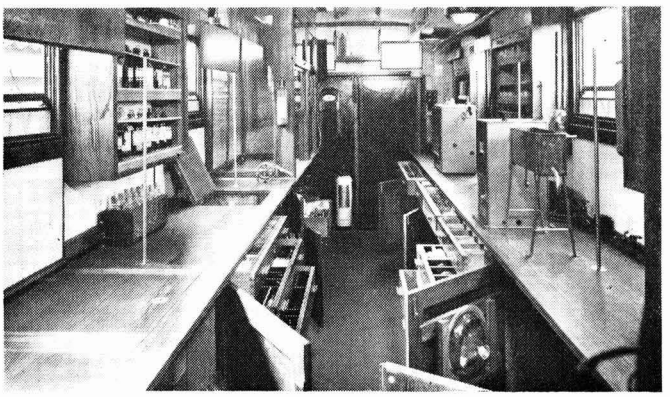
(a) Made to individual design—in trans-Atlantic terms 'custom-built.'
(b) Unit construction.
(c) Standardised component construction.

Made-to-order equipment formed the bulk of production up to some 20 years ago, and the type still has some legitimate application, either for the laboratory where the work processes are such that specially designed equipment is essential, or for the laboratory which, for reasons of prestige or advertisement, must be 'different,' but with increases in the range and adaptability of various unit or standardised systems the field of 'made-to-order' business is narrowing.

Fittings of this type, although often of high efficiency for their intended purpose, are usually inflexible and incapable of adaptation to meet changing circumstances, so that an alteration in laboratory techniques may involve the scrapping of much expensive furniture. Being made to order these fittings are classed as a 'one-off' job, generally involving much estimating, drawing office and other preliminary time, an unduly high proportion of expensive handiwork, and some times the buying of small quantities of special materials at disproportionately high rates. All of these make for longer delivery times and higher costs, so that in many cases where at first a 'made-to-order' scheme appears to be essential it may well repay the intending purchaser to consider whether one of the standardised or unit systems may not be adapted to meet his requirements.



Section of one of the main organic chemistry laboratories of Parke Davies and Co.



BTL mobile oil testing laboratory for the Ministry of Supply, showing cupboards for glassware and breakable apparatus. (Photographs by Baird and Tatlock)

'Made-to-order' unit schemes are sometimes met, but as will be discussed later the flexibility of unit schemes by itself results in some increase in cost, which has to be encountered by the large-scale production of the units themselves, so that unless the 'made-to-order' scheme is of appreciable size such bulk manufacturing savings are not possible, and it is more than ever desirable to ascertain whether an already existing unit system is not suitable.

Inevitably the architect-designed scheme is nearly always of the 'made-to-order' type. In some cases this may be due to the previously mentioned cause of real necessity. In other cases it may arise from lack of awareness on the part of the architect as to the standard equipment available—an information gap which requires consideration. For the remainder, the 'made-to-order' feature is the natural result of the architect's efforts to materialise his own ideas of appearance and construction. Being individual ideas, however good, these are liable to enhance the 'one-off' production aspect, and consequently, they may prove somewhat more expensive than anticipated. The extra cost may be well justified in the case of a 'prestige' laboratory, but this is a matter which can be determined only by the purchaser.

Architect Designed

In a somewhat different category is the architect-designed scheme for a number of similar laboratories, e.g. a range of standardised furniture for all of the schools of a large education authority. This is essentially a form of unit system, and if bulk orders are placed with a large manufacturer the advantages of large scale production are obtained.

Movable unit construction has certain advantages over the 'made-to-order' method. It is always more flexible in use, although the degree of flexibility varies widely with different systems, probably being highest in the 'convertible' laboratory equipment now being marketed. As the units are normally produced in appreciable quantities a form of mass production technique can be used, with consequent savings in time, and larger quantities of raw materials can be partially purchased at bulk rates. However, this potential saving is offset by some other features.

Any unit system represents an attempt to produce a multi-purpose range of equipment, in which as many units or components as possible may be used for more than one purpose—a reduction in type quantity means that more units of each type can be made at lower bulk rates for the same capital expenditure. The units have therefore often to embody features which may be unnecessary for some prospective uses, but essential for others, e.g. fully finished ends to maintain the free position feature. Again, since nearly all unit systems incorporate the idea of the freely movable unit, both for flexibility and for improved access to services, some supporting device has to be introduced for the bench top, and whatever form this takes it is an additional cost that has to be met. Thus bulk production is essential to provide flexibility at a reasonable cost.

Standardised component construction is a logical development of the unit system, although it may be applied to static or movable units. It is essentially the rationalisation of components so that as wide a range of articles as possible may be built up from the fewest practicable number of component types. Owing to the interchangeability of many of the components, these can be held in common stock in their pre-assembly form, thus saving much factory storage space, and final assembly costs do not have to be met until sales are assured.

Three Materials

Except for a small quantity of fittings made from concrete and ceramics all laboratory furniture is built of either timber, steel or various plastics. Timber was the original structural material, and it is still widely used. It is easily worked, and the manufacturing techniques are usually such that there is not quite the same wide difference in cost between large and small batches as for some other materials. Consequently, for 'made-to-order' schemes, timber is almost universal.

Steel is of more recent introduction, and for certain types of laboratory where cleanliness, low surface adsorption, and resistance to a wide range of temperature and humidity are required it is a much more suitable material than is timber. It is not an economic proposition to use steel for 'one-off' projects, so that in general the use of this material must be confined to standard unit systems. In larger quantities however there is little difference in cost between steel and timber laboratory furniture of the same design types and standards of quality.

Plastics, more particularly plastics-faced timbers, usually melamine-surfaced, have aroused interest in the last few years, and a number of laboratories have been equipped with furniture constructed of such materials. Except for certain bench top usages however plastics for laboratory construction may still be regarded as being in the experimental stage. In general this variety of equipment is at present rather more costly than is either steel or timber of the same design type, although the disparity in costs will be reduced if the material gains sufficient popularity for it to be used in any standard unit systems.

With the extension of the scientific approach to formerly under-developed areas there has grown up an export trade in laboratory furniture, this trade being almost solely in unit systems owing to the ease with which the units can be packed, shipped and handled and the small amount of skilled labour required for site erection.

For climatic reasons a high proportion of this export trade is in furniture of steel construction, but in certain areas, e.g. India, local resources are sufficient for the fabrication of much of the simpler furniture in timber at a lower cost than for imported steel furniture.

Strong US Influence

In other areas, particularly in North and South America, US design influence is strong, and of recent years this influence has been in favour of steel rather than of timber furniture. Consequently although countries such as Canada are quite capable of producing timber laboratory furniture as good as any which they can import their home market is of insufficient size to support a steel laboratory furniture industry, and as a result there is an export trade in such steel equipment to otherwise highly developed countries.

Figures for the trade as a whole are not available, but as an example of the volume of exports, and in spite of the growth of laboratory facilities in this country, nearly 25 per cent of the laboratory furniture production of one of our leading manufacturers is exported, and about 90 per cent of this export is in steel.

If this country is to improve or even to maintain its position in a world where scientific methods are playing an ever-increasing part it is clear that training facilities for scientists must be expanded, and that the trained scientists must be provided with suitable work places. To meet this programme of expansion, with attendant replacement and development, the laboratory furniture industry has a prospect of steady growth for some years ahead, limited only by the economic conditions of the country as a whole.

LABORATORY EQUIPMENT REVIEW

Apparatus and Instruments for Research and Industry

New Bunsen Burner

A new three-jet maximum laboratory bunsen burner for propane, butane or their mixtures, methane (natural) and sludge gas, has been introduced by Amal Ltd., Holford Road, Witton, Birmingham 6, an ICI subsidiary. This three-jet burner is not suitable for use with town gas. The air proportioning of this model is automatic.

Height is 7¼ in. and effective flame surface diameter is 2.4 in. It can be supplied with or without volume control on the burner itself. Flame characteristic is a surface of short blue cones like a carpet of flame. Turn-down is said to be very stable and a wide range of pressures retain the characteristics. Proposed list price with volume control is £5 2s 6d; without volume control and controlled from bench tap, price is £4 15s.

CO and CO_2 Measurement

Type SC/L CO analyser produced by the Infra Red Development Co. Ltd., 40 Tewin Road, Welwyn Garden City, has been designed at the lowest possible price by standardising the ranges and restricting the equipment to essentials. This model is available for £268, complete with cylinder of standard CO/N_2 mixture for accuracy checks. CO ranges are: 0-0.05 per cent and 0.03 to 0.25 per cent. The type SC instruments are suitable for CO_2, N_2O, NO, SO_2 and the hydrocarbons, particularly for laboratory work.

The company also provides a standard service for the supply and recharging of small cylinders. This is available to analytical chemists, whether or not they are concerned with infra red gas analysis. Considerable 'libraries' of mixtures are available.

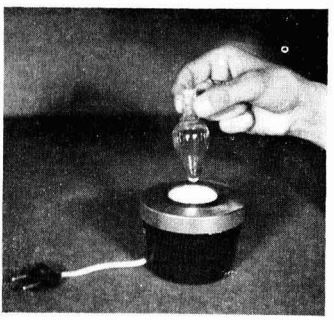
Developments in Plastics Valves

A range of plastics valves is being developed by the Saunders Valve Co. Ltd., Cwmbran, Monmouth. For use in acid laden atmospheres are h.s.b. (high styrene butadiene base) valves with ebonite bonnet. Also available are ebonite valves which have either block ebonite or hexagon end ebonite bodies to which standard cast iron, silicon aluminium, h.s.b. or other bonnets can be fitted. The third type in this series has a body of Vulcathene (grade II polythene) and again can be fitted with cast iron, h.s.b., acid resisting bronze or other bonnets.

These valves are made with screwed and flanged fittings and in their standard form are fitted with supporting stirrups.

Micro Isomantles

A new range of micro Isomantles is available from Isopad Ltd., Barnet By-Pass, Boreham Wood, Herts. Type MIC is available for round bottom and pear-shaped flasks from 5 to 50 c.c. Type PMM is a high power Isomantle, with approximately 50 per cent higher loading than type IMM. Heating elements of both types operate at black heat, but in type PMM a higher rate of heat transfer is achieved. Type IMS glass cloth covered Isomantles are of squat form and are fitted with a round metal base plate with three rubber feet. They are provided with



Isomantle by Isopad for pear shaped 25 ml bulb

a rod to hold the mantle in any required position by retort stands. This type is available up to and including one litre size.

Laboratory Stirrer

The new RZR laboratory stirrer, produced by Jones and Stevens Ltd., Long Lane, Littlemore, Oxford, was designed to meet the call for a miniature laboratory stirrer that would give full motor performance at any speed. Powered by an enclosed f.h.p. a.c. motor, this stirrer is fitted with two hollow shafts (one for high speed, the other for low) and each is provided with a key type chuck, enabling the blades to be set at any height. Switch-over is effected with a quick release handle. A graduated visible scale enables the speed of the shafts to be regulated with torque increasing as speed decreases. Speed range is: high speed shaft, 2,000 to 100 r.p.m. (infinitely variable); low speed shaft, 300 to 15 r.p.m., 240 to 12, 180 to 9 and 120 to 6. This stirrer is priced at £21 3s.

This company also supplies a range of valves for research work, including stop valve for both high pressures up to 500 atmospheres and for vacuum applications; 1 mm needle control valve for use with pressures up to 350 atmospheres as well as for high vacuum; and a diaphragm valve for pressure and vacuum applications. An infinitely variable transmission, type RZG, is supplied for laboratory use, price £17 10s 8d.

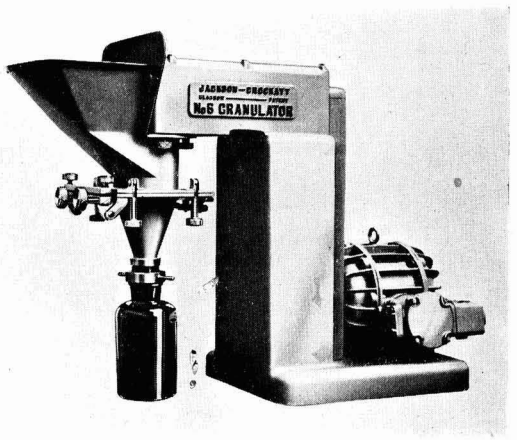
Integrated Gas Flow Volumes

Primarily intended for oil refineries, the E40 gas flow meter, made by Parkinson and Cowan Industrial Products, Cottage Lane, City Road, London EC1, is also of use in the chemical industry. Capacity is 2½ litres per revolution, 1,000 litres per hour and normal accuracy is ±0.5 per cent over the whole range. This can be improved to ±0.25 per cent by using the Hyde method.

Type A and B laboratory test meters are also produced by Parkinson and Cowan, together with types CD1, CD4, D and C D1, for medical use.

Bench Granulator

The No. 6 bench type granulator manufactured by J. G. Jackson and Crockatt Ltd., Nitshill Road, Thornliebank, Glasgow, has been designed for work in sterile conditions necessary for the manufacture of penicillin and other fine chemical products. All parts working on the material being granulated are of stainless steel and can easily be dismantled for thorough washing without the use of spanners. The machine is powered by a self-contained electric motor drive. All gearing is enclosed in an oil bath and



This granulator made by Jackson and Crockatt is used for making small batches of special drugs and in the manufacture of penicillin

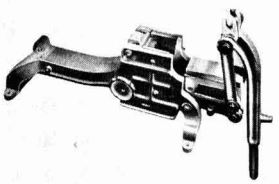
LABORATORY EQUIPMENT

grease nipples or other external lubrication are not required.

Quiet in operation, this model is said to granulate efficiently damp materials. An interchangeable stainless steel beater of a different 'face angle' is available for use in the same machine when granulating dry materials.

Hand Operated Jaw Crusher

A hand-operated jaw crusher, designed to deal with small, occasional samples where the installation of a power unit is not warranted or where sampling may be



Hand operated jaw crusher made by Knapp and Bates

carried out far from suitable sources of power, has recently been introduced by Knapp and Bates Ltd., Africa House, Kingsway, London WC2. Constructed of aluminium alloy wherever possible, it has been produced as a lightweight crusher, capable of being carried by one man and of reducing material from 1½ in. cube down to ⅛ in. at the rate of 40-45 lb/hr.

The unit consists of two manganese steel jaws, one of which is fixed, the other being hinged at its base and coupled at the top to a handle or lever of malleable iron. For cleaning, this lever is arranged to fold back over the moveable jaw, thus giving clear access. Jaw setting is controlled by a cast iron hand wheel and spacer bolts and locking cam are of mild steel. Risk of loss by flying particles is said to be eliminated, labour requirements considerably reduced and a greater production per man possible without supervision.

Emulsification and Dispersion

Ultrasonics Ltd., Westgate, Otley, Yorks, have developed the Minisonic laboratory and small batch homogeniser. This is a small version of the Rapisonic production homogeniser which has been in use for the last five years. The Minisonic utilises fluid-dynamic forces in the liquid to be processed in order to release extremely high local pressures. The working part is basically a liquid whistle of simple construction.

Instruments for Science and Industry

The Kawerau circular chromatography apparatus made by Shandon Scientific Co. Ltd., 6 Cromwell Place, London SW7, was first shown at the Cambridge meeting of the Biochemical Society in 1956. It has been found suitable for the analysis of sugar in urine and the screening of large numbers of samples in surveys dealing for example with the distribution of amino acids. It can also be used for rapid semi-quantitative analysis to check manufacturing processes.

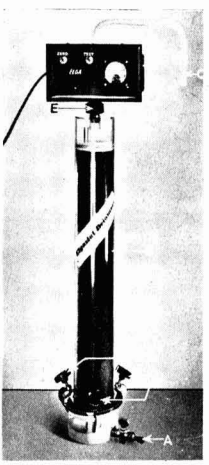
Automatic pipette control, designed to overcome the disadvantages and dangers of mouth suction, is marketed by Shandon. Known as the Pumpett, this apparatus obviates any oral contact with the pipette. It is claimed that this apparatus will enable the accuracy of discharge to be controlled to a high degree. The user will be able to do away with expensive burettes.

The Circofreeze, a refrigerator with a built in coolant reservoir, is designed to produce low temperatures which can be made available in any part of the laboratory or workshop.

Elgastat Major Deioniser

The Elgastat major, newly introduced by Elga Products Ltd., Railway Place, London SW19, provides purified water at tap speed far exceeding pharmacopœia requirements. Conductivity water provided is said to equal three distillations in quartz. Cost is claimed to be lower than that of distilled water; no supervision or maintenance, such as defurring are required and a cartridge exchange service avoids regeneration in situ.

Model B104 (without conductivity meter) has two applications. First it provides washing water for slides and for any work where single distilled water is normally



Elgastat Deioniser

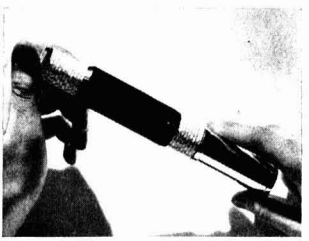
used in the laboratory. It can also be used to provide distilled water for batteries of fork lift trucks etc.

Model B.104/CON, with conductivity meter, is designed for the research laboratory. Facilities include the monotoring of effluent purity which is claimed to be well above 4,000,000 ohms/cm (conductivity water). The effluent may be piped to any number of benches.

The Elgastat method of deionisation involves the simple passage of the crude water through an intimate mixture of strongly acidic cation and strongly basic anion exchange resins (termed Elgalites). Hydrogen ions produced during the cation exchange process are almost immediately removed from the scene of reaction by adsorption or neutralisation on the anion exchange resins. Since any hydroxyl ions produced on the anion resin immediately react with hydrogen ions from the cation resin, even very unfavourable exchange equilibria may be driven to completion.

Otis King Calculator

The Otis King calculator, made by Carbic Ltd., 54 Dundonald Road, London SW19, has been improved by providing the scales with a plastics coating, making them more durable than the varnished



Carbic's Otis King calculator

paper scales previously used. Other modifications have been incorporated.

Of non-warping metal construction, the Otis King is in effect a slide rule with 66 in. scales. Model K solves multiplication, division, percentages, calculations etc.; model 1 gives logarithms in addition. Both models are priced at 57s 6d.

Fire Fighting Appliances

Most generally recommended reagent for extinguishing laboratory fires is carbon dioxide, according to The Pyrene Co. Ltd., 9 Grosvenor Gardens, London SW1. Pyrene manufacture a range of carbon dioxide extinguishers from four hand extinguishers up to larger models built in the form of portable trolleys which can be wheeled quickly to the outbreak.

For protection against larger outbreaks fixed installations are possible employing one or more carbon dioxide cylinders. Operation can be either manual or automatic—the latter employing the simple fusible link, electrical heat detectors or more sensitive devices such as the Pyrene rate of rise fire detecting system. These automatic systems can also be arranged to switch off fans, close doors and let down asbestos curtains in the area of the fire.

Serum Dispenser

Nash and Thompson Ltd., Oakcroft Road, Chessington Road, Surrey, are producing an automatic serum dispenser for multiple titrations. The apparatus is designed to accelerate and facilitate the normal serological and other testing methods that involve repetitive titrations. It eliminates the use of serological pipettes, standard droppers and other

volumetric delivery glassware. Twelve tests can be done, it is claimed, simultaneously in no more than the time required for a single test by normal methods.

Special racks which carry a row of ungraduated pipettes are set on the lifting platform by means of which the 12 pipettes can be inserted simultaneously into position in the head of the apparatus. They are secured by movement of a lever that compresses rubber collars around the neck of each pipette. In this position the pipettes are individually connected with 12 pumping units.

The test tube racks containing 12 test tubes or a common trough can be brought to the open tips of the pipettes by the lifting platform and measured volumes of fluid are aspirated into each pipette. The maximum volume aspirated is 1.0 ml and the graduations are such as to allow 0.01 ml volumes to be measured.

The instrument is being made under licence from the National Research Development Corporation.

Processing Equipment

Wet or dry grinding and mixing, shaking or polishing can be carried out in the multi-duty mill made by Podmores (Engineers) Ltd., Hanley, Stoke on Trent. For dry mixing the double cone mixer is claimed to give a gentle yet rapid and efficient mix without altering the size or shape of the particle. Cleaning is easy due to the good shape and absence of complicated mechanism.

The laboratory test sieve vibrator is for performing rapid sieve analyses. It is operated electromagnetically, eliminating all wearing parts and ensuring quieter working. Vertical motion of the sieves is provided and is claimed to give thorough stratification and prevent blinding, and rotational movement presents the particles at all angles to obtain maximum screening efficiency.

Manesty Water Stills

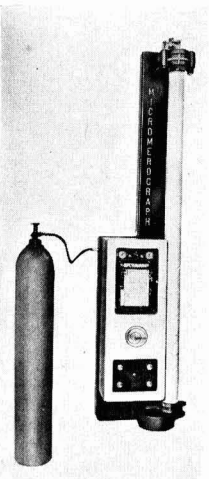
Manesty Machines Ltd., Evans Road, Speke, Liverpool 19, are now offering the Manesty OB water stills in vitreous enamel and chrome finish, as is the case with their OOB models. These stills are fitted with stainless steel condensing tubes; and the nozzle and condensing tube is supplied in one piece. Improvements to both models include new weir pipe and overflow tube, new weir chamber with removable plug; new type wall bracket, improved elements and connectors. They can supply distilled water above the British Pharmacopoeia requirements. Output of model OB is three pints an hour, while model OOB has an output rating of six to eight pints an hour.

Micromerograph Now Available in UK

The Micromerograph, made by Sharples Centrifuges Ltd., Tower House, Woodchester, Stroud, Gloucestershire, is an apparatus for particle size distribution analysis. Manufactured in Philadelphia, US, it has previously only been available in the US.

The powder under test is deagglomerated by projecting through an orifice with a jet of nitrogen into the top of the sedimentation column. The particles fall at their terminal velocities until stopped by the pan of a servo-electronic balance at the bottom of the column. Time for the fall varies from a few seconds to three hours depending on the powder.

The current required to keep the beam balanced is a measure of the accumulated weight of powder on the pan. This current operates a moving chart recorder, giving a record of accumulated weight against time. By applying Stokes' law it is possible to determine the percentage weight of particles smaller than any given micron size. Density can be determined with a pyknometer.



Sharples Micromerograph

The makers claim that this instrument can be used for both production control, where it can be used by non-technical operators, and in research.

Laboratory pH Meters

The range of laboratory pH meters produced by the Electrofact instrumentation division of Hartley Electromotives Ltd., 37 Thurloe Street, London SW7, includes a general purpose model, type 6C2, supplied with a comprehensive selection of electrodes to suit a variety of applications. With a pair of standard electrodes, clamp and stand, it is priced at £90. A miniature pH meter, type 40A, is also available and measures 9 in. by 4½ in. by 2½ in., with a weight of 4 lb. Complete with a pair of electrodes mounted in a special cylindrical sleeve, this model is priced at £50.

The pH test unit, type 140B, is battery operated and incorporates a standard cell. After simple standardisation with the aid of an indicating milliamp meter, it can be used as a source of pH signal at any value from 0-14 at 20°C. It is particularly useful for calibration of pH equipment and for test purposes. Price is £40.

Resin Bonded Glass Fibre Ducting

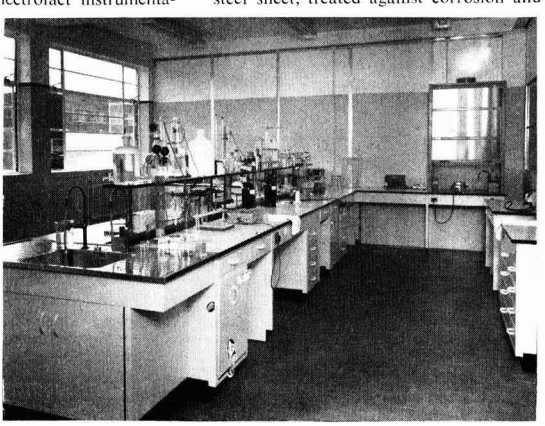
Fume extraction and ventilation ducting piping is made from resin bonded glass fibre by Thermo-Plastics Ltd., Luton Road Works, Dunstable, Beds. Bonding resins used fall into four main categories: polyester for general purpose and acid resistant applications; epoxies higher quality reinforcements; silicones for high temperature resistance; and furanes for alkali resistance.

Thermo-Plastics also make ducting, tanks, storage vessels, cowls and similar components from rigid p.v.c., Perspex and other materials.

Unit Metal Laboratory Furniture

Griffin and George Ltd., Alperton, Middlesex, manufacture a range of wood and metal laboratory furniture suitable for university and industrial research organisations. To ensure flexibility of arrangement, unit construction is used. This provides for rapid installation and elimination of builders work, together with low maintenance costs.

Unit metal laboratory furniture is supplied in association with Grundy Equipment Ltd. It is fabricated from light steel welded sections and heavy gauge steel sheet, treated against corrosion and



Metal laboratory furniture installed in the research laboratories of the National Cash Register Co. by Griffin and George Ltd.

LABORATORY EQUIPMENT

covered with two coats of melamine based stoving enamel. Prefabricated service racks are also available. Made from angle iron they are provided in standard lengths of 3 ft. 4 in. and 5 ft.

Apparatus for gas-liquid chromatography is made by Griffin and George. This is suitable for the analysis of mixtures of liquids vaporising between 20 and 200°C at atmospheric pressure.

Laboratory Filter Press

The plate and frame laboratory filter press, available from Manlove Alliott and Co. Ltd., Bloomsgrove Works, Nottingham, is fitted with a hand operated feed pump. It is designed for carrying out filtration tests to determine the filtration capacity required for full scale plants and small scale batch production of fine chemicals.

Plate and frames are 10 in. sq. and the press can be fitted with frames varying in thickness between ½ in. and 2 in. The numbers of frames can be varied to give different capacities. These presses are available in a variety of materials, such as cast iron, stainless steel, aluminium and certain protective coatings. They are usually bench mounted.

The firm's twin roll film drier is suitable for a steam pressure of up to 100 p.s.i. Roller speeds can be varied between 4 and 12 r.p.m. and the doctor knives are spring loaded and fully adjustable. Free standing, the machine is suitable for pilot plant operation and for laboratory drying problem investigations.

PTFE Sleeves

A new range of p.t.f.e. sleeves introduced by the Loughborough Glass Co. Ltd., Loughborough, is designed for fitting to ground glass joints to prevent them sticking as an alternative to greasing. The sleeves are truncated cones of p.t.f.e. film (about 0.003 in. thick). The waxy surface of p.t.f.e. acts as a lubricant, preventing adhesion. Advantages claimed are a reduction in breakage; no contamination of product as the sleeves are attacked only by molten alkali metals and fluorine (in addition there are no known solvents); no leakage; vacuum tightness; temperature resistance in the range −75°C to 250°C; and economy in use.

Also available is a glass still which produces distilled water to BP 1953 requirements, pyrogen-free and suitable for injection. Output is 4 litres per hour. Element rating is 3 kW 250 volts and water consumption is about 80 litres an hour. New features of this model are a combined condenser and steam trap, reduced overall height, simplified assembly, neater appearance and a robust chrome plated immersion heater.

Other new products include a plastics laboratory column for chromatography, ion exchange or filtration; polythene syphons for the handling of corrosive and other dangerous chemicals; and the Loughborough vacuum gauge.

Determination of Sulphur Content

W. G. Pye and Co. Ltd., Granta Works, Cambridge, are marketing equipment developed in association with one of the major oil companies for the determination of sulphur content. Based on the American Society for Testing Materials' 'Proposed method of test for sulphur in petroleum products by the rapid high temperature combustion method', a quartz boat is pushed into a special combustion tube mounted in a furnace which produces a temperature gradient along the tube.

Master pH meter made by W. G. Pye and Co. Designed as a direct reading instrument it works in the two ranges 0-10 *and* 4-14 *p*H

Sulphur dioxide is given off and is carried along by a stream of nitrogen to an absorber. As the sulphur dioxide passes through the absorber a metal indicator electrode signals to a pH meter/millivoltmeter. This is connected to Pye automatic titration equipment which starts a flow of reagent from a burette which is continued until the sulphur dioxide is neutralised.

P.t.f.e. sleeves made by Loughborough Glass Co. These are fitted to ground glass joints to prevent sticking and are claimed to replace greasing

Laboratory Furniture

Laboratory furniture and apparatus primarily intended for the textile trade is made by Reynolds and Branson Ltd., Leodis Works, North West Road, Leeds 6. Laboratory units are usually made from selected oak, stained if necessary, and coated with a modern catalyst lacquer to give a chemically resistant and durable surface. Cupboards are fitted with guarea (African mahogany-type hardwood) shelves and bottoms.

Among the R and B scientific instruments is a pH meter which is claimed to be completely portable. Total weight, including self-contained batteries, is 5¾ lb. Readings are said to be accurate to 0.05 pH over the range 2 to 12 pH.

Emulsifier-Mixer

The Lang laboratory motor emulsifier-mixer is now made by Lang-London-Ltd., 280 Euston Road, London NW1, with a flexible shaft unit, in addition to the normal range of three mixing attachments, one of which will enter an aperture ¾ in. in diameter. These attachments make possible the treatment of ½-gill to 1 gall of material in practically any type of container. A patent coupling device makes possible immediate exchange of mixing attachment.

Speed control provides a range of 700 to 6,000 r.p.m., without stopping the machine. The motor can be raised or lowered to any position on the tubular stand. Standard length of spindles is 12 in. from the bottom of the coupling, but other sizes of spindles and agitators can be supplied. Overall height of the mixer is 35 in.

Adjustable Speed Drive Equipment

The adjustable speed drive equipment, series FMC1, produced by the Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs, is arranged to supply a suitably rated d.c. motor and is housed in a bench mounting case which also carries the manual controls. The equipment is designed to provide a wide stepless adjustment of the speed of a fractional h.p. motor (1/20 h.p. or less) and incorporates compensating circuits to minimise the change in speed from zero to full load.

Basic equipment, type 254.86, is housed in a fabricated sheet steel case that is fitted with rubber feet for bench mounting; the unit can also be wall mounted.

Laboratory Glassware

The range of laboratory glassware available from E. Brinkman Ltd., West Hill Glass Works, Epsom, covers ampoules, test tubes, tablet tubes and similar tubular glass containers that are suitable for production on fast automatic or semi-automatic machines.

Rotary Variable Transformers

A new range of Regavolt variable transformers from 250 VA to 2.5 KVA has been developed for laboratories, technical colleges and universities. One of the models is styled 'laboratory model'

and is equipped with a switch and fuse. It is said to be particularly suitable for all forms of test equipment as it gives an infinitely variable voltage from 0 to 10 per cent above the normal supply voltage. These units are available as open or protected models, ganged for three-phase work, or motorised and equipped as line voltage regulators. Manufacturers are British Electrical Resistance Co. Ltd., Queensway, Enfield.

Bench Type Mixer

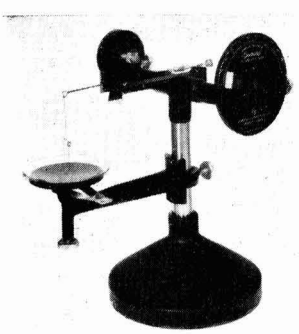
The latest Hobart mixer is a bench type model for laboratory use. Made by the Hobart Manufacturing Co. Ltd., New Southgate, London N11, it is available as a 20, 20-10 or a 12 quart model. Known as AE200, it has a $\frac{1}{3}$ h.p. ball-bearing motor with three speeds—104, 165 and 296 r.p.m. The 12 quart version, A120, has a $\frac{1}{4}$ h.p. ball-bearing motor with three speeds—126, 197 and 357 r.p.m. Both machines have the latest type of transmission, the gears being constantly in mesh, enabling speed change to be made without stopping.

Model CE100 is particularly suitable for laboratory use where small batches are being handled. Driven by a $\frac{1}{8}$ h.p. ball-bearing motor, the three speeds are 140, 250 and 446 r.p.m. In addition to a 10-quart bowl, three quart equipment is available, enabling the smallest mixes to be carried out.

Surface Tension Apparatus

The surface and interfacial tension apparatus made by the Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London SW1, has recently been redesigned. The apparatus is based on the instrument designed by Dr. P. L. de Nouy for the measurement of the surface tension or interfacial tensions of liquids by using the ring method, an accurate determination being possible in one or two minutes. The instrument is said to be particularly suitable for tests of the surface tension of liquids which are only available in small quantities.

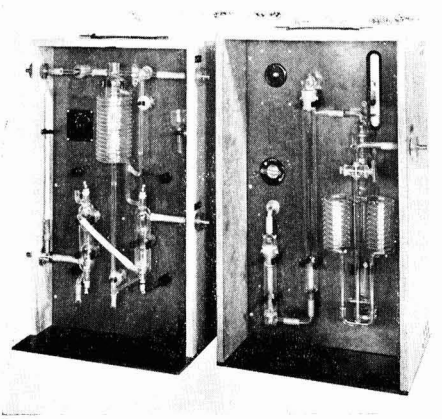
The apparatus consists of a platinum-



Surface tension apparatus

iridium ring 4 cms. in circumference, hung from the outer end of an arm. The other end of the arm is clamped to the middle of a torsion wire stretched between two clamps which can rotate in the frame of the instrument. A vessel containing the liquid under test is placed on the platform which can be raised or lowered. The two ends of the wire are rotated independently by means of knurled knobs. A vernier pointer, attached to the front clamp, moves over a scale graduated directly in dynes per centimetre.

Towers portable gas estimator



Interchangeable Stopcocks

The new Exelo interchangeable glass stopcocks, by W. G. Flaig and Sons Ltd., 39 Waterloo Road, London NW2, are claimed to be non-leaking and non-sticking. The base is a moulded body, the surface of which is an optical flat with two holes in it, connecting up to two tubes that are fused to opposite sides. The key is a similarly moulded part with one surface optically ground and having a curved channel that connects the flow through the tube when positioned correctly. The two parts are held together by means of a spindle through holes in the centre and a spring retaining clip. The hexagonal design of the key makes for easy operation and control. These stopcocks are available in either borosilicate or soda glass.

The new Exelo one-size stopper range of laboratory glassware now covers 50 items; polythene or hollow blown glass stoppers can be fitted to all sizes of all items.

Portable Gas Estimator

An estimator for the determination of CO, CO_2, NH_3, H_2S etc. in the range of 5 to 100 p.p.m. was developed by Imperial Chemical Industries, Billingham division, and is now being produced by J. W. Towers and Co. Ltd., Widnes, Lancs. The gas mixture is passed first through a gas meter to record volume and then through a cell containing a standard solution. Changes of conductivity due to the presence of the gas cause a bridge circuit to which the cell is connected to become unbalanced. A resistance box and galvanometer are used to compensate for this change and to restore the balance. By reference to tables it is possible to estimate the concentration of the gas.

The apparatus consists of five units: Conductivity unit; oxidation unit to convert CO to CO_2; resistance box; galvanometer; and gas meter.

The latest Towers countercurrent apparatus, which is fully automatic, is claimed to have more tubes than any standard instrument previously made in this country and to be more compact than any other type.

Humidity Test Chambers

The smaller popular test chambers supplied to the chemical and allied industries both for climatic (tropical) and other humidity tests by Barlow-Whitney Ltd., 2 Dorset Square, London NW1, have been redesigned in the light of experience. The units are of modern design with clean lines and are said to ensure reliable performance under the prolonged and arduous conditions associated with climatic testing.

The company has also supplied larger cabinets up to 9 ft. cube and the range has now been considerably extended to include a variety of intermediate sizes. Also made by Barlow-Whitney are industrial heating equipment, including ovens, furnaces, hotplates and heating units for most solids and liquids.

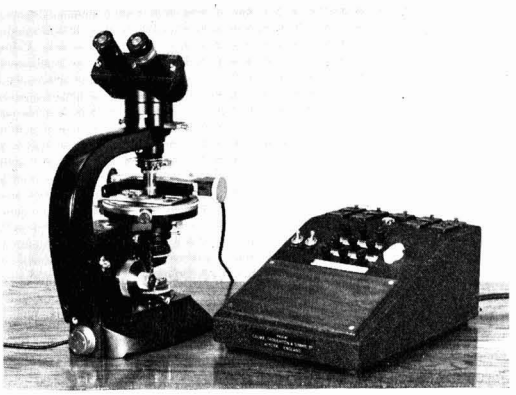
Scientific Plates

A wide range of scientific plates is available from Kodak Ltd., Victoria Road, Ruislip, Middx, and is fully described in a special booklet. Other Kodak products for research work are: 35 and 70 mm spiral film processing outfits, models 100 and 35/70 spiral film driers, a Velox sodium darkroom safelamp; and the colour densitometer, model 1.

Point Counter

The point counter manufactured by Cooke, Troughton and Simms Ltd., Haxby Road, Yorks, transmits electrical impulses by the operation of the mechanical stage to the counter unit. This continues to operate the selected counter until the impulses are switched to another counter by one of eight push buttons, each of which is mutually exclusive. This method of operation is said to increase the speed of analysis as the selector button need only be operated on passing the crystal

LABORATORY EQUIPMENT



Point counter by Cooke, Troughton and Simms Ltd. which can be used for particle counting or blood cell analysis

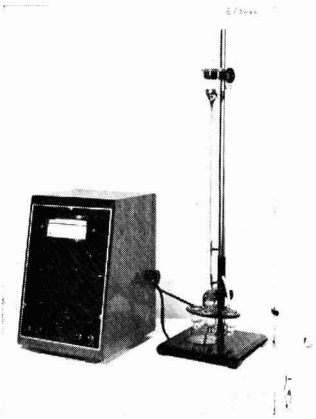
boundaries. The stage can be transversed to give about 12 counts per second.

The mechanical stage can be attached to any Cooke polarising microscope and transmits alternately from both directions at either 10 or 20 counts per mm and allows counting over the full area of a 3 in. by 1 in. slide. The counting unit has eight four-figure counters and a totaliser; a switch is provided to isolate stage transmissions, thus enabling the unit to be used for particle counting or blood cell analysis.

Tinsley Polarograph, Mk 16

Evershed and Vignoles Ltd., Acton Lane Works, Chiswick, London W4, have introduced the Tinsley polarograph mark 16 for rapid and accurate chemical analysis in laboratories where the volume and scope of the analytical work does not warrant the outlay for the larger type of recording polarograph. The mark 16 is therefore marketed to meet the need for a smaller and less costly instrument.

Although non-recording, this polarograph retains many features of the larger instrument, including the derivative circuit and it is claimed to be the only non-recording polarograph to do so. The sensitivity is such that changes in current of 100 micro-microamperes can be detected.



Mark 16 Tinsley polarograph

Small Chemical Centrifuge

The MSE chemical centrifuge with a cake capacity of 300 ml is designed by Measuring and Scientific Equipment Ltd., Spenser Street, London SW1 for the dehydration of solid or semi-solid matter, for clarifying liquids by the removal of solid suspensions and for the recovery of solids from suspensions. It can be used for continuous operation.

The centrifuge consists of the motor

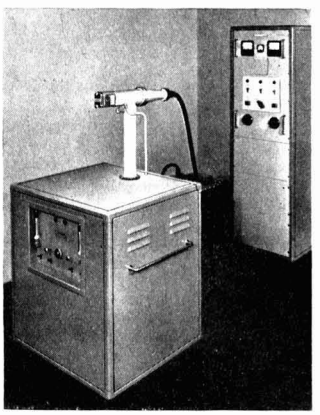
'Chemical' centrifuge made by Measuring and Scientific Equipment, claimed to provide means for dehydrating solid or semi-solid matter, clarifying liquids and recovering solids on the experimental or small production scale.

base, stainless steel draining chamber and a 5 in. diameter basket which can be detached from the tapered motor-shaft. Stepless speed control is an important feature and the maximum permissible speed of the basket is 4,000 r.p.m. The stainless steel baskets can be supplied either with 3/32 in. perforations or without them for working on the 'overflow' principle. When using an unperforated basket at 4,000 r.p.m. the flow rate of clean water is 45 gal. an hour.

A larger MSE chemical centrifuge will be available before the end of 1957. It has a cake capacity of 3,000 ml and the flow rate of water with an unperforated basket at 3,000 r.p.m. is 150 gal. an hour. Flow rate is slightly lower at the maximum speed of 4,000 r.p.m.

Diffraction Equipment

The range and output of the Newton Victor Raymax 60 diffraction equipment and diffractometer with electronic counting gear have been extended by the inclusion of a constant high voltage generator for operation at voltages up to 60kV and currents up to 25mA. Manufacturers are Metropolitan-Vickers Electrical Co Ltd., Trafford Park, Manchester 17. Rectifying valve and condenser are oil immersed in the same tank as the high voltage transformer, together with an independently adjustable negative voltage



Newton Victor Raymax 60 diffraction equipment and diffractometer with electric counting gear made by Metropolitan-Vickers Electrical

to focus the electron beam in the X-ray tube. Width of focus may be varied between 0.1 mm and 1 mm and the size of the focus is not altered by variation of the tube current.

The diffractometer has two separate worms and worm wheels for rotating the specimen and Geiger counter respectively. The angular position of either can be read with great accuracy. When required for normal focusing work, the two work shafts are connected through 2:1 gearing so that the specimen rotates at half the speed of the counter. The specimen and/or the counter can be driven via a 5-speed gear box by a motor. Radius of the circle traversed by the receiver slit is 6 in. Soller slits are fitted and a variety of inlet and detector slits are available. The counter rotates through 155 degrees. The h.t. supply for the Geiger counter, the scaling unit and rate-meter are mounted in a separate cabinet.

Glass-to-metal Seals

Two recent additions to the equipment made by Solus Electronic Tubes Ltd., 15-18 Clipstone Street, London W1, an associate of General Radiological Ltd., are glass-to-metal seals and a mobile vacuum storage unit, type M410. The new strain-free glass-to-metal seals are manufactured

from high quality metal alloy tubing joined by a four-stage graded seal to Phoenix borosilicate glass. These seals, supplied fully annealed and chemically cleaned, are particularly suitable for high vacuum work. Phoenix glass, which has an expansion coefficient of 32 by 10^{-7}, is said to seal readily to all common borosilicate laboratory glasses.

The mobile vacuum storage unit was designed to provide a means of storing outgassed vacuum tube electrodes so as to prevent any possibility of contamination. The unit can be used for vacuum impregnation of small transformers, etc., vacuum casting of polyester resins and many other operations. The equipment consists of eight aluminium containers mounted on a trolley and connected by a manifold to a rotary vacuum pump fitted beneath them.

New Design of Spray Drier

A small scale spray drier known as the 'Production Minor' has been developed by Niro Atomizer, 12 Aurehojvej, Copenhagen, Denmark. Evaporative capacity is 8kg. per hour at an inlet air temperature of 200°C and an outlet air temperature of 80°C. The plant has been so designed that it is possible to double the air flow giving a water evaporation of 35kg. per hour at inlet temperature of 350°C and outlet temperature of 100°C. Volume of the drying chamber is 1.3 cu. m.

The atomiser is electrically driven with an atomiser wheel running at 24,000

By means of the 'Production Minor' made by Niro Atomiser small scale spray drier shown here it is possible to evaporate water at rates up to 35 kg. per hour

r.p.m. A single cyclone is mounted which can be varied between full and half air quantity. Drying air is heated by a direct gas burner.

'Field' Microscope

The small 'field' microscope, made by Jencons (Scientific) Ltd., Mark Road,

A miniature field microscope for the laboratory, school, home and traveller, made by Jencons (Scientific) Ltd.

Hemel Hempstead, Herts, is now fitted with a carrying handle on the base. Height extended is 10¾ in. and closed 7½ in.; stage area is 2½ in. sq. and weight is 2 lb. With draw tube closed, magnification is 50 diameters, first extension 100-150 diameters and second extension 200 diameters. Price is £8 15s.

Also available is a redesigned model 11 micro-projector that is fitted with a heavy base to which an axis pillar is firmly fixed. Positioned to this pillar, the 'modern' microscope is complete with coarse and fine adjustments, double or triple nosepiece and a large square acid resisting stage. A 200-250 volt transformer is fixed to the base of the instrument. Two models are available, one with a No. 4 eyepiece, 1 in. and ⅔ in. OG double nosepiece, costing £52; and the other with a micro-projector stand with rack and pinion, coarse and fine adjustment, complete with mirror, dark filter projection head and screen, at £43.

New Rapid Measuring Benzole Meter

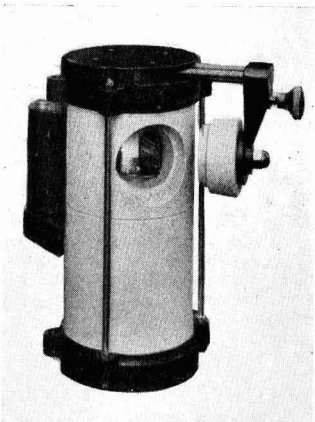
A benzole meter for rapid and accurate measurement of the amount of benzole present in rich coal gas, or left in the gas after extraction, has been developed by Hanovia lamps division of Engelhard Industries Ltd., Slough, Bucks, in conjunction with the research department of National Benzole Ltd.

It will measure 0.1 to 6.0 grams of benzole per 100 litres of coal gas. However, it can be adjusted when required to show a full scale reading for 4.0 gram/litres of gas. It will respond almost identically to benzene, toluene or xylene, and will also respond in varying degrees to other important vapours with high absorption in the UV region around 2.537 AU. The vapours of such compounds as trichloroethylene, methyl ethyl ketone, and styrene will show varying degrees of absorption to short UV., and the meter will also prove useful for estimating a number of other organic compounds in the vapour state.

The operation of the unit depends on the characteristic absorption values of certain organic and inorganic compounds in vapour form to selected ultra-violet wavelengths. It comprises a sensitive photoelectric photometer in which a fixed length gas cell is interposed between a low pressure mercury vapour tube—substantially monochromatic—and a photoelectric detector with a quartz envelope. The photo-electric cell is arranged to unbalance a dual pentode bridge circuit when the transmission path is influenced by the presence of benzole. The meter indicates the state of unbalance in the bridge circuit and thus the amount of benzole in the chamber.

Universal Scintillation Castle

New instruments introduced by Panax Equipment Ltd., 173 London Road, Mitcham, are the universal scintillation castle and automatic counting equipment,



Panax universal scintillation castle

type AC300/5. The castle provides at least 1½ in. of lead protection in all directions around the scintillation detector and photomultiplier tube. Samples, which may be in dishes or on planchettes, are introduced into the castle on a carrying slide that can be placed at different distances from the detector. With the door closed, it is light-tight. The castle can be inverted so that it becomes available for a number of applications, including gamma-ray emitters, liquid scintillators for soft beta ray emitters and moderate energy beta ray and soft gamma ray emitters.

The fully automatic counting equipment is designed for use with Geiger or scintillation counters that incorporate a pre-amplifier, a stabilised EHT supply variable over the range 0-2,000 volts at 200 microamps, and a discriminator, with the following ranges: negative 0.1-5 volts, positive 1.0-50 volts.

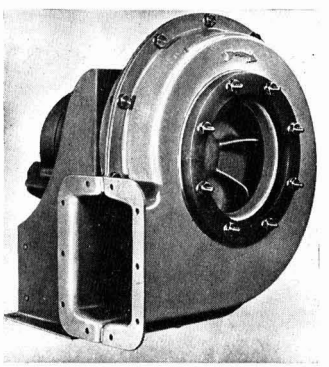
Pestle and Mortar Grinding

The pestle and mortar grinder made by Herbert Alexander and Co. Ltd., Charmouth Street, Leeds 11, for the fine grinding of samples, is driven by an enclosed

fractional h.p. motor and worm reduction unit. Pestle and mortar rotate in opposite directions, the pestle at 96 r.p.m. and the mortar at 31 r.p.m. The mortar is fitted into a hardwood holder that rests freely on the sponge rubber bed of the carrier, assuming an inclination to the horizontal plane under the pestle, giving even grinding pressure. The centre line of the pestle, being offset to that of the mortar, is instantly retractable for withdrawal of the ground sample. Pestle and mortar are of polished agate in the standard machine, but alternative materials can be supplied.

Handling Corrosive Fumes

Latest design fans developed for the handling of corrosive fumes by Keith Blackman Ltd., Mill Mead Road, London N17, are their series 1 and 2 p.v.c. centrifugal fans and p.v.c. bifurcated fans.



One of the range of p.v.c. centrifugal fans made by Keith Blackman Ltd.

Series 1, with direct motor drive, comes in three sizes with aerodynamically designed impellers of 6 in., 12 in. and 18 in. diameters. The range of capacities that can be handled is from 50 c.f.m. to 2,500 c.f.m. volumes and up to 4 in. w.g. pressures. Type A has a forward curved open paddle type blade impeller; type B is a backward curved, open paddle type blade impeller.

The series 2, with an indirect pulley drive, is available in a range of nine sizes with capacities from 2,000 c.f.m. to 40,000 c.f.m. volumes. This series is a multivane centrifugal type and it has 16 forward curved blades. It is fabricated in rigid p.v.c.

The Tornado p.v.c. bifurcated fan has greater anti-corrosive properties to combat fumes from a wider range of chemicals than the alternative specially coated steel-plate fans. They are suitable for handling fumes from a wide range of chemicals at temperatures up to 120°F.

Radioactive Chromatogram Scanner

The newly developed Labgear automatic radioactive chromatogram scanner, when used with the Labgear automatic printing counter, offers an automatic scheme for chemical assay. Manufacturers are Labgear (Cambridge) Ltd., Willow Place, Cambridge. The chromatograms for examination are cut into strips 25 mms. wide and attached, end to end, to a length of standard 35 mm. film stock which is used as a 'conveyor belt'. The film thus prepared is drawn step-by-step under a Geiger-Muller tube detector by means of a sprocket driven from an electro-magnetically operated clutch.

Motive power is supplied by a continuously running synchronous motor having an integral gear box with a final shaft speed of 1 r.p.m. This shaft carries the magnetic clutch which drives the film sprocket and two cams that operate micro-switches to provide count-programme timing pulses and 'end-of-task' signals. A further micro-switched-operated device automatically switches off the equipment when the full assay is ended.

The detector tube is heavily lead shielded both above and below the window to provide the lowest possible background count and is held in a detachable Perspex mounting that carries, in addition, an interchangeable beta screen with a 5 by 25 mm. scanning slot, located above the paper feed channel through which the film is drawn. Count capacity is 100,000 counts (1,000 secs); range of counting speed is 0-3,000 per second.

Temperature Control

The new temperature control unit, type N241, introduced by Airmec Ltd., High Wycombe, Bucks, operates over the temperature range −70°C to +600°C, control being effected by means of a heavy duty output relay. The sensitive element being a platinum resistance is of small dimensions, robust and stable.

The output relay operates and releases on a change in value of the temperature sensitive resistor of approximately 0.1 per cent. The equipment operates from 210-250 c/s mains supplies and overall dimensions are 4 in. by 5 in. by 6 in.

Chemical and Biological Analysis

The estimation of humidity with cobalt thiocyanate paper using the Lovibond comparator is described in a leaflet from The Tintometer Ltd., Waterloo Road, Salisbury, Wilts. The method is suitable for humidity measurements in small spaces or crevices and against surfaces which are not in moisture equilibrium with the atmosphere.

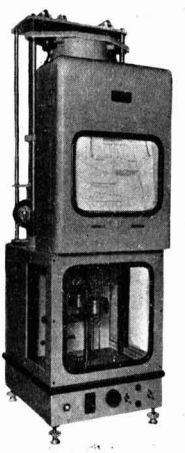
Dry Powder Extinguisher

The new dry powder fire extinguisher produced by Nu-Swift Ltd., Elland, Yorks, is said to be able to put a fire out in a few seconds. The striking of the knob forces a cloud of fine powder to shoot out under pressure, smothering the flames. The dry powder consists of a number of chemicals, the principal of which is sodium bicarbonate. All particles are regular in shape and size and ingredients liable to bacteriological spoilage are not used.

Approved by the Fire Offices Committee, it will operate at temperatures down to −40°C. The model is suitable for use on all accessible fires involving inflammable liquids, such as petrol, oils, paraffin, paints, varnishes, greases, fats and tar, alcohols and organic solvents.

Thermo Recording Balances

Recording of changes of weight of samples suspended in a furnace can be carried out by the thermo-recording balance made by Stanton Instruments



The Stanton thermo-recording balance shown here records the changes in weight of samples suspended in furnaces

Ltd., 119 Oxford Street, London W1. At the same time the temperature of the furnace is recorded. There is no mechanical contact between the balance and the recorder so that it is claimed that full advantage can be taken of the sensitivity of the balance up to 1 mg. per chart division.

Ancillary equipment is also available which provides various chart speeds, programme control of the furnace and special timing devices for the testing of samples subject to very slow changes in weight, as well as for carrying out tests under controlled atmospheres.

Three single pan Ultramatic balances are made by Stanton. It is claimed by the makers that these balances will meet every need for both accurate analytical instruments and for process control work.

Electronic Timers and Relays

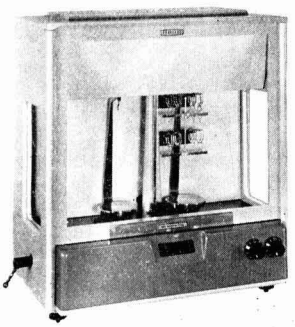
Evans Electronic Developments Ltd., Evonic Works, Shady Lane, Birmingham 22A, have recently placed on the market a new electronic relay and a new electronic timer. The timer, type ET/1 is designed for long service with minimum maintenance. Timing ranges available are between 0.1 second and 3 minutes. Models are available for all AC supply voltages.

The Evans electronic relay, type SC, has a small gas-filled tetrode thyratron of the

2D21 type with a.c. voltage. Anode feed is biased to a non-firing condition by means of a small selenium rectifier from the heater supplier. To ensure long operating life, the thyratron is run at about 25 per cent of its maximum rating.

New Range of Analytical Balances

Features of design which have been incorporated in the new balances produced by L. Oertling Ltd., Cray Valley Road, St. Mary Cray, Kent, include a delta-form beam to obtain maximum



A typical balance made by Oertling Ltd.

strength combined with minimum weight. Made from light alloy, all beams are radiographed and subjected to special heat treatment to ensure freedom from impurities and creep. The beam and other operating parts of the mechanism are totally enclosed within compartments separate from the weighing compartments. This ensures that the beam operates under even temperature conditions and also that its performance is not impaired by draughts, fumes or dirt in its mechanism.

Important changes have been made in the chassis design. For many years analytical balances were designed with various operating parts connected to the case of the instrument. In the new designs all parts of the instrument are mounted from one rigid light alloy chassis and the case of the instrument now serves merely as a dust cover.

Temperature Schedule Controller

The IP 6 pyrogram controller made by Industrial Pyrometer Co., 66-67 Gooch Street, Birmingham 5, is operated by a cam which is shaped in accordance with the required temperature schedule. This cam is rotated by a synchronous electric motor in 12, 24 or 48 hours. Rotation of the cam resets the temperature control setting of the control mechanism which may be either mechanical or electronic.

If necessary the programme can be terminated at a selected time or longer 'soaking' times can be allowed for heavy charges.

Plastics Coated Sieves

The new range of nylon and polythene coated sieves produced by Endecotts (Filters) Ltd., 251 Kingston Road, London SW19, can be fitted with nylon or silk weaving and are designed for resistance to abrasive and chemical actions. The sieve rims are constructed with fillets as part of the frame, which has no crevices or blind spots. The mesh can readily be replaced when worn or damaged. The sieves are made to nest and can be used for mechanical sieving when used with a lid and receiving pan.

Measurements are: inside diameter 8 in.; top to sieve surface, 2 in.; sieve surface to base, $\frac{5}{8}$ in.; overall depth $2\frac{5}{8}$ in.

High Efficiency Filter

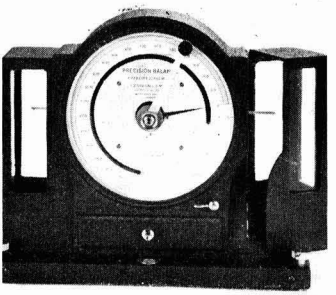
For situations where the normal high efficiency filter is not adequate, e.g. in photographic, pharmaceutical, biological or atomic energy work, Vokes Ltd., Henley Park, Guildford, Surrey, manufacture filters which are suitable for particles in the range 0.1 to 5 microns. An efficiency of 99.95 per cent is claimed for these filters which are in three basic forms: (a) Units employing a relatively thick lap of fibrous material, (b) Units whose retention efficiency is enhanced electro-statically by impregnation of the fibres with resinous materials and (c) Units containing specially developed media containing sub-micronic fibres.

Torsion Balances

Designed for the speedy and accurate determination of loss of moisture, oxidation etc., are a range of torsion balances made by White Electrical Instrument Co. Ltd., 10 Amwell Street, Rosebery Avenue, London EC1. These balances have been incorporated in electrically operated equipment for the weight control of liquid flow and delivery of powders in automatic processing plants.

Ventilators from Plastics Materials

Construction of ventilators from plastics materials is carried out by Rediweld Ltd., Crawley, Sussex. In the Rediweld design the stator is made from rigid p.v.c. sheet by moulding while the rotor is moulded in polythene. This procedure



Differential torsion balance by White Electrical

is said to reduce costs considerably, at the same time improving performance.

Also made by Rediweld is the Rediweld Vacumatic which is claimed to avoid costly breakage of vacuum filtration flasks. The Vacumatic consists of a rubber ring which is part of the vacuum line. The flask is placed on the ring and is held firmly in place. Another Rediweld product is a flexible manometer which can be folded into a small size.

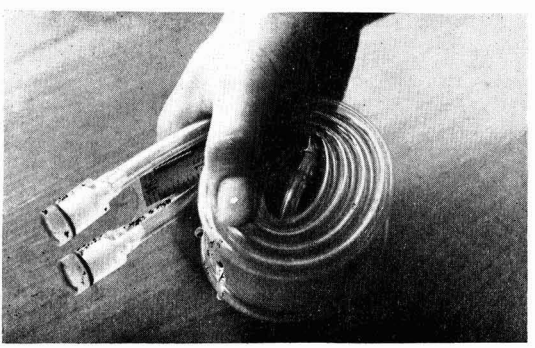
Equipment for Rubber and Plastics Industries

Laboratory equipment for the rubber and plastics industries is made by Francis Shaw and Co. Ltd., Corbett Street, Manchester 11. Included in the range is a plastics extruder fitted with a 1 in. diameter screw. A variable speed gear is fitted and the scroll speed is indicated by a atchometer. Heating is by electrical elements on the barrel die head.

A vulcanising pan suitable for open steam or hot air cures is also made by Shaw. The pan is of the double cased type with steam inlets into the pan body or into the case. It is fitted with a self sealing boltless door and has a safety device coupled to a warning whistle.

Hollow Shaft Stirrer

A stirrer motor with a hollow shaft is made by Gallenkamp and Co. Ltd., Sun Street, London EC2. The hollow shaft can be fitted rapidly with any one of a set of stirrers and the immersion depth can be adjusted quickly. By insert-



The Rediweld plastic tube manometer rolled up in the hand. When unrolled, this instrument can be used for the determination of velocity, static pressure, and leakage, for checking gas pressures and for the balancing of air-fuel ratios. It is also useful for tests on fans and blowers

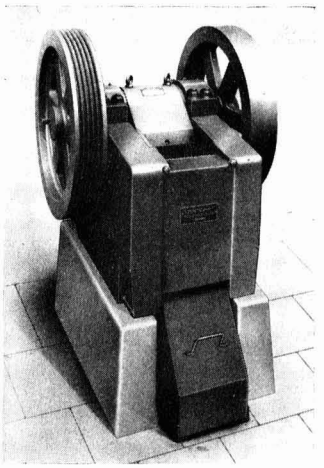
ing a push chuck it becomes a conventional laboratory stirrer for any 0.635 cm. diameter rod. By fitting a magnetic rotor it can be used as a magnetic stirrer. Speed (which can be reduced by rheostat) is 1,200 r.p.m. and the torque is 380 gm. cm.

Gallenkamp have an agency agreement with LKB-Produkter of Stockholm for the sale of conductivity bridges, cells and external resistors, polarographs, column electrophoresis apparatus, composite columns for chromatography, paper electrophoresis apparatus, chromatographic filter paper columns, and automatic fraction collectors.

Sample Crushing Machines

Among recent developments by Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London EC4, are three sample crushing machines. The first is the 6 in. high-speed laboratory hammer mill, which was developed primarily for coal grinding but is claimed to be equally efficient on most other materials. Sample recoveries of the order of 99.8 to 99.9 per cent are said to be obtained and a 2 lb. sample is reduced from ¼ in. to 99 per cent less than 72 mesh BSS.

Second is a jaw crusher which crushes such material as damp coke in the first stage of the preparation for sampling and testing. Third are the standard chrome steel crushing rolls, primarily designed for handling 2 lb. samples of coke or coal.



Designed as a rapid primary crusher, this jaw crusher by Sturtevant Engineering Co. is claimed to be suitable for materials where loss of moisture and contamination by abrasion are to be avoided

NEW GAS CHROMATOGRAPHY CHEMICALS SHOWN AT SAC

A RANGE of six new standard stationary phases of standard purity for gas chromatography were introduced by *May and Baker Ltd.*, Dagenham, at an exhibition held in conjunction with the congress. The forerunners of other chemicals for gas chromatography, they are: Dinonyl phthalate, Dimethylformamide, Diglycerol, Benzyldiphenyl, Squalane and Silicone oil.

They are available in packs of 25 and 100 gm. and it is stated that sufficient stocks are held to eliminate batch to batch variation over a long period. A suitable kieselguhr supporting medium will be available shortly.

H. Reeve Angel and Co. Ltd., 9 Bridewell Place, London EC4, showed examples of various shapes and forms in which filter paper is available.

Elesco Electronics Ltd., 2 Fitzroy Place, Glasgow C2, displayed electro-medical equipment and general radiological equipment such as gamma monitors, gamma counters, scintillation equipment etc.

The range of reagents shown by *General Chemical and Pharmaceutical Co. Ltd.*, Judex Works, Sudbury, Middlesex, included some modern introductions for specific analytical techniques.

Johnson Matthey and Co. Ltd, 73 Hatton Garden, London EC1, showed part of their current range of spectrographically standardised substances which represents 69 elements, including precious, base, rare and minor elements and the rare earths; graded series of alloy standards for quantitative spectrochemical analysis; and a new series of plastic formers which, designed for use with the standard ranges of JMC platinum electrodes, permit easy reshaping and safe handling and storage of the electrodes.

The new mark 3 Mervyn-Hanwell square wave polarograph, shown by *Mervyn Instruments Ltd.*, Woking, was said, at maximum sensitivity, to provide a chart record showing a deflection of 1 mm. for concentrations well below one-part per thousand-million and to detect and measure trace elements in the presence of major constituents even at ratios of 20,000 to 1.

The double monochrometer exhibited by *Sir Howard Grubb Parsons and Co. Ltd.*, Walkergate, Newcastle-upon-Tyne, was shown in ranges 5 to 15 or 5 to 25μ. Various accessories can be combined with the double monochrometer to produce a complete infra-red spectrometer.

W. G. Pye and Co. Ltd., Cambridge, showed a number of instruments including a mains operated direct reading universal *p*H meter and millivoltmeter (No. 11067) designed for use in research and plant control laboratories; automatic titrator (No. 11600), designed both as an accessory to the Pye *p*H meter and for automatic titrations and solution control; and conductivity meter 'W' (No. 11750), designed for direct reading of the conductivity of pure water produced by ion-exchange or distillation, for laboratory checks of water purity and for continuous monitoring of plant output.

(*Continued on page 1127*)

Polystyrene Used With Concrete

TWO APPLICATIONS for Lustrex polystyrene, made by Monsanto Chemicals Ltd., in conjunction with concrete have been developed. Lustrex T6, specially developed for extrusion as sheet, has been successfully used to form moulds for concrete shuttering. At the Bristol Corporation's Barton Hill flats site it was used to cast the concrete walls. The moulds measured approximately 4 ft. by 3 ft.

It is claimed that Lustrex shuttering eliminates the lines and irregularities in concrete surfaces which occur with wooden shuttering.

Lustrex pellets are used in a new technique for the construction of terrazzo floors. Many shades and colours are available and decorative effects, unobtainable by other methods, are easily produced.

Most suitable grades are Lustrex T11 and T3. The finish, a mixture of Lustrex pellets, white cement and silver sand, is laid on a base which is sufficiently stiff to work on but which has not set and hardened.

It is reported that trial areas of this flooring have been under traffic continuously for some months and show little or no signs of wear.

Americans Attend Harwell Conference on Controlled Thermonuclear Reactions

US research workers attended a private three-day conference on controlled thermonuclear reactions at the Atomic Energy Research Establishment, Harwell, from 20 to 22 June.

Delegates included research workers engaged in the UK and the US research programmes and about 100 representatives from British industrial firms, universities and interested government departments.

Purpose of the conference was to discuss the progress of both the British and American programmes and to examine some of the practical problems in which it is hoped that British industry might assist.

The conference was held on a classified basis and consequently the proceedings of the meeting will not be published.

TRADE NOTES

New Telephone Numbers

Telephone number of Charles Winn and Co. Ltd., Granville Street, Birmingham 1, has been changed to Midland 7151 (9 lines).

New telephone number of the Algological Products Co., 704 Old Kent Road, London SE15, is Brixton 9296.

New Works Planned

Carless, Capel and Leonard Ltd., Petroleum Chemical Works, Wallis Road, London E9, have had plans drawn up for the erection of new works premises at Trego Road, London E9.

People in the NEWS

● On 6 July PROFESSOR NORMAN FEATHER, Professor of Natural Philosophy at Edinburgh, will speak in London on the life and work of Frederick Soddy. The occasion is a small dinner which will be attended by speakers from Oxford and representatives of other universities. Anyone interested in attending should apply at once to Major Howorth, 55 Park Lane, London W1.

● The Perkin Centenary Trust has awarded the Perkin Centenary Fellowship to MR. JOHN EDWARD BLOOR of Manchester for study in the department of chemistry, Manchester College of Technology, on the structure and properties of merocyanine dyes and related compounds. Perkin Centenary Scholarships have been awarded to MR. JAMES MCCARTNEY, of Newtownards, Northern Ireland, tenable at Queen's University, Belfast; to MR. CLIVE MILNE of East Ardsley, near Wakefield, Yorkshire, tenable at Bradford Technical College; and to MISS GABRIELLE GRIFFIN of Withington, Manchester, tenable at Manchester University. The Perkin Centenary Trust was established to commemorate the discovery in 1856 of the first synthetic dyestuff, mauveine, by William Henry Perkin.

● MR. JOHN WILKINSON, aged 22, of Nest Estate, Mytholmroyd, near Halifax, who contracted poliomyelitis in 1947, which left him paralysed in the legs so that he has to use an invalid chair, has gained a B.Sc. degree with second class honours in chemistry at the University of Leeds, and is to take up work in the Patents Department of Dunlop Ltd.

● MR. N. L. G. LINGWOOD, whose re-election as president of the British Acetylene Association was announced in last week's CHEMICAL AGE (p. 1055), is distribution director of British Oxygen Gases Ltd. He was born at Dunwich, Suffolk, and educated at Woodbridge School. During the first world war he served overseas in the Royal Fusiliers. Among the posts he has held with BOC are district engineer, Manchester (1932), district manager, Manchester (1934), director of sales, HQ (1945) and commercial executive (1953). Mr. Lingwood is a member of the Institute of Welding, an Associate Member of the Institute of Mechanical Engineers, and has been a member of the British Acetylene Association since 1946. He was treasurer from 1952 to 1954, vice-president from 1954 to 1956 and has been president ever since. He is married with one son.

● MR. JASPER FRANKENBURG, chairman of Greengate and Irwell Rubber Co. Ltd., and vice-president of the Research Association of British Rubber Manufacturers, took office as chairman of the Federation of British Rubber and Allied Manufacturers' Associations at the annual general meeting on 20 June. He succeeds MR. REAY GEDDES, a director of Dunlop Rubber Co. Ltd.

● Sir W. H. Bailey and Co. Ltd., Patricroft, Manchester, have appointed MR. R. A. BARTLEY as technical sales representative for the North Eastern area, including Northumberland, Durham, Cumberland and the North Riding of Yorkshire. Enquiries should be addressed to Mr. Bartley, at 79 Ravensbourne Avenue, East Boldon, Co. Durham.

Mr. Edward Whitworth, joint deputy research manager, research department, ICI Nobel division, who, as reported last week, was awarded the OBE in the Queen's Birthday Honours

● DR. G. R. TRISTRAM has withdrawn from his appointment to the Chair of the Leather Industries Department at the University of Leeds. This appointment was to have come into effect from 1 October. He was to have succeeded Professor Donald Burton, who has now agreed to continue in the Chair for a period of two years, ending in September 1959.

● MR. B. H. TURPIN, managing director, QVF Ltd., Fenton, Stoke-on-Trent, left England on 17 June on a trans-Atlantic tour to visit distributors and study the overseas market. He will visit New York, Rochester and Detroit, after which he will make an extensive tour of Canada, staying at Toronto and other large cities. MR. J. G. WINDOW, the company's sales director, left by air on 22 June to visit customers and agents in Norway, Sweden, Finland, Denmark, Holland, Italy and France.

● MR. G. I. GIBBONS, chief labour officer, Courtaulds Ltd., who, as reported last week, was awarded the O.B.E. in the Birthday Honours, joined Courtaulds in May 1940 as labour manager at Preston. He became divisional labour manager for a group of the company's factories in the Northwest in 1942, and in 1944 was appointed deputy chief labour officer of Courtaulds at their headquarters in Coventry. He was appointed chief labour officer in January 1951. A fellow of the Institute of Personnel Management, Mr. Gibbons was its national president from October 1953 to October 1955.

Among those who also received awards in the Honours List are MR. A. T. S. ZEALLEY, former ICI Billingham division chairman and member of the ICI main board, who received a knighthood, MR. J. A. BROWN, Casebourne laboratories manager, ICI Billingham division, who was awarded a C.B.E., and MR. W. A. ELLIS, a pensioner of ICI Billingham division.

G. I. Gibbons who was awarded the OBE in the birthday honours

● MR. ELMER R. WEAVER, chief of the gas chemistry section of the US National Bureau of Standards, is retiring 31 May after 45 years' service.

Insecticides Course at Rothamsted

NINE entomologists from seven European countries and the Lebanon are attending the British Council course on insecticides at Rothamsted and London from 23 June to 6 July.

From 23 to 29 June demonstrations, lectures and practical field work on the use, and methods of study, of insecticides, took place at Rothamsted Experimental Station, Hertfordshire.

The main emphasis of the course is on the use of insecticides in plant protection, but their use in the protection of stored products will also be covered. Special attention is being given to the physico-chemical and biochemical properties of insecticides now in use.

From 29 June to 6 July members of the course will reside in London and make visits to university departments and commercial research stations.

Acid Tanker Overturns

An acid tanker, a 10-ton vehicle owned by Bulk Liquid Transport Ltd. Leeds, crashed and overturned on a bend on the main Grimsby-Doncaster Road, near Limber, Lincs, on 22 June, and its cargo of 4,000 gallons of sulphuric acid spilled over the road. The road was closed and traffic diverted while Cleethorpes firemen fought their way through the spurting acid to rescue the driver who was trapped in his cab. He was taken to Grimsby General Hospital suffering from severe shock, and his condition was later stated to be 'rather poorly.'

Overseas News

RECORD YEAR FOR CANADIAN CHEMICALS AND NO SIGN OF SLACKENING

PRODUCTION of Canadian chemical and allied industries reached record levels in 1956, owing to the country's high level of industrial activity in that year. Factory shipments at $1,113,600,000 were $69,500,000 or 6.6 per cent over the 1955 total of $1,044,100,000 and there appears to be no sign that the chemical industry's post-war growth is slowing down, according to a Bureau of Statistics report just issued.

In 1956 there were 1,120 operating establishments in the chemical and allied industries compared with 1,126 in 1955. An increase of 26.2 per cent in the factory value of shipments was registered for compressed gases, 12.8 per cent for medicinal and pharmaceutical preparations, 11.8 per cent for heavy chemicals and 10.1 per cent for primary plastics.

The only industries to show declines where fertilisers which fell 10.5 per cent and vegetable oils which dropped 15.7 per cent. Increases for other groups were: coal tar distillation, 9 per cent; paints, 8.3 per cent; soaps, 9.2 per cent; toilet preparations, 3.4 per cent; inks, 7.1 per cent; adhesives, 7.8 per cent; polishes, 4.6 per cent; and miscellaneous chemicals, 7.3 per cent.

Target for capital expenditures by the chemical industry on new plants and for machinery and equipment was set at $138,300,000 in 1957, an increase of 12.5 per cent over an actual investment of $122,900,000 in 1956 for the same purpose.

Synthetic Fibre Factory in Rumania

Construction of a synthetic fibre factory will shortly begin in Rumania. Claimed to be the first of its kind in Rumania and the biggest in south-east Europe, it will produce Relon synthetic fibres.

Addition of Bromotrichloro-Methane to Olefins

A new technique has been developed by A. M. Lovelace and D. A. Rausch, Wright Air Development Centre, which applies to the preparation of intermediates for monomers to be used in the polymerisation of new fluid plastic and elastomeric materials for high temperature applications in aircraft.

Said to offer many advantages over other methods, the new technique was adapted for the addition of bromotrichloro-methane to olefins by means of cobalt-60 gamma radiation. The radiation proved to be a potent source of free radicals for the initiation of conventional free radical reactions. Good yields of the simple one-to-one adducts were obtained, lower molar ratio of starting materials was required, high conversion in a short exposure time resulted and the reaction was not complicated by the presence of organic peroxides. Resulting products proved to be identical to those obtained through use of organic peroxides or ultraviolet light.

A copy of this report is available, price 50 cents, Order PB 121279 from the Office of Technical Services, US Department of Commerce, Washington 25.

New Uses for Urethane being Sought

Urethane (ethyl carbamate) is now being examined as a promising chemical raw material in the US, according to Food Machinery and Chemical Corporation. This company supply urethane in quantity, in high purity, and in both fused and crystal grades and to assist investigators and buyers have produced a technical bulletin (No. 5) on urethane. Interest in the use of urethane in the fields of plastics, monomers, co-monomers, plasticisers and fibre and moulding resins is said to be growing.

Other applications for this chemical are to be found in textile finishing, agricultural chemicals (including weed-killers, fungicides and insecticides), and in medicine and pharmacy in hypnotics, sedatives, anticonvulsants, anaesthetics, analgesics and antiseptics.

US Fatty Acid Production

According to *Baird-facts*, US production last year of saturated fatty acids was rising slightly while output of unsaturated material was declining. Last year about 228 million lb. of saturated acids and 178 million lb. of unsaturated acids were produced. US Chemical manufacturing, it was estimated, would use 55 million lb. of all types this year. Some 25 million lb. of unsaturated vegetable acids, 7 million lb. of low-resin acids and 5 million lb. each of coconut-type and oleic acids would move into the resin-plastics market. Rubber product, it was expected would consume 40 million lb. (all types) and synthetic cleaners would consume a similar amount. Lubricants will require 31.5 million lb. of the 20 to 22 million lb. that paints and varnish trades will take, some 75 per cent would come from vegetable oils such as linseed and soya bean. The 11 million lb. market in toiletries and drugs would take mostly oleic and stearic acid.

Industrial Fine Chemicals' Production

Plans for the manufacture of a diverse line of industrial fine chemicals were announced on 13 June by The Nichols Chemical Co. Ltd. The plant will be built at Nichols' production centre in Valleyfield, Quebec, which now has one of the largest sulphuric acid manufacturing facilities in eastern Canada. The country's first liquid hydrofluoric acid plant is also under construction at Valleyfield and will be in operation this summer.

According to Dr. E. P. Aikman, vice-president and general manager, the new plant will make Canada independent of foreign sources for a large number of fine chemicals now used in tonnage quantities by the chemical industry itself and by many industries having chemical processes. Among products to be made will be metallic and alkali fluoborates and fluorides, as well as many inorganic salts including nitrates, sulphates and acetates.

The new plant is expected to be in production by December of this year. It marks the sixth major expansion for Nichols Chemical in the past two years.

ANIC Orders Styrene Plant

Société Belge de l'Azote, Liège, Belgium, announce that their engineering division has secured a contract from Azienda Nazionale Idrogenazione Combustibili for the erection of a Koppers styrene monomer plant at Ravenna, Italy. Its annual capacity will be 14,000 tons.

The styrene will be used for making synthetic rubber in the plant now under construction at Ravenna in which ANIC is to produce 30,000-35,000 tons of synthetic rubber and 350,000 tons of nitrogenous fertilisers a year from 1958 onwards. This plant, which will also use natural gas from the Po Valley as its raw material, is being built with technical assistance from Union Carbide & Carbon and Phillips Petroleum.

At present styrene is made in Italy only by Montecatini at Ferrara.

German Chemicals in Nigeria

A representative of the German IG Farben chemical concern, Mr. H. Wydre, has been in Kano, commercial centre of Northern Nigeria, during recent weeks to see something of the city's indigo dye industry and to give the dyers information about modern dyeing methods. He has also visited textile mills in the Northern Region.

Cloth dyeing is one of the ancient craft of Kano, and the methods used today are much the same as in ancient times. But Mr. Wydre has said that he finds the people receptive to new ideas. They are interested in modern methods of dyeing.

During his tour of Nigeria, Mr. Wydre has travelled more than 30,000 miles and has supplied many samples of dyeing chemicals. He has also had discussions with officials connected with the dyeing industry.

Chlorine-soda Plant Completed at Venezuelan Institute

The chlorine-soda plant of the Venezuelan Petrochemical Institute has been completed and is under test for three months. Bids have been invited by the Institute for a dam to be built on the Rio Moron to provide water both for the Institute and for the town.

Commercial News

Boots' Chemicals Contributed to 1956 Profit Increase

PROFITS of Boots Pure Drug Co. for the year ended 31 March 1957 amounted to £4,754,998 (£4,390,637). Group net profit, including back payments received under the National Health Scheme, was £2,191,828 (£2,029,454). Net profit of Boots Pure Drug Co. Ltd., was £1,994,377 (£1,736,015). Balance brought forward amounted to £256,596 and tax provision no longer required to £34,154, making a total available of £2,285,127. A final dividend of 10 per cent is proposed, making 16 per cent (14 per cent).

Mr. J. P. Savage, chairman, in his annual review said that the company have shown an increase in their profits for the seventh year in succession. 'A major contribution to the increase this year comes from the chemical division. The big investment made here since the war is now producing a commensurate return in terms of profit.'

The company propose to revalue their properties, which appeared in the consolidated balance-sheet at £10.6 m. after depreciation.

Completion of a new warehouse building and progress with the new biological research institute would, according to the chairman, be the first call on the company's resources in the coming year. Looking further ahead, their objective was to ensure that all production resources were brought fully up to date and that administrative facilities were modern and efficient. Long term development was being planned on this basis.

During the year a substantial increase in sales of products made in the fine chemical department had taxed their productive capacity to the utmost, continued the chairman. Sales of agricultural merchandise also showed a healthy improvement.

Crookes Laboratories

Net profit of Crookes Laboratories for the year ended 31 March 1957 amounted to £42,047 (£64,085) and dividend 25 per cent (same). Current assets are £711,497 (£718,385), liabilities £134,390 (£114,330).

Yorkshire Dyeware and Chemical

Group net profit of Yorkshire Dyeware and Chemical Co. for the year ended 31 March 1957 amounted to £121,798 (£122,663), and distribution was 20 per cent (same). Fixed assets as revalued amount to £930,652 (£455,231) and current £1,204,873 (£1,245,063). Liabilities are £233,623 (£295,372).

Charles Hearson and Co.

The proprietors of Charles Hearson and Co. Ltd., manufacturers of laboratory apparatus and furniture, Willow Walk, London SE1, state that changes have recently taken place in the management of the company. The company is said to be developing its output along advanced lines and has in mind the need of providing dependable delivery and first class products.

Fisons Ltd.

The directors of Fisons Ltd., fertiliser manufacturers, declare an interim dividend of 5 per cent (same).

British Nylon Spinners

Trading profit for British Nylon Spinners fell by £1.85 million in 1956, largely as the result of price cuts introduced on October 1955. The figure was £8,757,899 (£10,608,043). Net dividends to the parent companies, Imperial Chemical Industries and Courtaulds, were £1,656,000 (£1,380,000), equivalent to 16 per cent on the £18 million capital following the 50 per cent scrip issue of last October.

Hardman and Holden

Trading profits for Hardman and Holden (chemical manufacturers) for the year ended 31 March 1957, were £289,120 (£314,986), less depreciation £51,421 (£46,802), directors' salaries, commission, fees etc., £25,582 (£27,813), and tax £89,348, (£120,553). After deducting investment allowances etc., relief of £26,250 (£11,165), there was a net profit of £112,769 (£119,818). Final dividend was 12½ per cent making 17½ per cent (same) for the year.

NEW COMPANIES

NITROGEN SPRAYS LTD. Capital £1,000. Manufacturers of and dealers in chemical machinery and disinfecting, vaporising, impregnating, spraying, drying and conditioning machinery; chemical and mechanical engineers, chemical manufacturers etc. Directors: G. H. Field, W. D. Sowerby, E. Field and C. P. Sowerby. Registered office: The Garage, Gilsland, Carlisle.

DERMASAN LTD. Capital £100. Manufacturers, importers and exporters of and dealers in pharmaceutical preparations, cosmetics, shampoos, chemicals, drugs, medicines etc. Secretary: J. D. Eccles. Registered office: 85 London Wall, London EC2.

B.K. CHEMICALS LTD. Capital £300. Manufacturers of and dealers in all classes of goods in plastics or similar materials etc. Directors: P. S. Davies, F. E. Martin. Registered office: 17 Upper Grosvenor Road, Tunbridge Wells.

BOTTOM DRUM LTD. Capital £1,000. Manufacturers of and dealers in organic and other fertilisers, manures, loams etc. Directors: H. Barrett, C. Heywood. Registered office: Office of Arnold Taylor and Co., 83 Bridge Street, Manchester 3.

W. H. DIXON AND SON (MANCHESTER) LTD. Capital £100. Manufacturers of and dealers in soap and washing materials, oils, greases etc. Directors: W. H. Dixon, Senr., W. H. Dixon, Jun. Registered office: 78 Upper Medlock Street, Hulme, Manchester 15.

CHANGE OF NAME

HANBURY CHEMICALS LTD., Hanbury Works, Stoke Prior, Bromsgrove, changed to Silicone Products Ltd. on 4 April 1957.

Market Reports

PRICES CONTINUE STEADY

LONDON There has been little change in trading conditions on the industrial chemicals market during the past week and in most sections buying interest has been maintained with contract delivery specifications covering good quantities. Prices continue steady at recent levels but since last week's report zinc oxide prices have been further reduced, white seal now being quoted at £95 per ton, green seal at £93 and red seal at £90 for 2 ton lots.

Fertilisers are now experiencing the seasonal lull in demand and there will be little activity until the new fertiliser year begins next month.

The demand for coal-tar products has been well maintained with a ready outlet for creosote oil, phenol crystals and all grades of cresylic acid.

MANCHESTER The beginning of the industrial holiday season this week—a number of towns in Lancashire are celebrating 'wakes' week—has affected to some extent the movement of contract deliveries of heavy chemicals and also the number of fresh inquiries dealt with on the Manchester market, but allowing for this seasonal factor trading conditions are regarded as generally satisfactory both on home and export accounts. Prices maintain a firm front pretty well throughout the range. The demand for fertilisers is quiet, but there is a steady movement of most of the light and heavy tar products.

GLASGOW The increased demand experienced during the week ending 15 June has been well maintained in practically all sections of the trade, with some branches being extremely busy. Prices on the whole have remained steady with little movement either way and generally speaking the week has been satisfactory from a trading point of view. Quite a lively interest has continued to be shown in chemicals for the export market and the off-take in agricultural chemicals has been up to expectations.

BRITISH CHEMICAL PRICES

These prices are checked with the manufacturers, but in many cases there are variations according to quality, quantity, place of delivery, etc.

Abreviations: d/d, delivered; c.p., carriage paid; ret, returnable; non-ret. pack, non-returnable packaging; tech, technical; comm, commercial; gran, granular.

All prices per ton unless otherwise stated

General Chemicals

Acetic Acid. D/d in ret. barrels (tech. acid barrels free); in glass carboys, £8; demijohns, £12 extra. 80% tech., 10 tons, £97; 80% pure, 10 tons, £103; commercial glacial, 10 tons, £106.

Acetic Anhydride. Ton lots d/d, £136.

Alum. Ground, f.o.r., about £25. MANCHESTER: Ground, £25.

Aluminium Sulphate. Ex-works, d/d, £15 10s. MANCHESTER: £15 15s to £18 10s.

Ammonia, Anhydrous. Per lb., 1s 9d to 2s 3d.

Ammonium Chloride. Per ton lot, in non-ret. pack, £29 2s 6d.

Ammonium Nitrate. D/d, in 4-ton lots, £31.

Ammonium Persulphate. MANCHESTER: per cwt., in 1-cwt. lots, d/d, £6 2s 6d; per ton, in min. 1-ton lots, d/d, £112 10s.

Ammonium Phosphate. Mono- and di-, ton lots, d/d, £106 and £97 10s.

Antimony Sulphide. Per lb., d/d UK in min. 1-ton lots: crimson, 4s 7d to 5s 10½d; golden, 2s 10½d to 4s 3¾d.

Arsenic. Ex-store, £45 to £50.

Barium Carbonate. Precip., d/d, 4-ton lots, bag packing, £41.

Barium Chloride. 2-ton lots, £49.

Barium Sulphate (Dry Blanc Fixe). Precip., 2-ton lots, d/d, £35.

Bleaching Powder. Ret. casks, c.p. station, in 4-ton lots. £28 12s 6d.

Borax. Ton lots, in hessian sacks, c.p. Tech., anhydrous, £66; gran., £45; crystal, £47 10s; powder, £48 10s; extra fine powder, £49 10s; BP, gran., £51; crystal, £56 10s; powder, £57 10s; extra fine powder, £58 10s.

Boric Acid. Ton lots, in hessian sacks, c.p. Tech., gran., £74 10s; crystal, £82 10s; powder, £80; extra fine powder, £82; BP gran., £87 10s; crystal, £94 10s; powder, £92; extra fine powder, £94.

Calcium Chloride. Ton lots, in non-ret. pack: solid and flake, £16.

Chlorine, Liquid. In ret. 16-17-cwt. drums d/d in 3-drum lots, £38 5s.

Chromic Acid. Less 2½%, d/d UK, in 1-ton lots, per lb., 2s 0¾d.

Chromium Sulphate, Basic. Crystals, d/d, per lb., 8¾d; per ton, £75 16s 8d.

Citric Acid. 1-cwt. lots, per cwt., £10 15s.

Cobalt Oxide. Black, per lb., d/d, bulk quantities, 13s 2d.

Copper Carbonate. Per lb., 3s 8d.

Copper Sulphate. F.o.b., less 2% in 2-cwt. bags, £82 15s

Cream of Tartar. 100%, per cwt., about £11 12s.

Formaldehyde. In casks, d/d, £37 5s.

Formic Acid. 85%, in 4-ton lots, c.p., £86 10s.

Glycerine. Chem. pure, double distilled 1.260 s.g., per cwt., in 5-cwt. drums for annual purchases of over 5-ton lots and under 25 tons, £10 1s 6d. Refined pale straw industrial, 5s per cwt. less than chem. pure.

Hydrochloric Acid. Spot, per carboy, d/d (according to purity, strength and locality), about 12s.

Hydrofluoric Acid. 60%, per lb., about 2s 6d per lb.

Hydrogen Peroxide. Carboys extra and ret. 27.5% wt., £128 10s; 35% wt., d/d, £158.

Iodine. Resublimed BP, under 1 cwt., per lb., 14s 2d; for 1-cwt. lots, per lb., 13s 5d.

Iodoform. Under 1 cwt., per lb., £1 2s 3d.; for 1-cwt. lots, per lb., £1 2s 6d.

Lactic Acid. Pale tech., 44% by wt., per lb., 14d; dark tech., 44% by wt., ex-works, per lb., 9d; chem. quality, 44% by wt., per lb., 12¼d; 1-ton lots, usual container terms.

Lead Acetate. White, about £154.

Lead Nitrate. 1-ton lots, about £135.

Lead, Red. Basis prices: Genuine dry red, £120; orange lead, £134. Ground in oil: red, £141 10s; orange, £153 10s.

Lead, White. Basis prices: Dry English in 5-cwt. casks, £128 10s; Ground in oil: English, 1-cwt. lots, per cwt., 194s.

Lime Acetate. Brown, ton lots, d/d. £40; grey, 80-82%, ton lots, d/d, £45.

Litharge. In 5-ton lots, £122.

Magnesite. Calcined, in bags, ex-works, about £21.

Magnesium Carbonate. Light, comm., d/d, 2-ton lots, £84 10s under 2 tons, £97.

Magnesium Chloride. Solid (ex-wharf), £16 10s.

Magnesium Oxide. Light, comm., d/d, under 1-ton lots, £245.

Magnesium Sulphate. Crystals, £16.

Mercuric Chloride. Tech. powder, per lb., for 5-cwt. lots, in 28-lb. parcels, £1 4s; smaller quantities dearer.

Mercury Sulphide, Red. 5-cwt. lots in 28-lb. parcels, per lb., £1 9s 3d.

Nickel Sulphate.—D/d, buyers UK, nominal, £170.

Nitric Acid. 80° Tw., £35.

Oxalic Acid. Home manufacture, min. 4-ton lots, in 5-cwt. casks, c.p., about £131.

Phosphoric Acid. Tech. (s.g. 1.700) ton lots, c.p., £100; BP (s.g. 1.750), ton lots, c.p., per lb., 1s 4d.

Potash, Caustic. Solid, 1-ton lots, £93 10s; liquid, £34 15s.

Potassium Carbonate. Calcined, 96/98%, 1-ton lots, ex-store, about £74 10s.

Potassium Chloride. Industrial, 96%, 1-ton lots, about £24.

Potassium Dichromate. Crystals and gran., per lb., in 5-cwt. to 1-ton lots, d/d UK, 1s 1¼d.

Potassium Iodide. BP, under 1-cwt., per lb., 10s 3d; per lb. for 1-cwt. lots, 9s 9d.

Potassium Nitrate. 4-ton lots, in non-ret. pack, c.p., £63 10s.

Potassium Permanganate. BP, 1-cwt. lots, per lb., 1s 10¼d; 3-cwt. lots, per lb., 1s 10d; 5-cwt. lots, per lb., 1s 9¼d; 1-ton lots, per lb., 1s 9¼d; 5-ton lots, per lb., 1s 8¾d. Tech., 5-cwt. in 1-cwt. drums, per cwt., £9 8s 6d; 1-cwt. lots, £9 17s 6d.

Salammoniac. Ton lot, in non-ret. pack, £45 10s.

Salicylic Acid. MANCHESTER: Tech., d/d, per lb., 2s 8½d.

Soda Ash. 58% ex-depot or d/d, London station, 1-ton lots, about £16 8s.

Soda, Caustic. Solid 76/77%: spot, d/d 4-ton lots, £32 6s 6d.

Sodium Acetate. Comm. crystals, d/d, £91.

Sodium Bicarbonate. Ton lot, in non-ret. pack, £17.

Sodium Bisulphite. Powder, 60/62%, d/d, 2-ton lots for home trade, £42 15s.

Sodium Carbonate Monohydrate. Ton lot, in non-ret. pack, c.p., £57.

Sodium Chlorate. 1-cwt. drums, c.p. station, in 4-ton lots, about £85.

Sodium Cyanide. 96/98%, ton lot in 1-cwt. drums, £113 5s.

Sodium Dichromate. Crystals, cake and powder, per lb., 11¼d. Net d/d UK, anhydrous, per lb., 1s 1d. Net. del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride. D/d, 1-ton lots & over, per cwt., £5; 1-cwt. lots, per cwt., £5 10s.

Sodium Hyposulphite. Pea crystals, £35 15s; comm., 1-ton lots, c.p., £32 10s.

Sodium Iodide. BP, under 1 cwt., per lb., 14s; 1-cwt. lots, per lb., 13s 2d.

Sodium Metaphosphate (Calgon). Flaked, paper sacks, £133.

Sodium Metasilicate. D/d UK in ton lots, loaned bags, £25.

Sodium Nitrate. Chilean refined gran. over 98%, 6-ton lots, d/d station, £29 10s.

Sodium Nitrite. 4-ton lots, £32.

Sodium Percarbonate. 12½% available oxygen, per cwt., in 1-cwt. kegs, £8 6s 9d.

Sodium Phosphate. D/d, ton lots: di-sodium, crystalline, £40 10s, anhydrous, £88; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate. 75-84° Tw. Lancs and Ches., 4-ton lots, d/d station in loaned drums, £10 15s; Dorset, Somerset & Devon, per ton extra, £3 17s 6d; Scotland & S. Wales, extra, £3. Elsewhere in England, not Cornwall, extra, £1 12s 6d.

Sodium Sulphate (Desiccated Glauber's Salt). D/d in bags, £18.

Sodium Sulphate (Glauber's Salt). D/d, £9 5s to £10 5s.

Sodium Sulphate (Salt Cake). Unground, d/d station in bulk, £6. MANCHESTER: d/d station, £7 10s.

Sodium Sulphide. Solid, 60/62%, spot, d/d, in drums in 1-ton lots, £33 2s 6d; broken, d/d, in drums in 1-ton lots, £34 2s 6d.

Sodium Sulphite. Anhydrous, £66 5s; comm., d/d station in bags, £25 5s-£27.

Sulphur. 4 tons or more, ground, according to fineness, £20-£22.

Sulphuric Acid. Net, naked at works, 168° Tw. according to quality, £11-£12 12 6d; 140° Tw., arsenic free, £9 2s 6d; 140° Tw., arsenious, £8 14s 6d.

Tartaric Acid. Per cwt.: 10 cwt. or more, £14; 1 cwt., £14 5s.

Titanium Oxide. Standard grade comm., rutile structure, £182; standard grade comm., anatase structure, £167 (from 1st Feb.).

Zinc Oxide. Max. for 2-ton lots, d/d, white seal, £95; green seal, £93; red seal, 2-ton lots, £90.

Solvents & Plasticisers

Acetone. All d/d, small lots, 5-gal. cans: 5-gal., £125; 10-gal., cans incl., £115. 40/45 gal. ret. drums, spot: Under 1 ton, £90; 1 to under 5 tons, £87; 5 to under 10 tons, £86; 10 tons under, £85. Tank wagons, spot: 1 to under 5 tons (min. 400 gal.), £85; 5 to under 10 tons (1,500 gal.), £84; 10 tons & up (2,500 gal.), £83; contract rebate, £2.

Butyl Acetate BSS. 10-ton lots, £173.

***n*-Butyl Alcohol BSS.** 10 tons, in drums, d/d, £152.

***sec*-Butyl Alcohol.** 5-gal. drums, £159; 40-gal. drums: under 1 ton, £124; 1-10 tons, £123; 10 tons & up, £119; 100 tons & up, £120.

***tert*-Butyl Alcohol.** 5-gal. drums, £195 10s; 40/45-gal. drums: 1 ton, £175 10s; 1-5 tons, £174 10s; 5-10 tons, £173 10s; 10 tons & up, £172 10s.

Diacetone Alcohol. Small lots: 5-gal. drums, £177; 10-gal. drums, £167. 40/45-gal. drums: under 1 ton, £142; 1-9 tons, £141; 10-50 tons, £140; 50-100 tons, £139; 100 tons & up, £138.

Dibutyl Phthalate. In drums, 10 tons, d/d, per lb., 2s; 45-gal. drums, d/d, per lb., 2s 1½d.

Diethyl Phthalate. In drums, 10 tons, per lb., 1s 11½d; 45-gal. drums, d/d, per lb., 2s 1d.

Dimethyl Phthalate. In drums, 10 tons, per lb., d/d, 1s 9½d; 45-gal. drums, d/d, per lb., 1s 10¾d.

Dioctyl Phthalate. In drums, 10 tons, d/d, per lb., 2s 8d; 45-gal. drums, d/d, per lb., 2s 9½d.

Ether BSS. 1-ton lots, drums extra, per lb., 1s 11d.

Ethyl Acetate. 10-ton lots, d/d, £145.

Ethyl Alcohol (PBS 66 o.p.). Over 300,000 p. gal. 2s 11¼d; d/d in tankers, 2,500-10,000 p. gal., per p. gal., 3s 1¾d. D/d in 40/45-gal.drums, p.p.g. extra, 1d. Absolute alcohol (75.2 o.p.), p.p.g. extra, 5d.

Methanol. Pure synthetic, d/d, £43 15s.

Methylated Spirit. Industrial 66° o.p.: 500-gal. & up, d/d in tankers, per gal., 5s 4d; 100-499 gal. in drums, d/d, per gal., 5s 8½d. Pyridinised 64 o.p.: 500 gal. & up, in tankers, d/d, per gal., 5s 6d; 100-499 gal. in drums, d/d, per gal., 5s 10½d.

Methyl Ethyl Ketone. 10-ton lots, d/d, £140.

Methyl *iso*Butyl Ketone. 10 tons & up, £159.

***iso*Propyl Acetate.** In drums, 10 tons, d/d, £137; 45-gal. drums, d/d, £143.

***iso*Propyl Alcohol.** Small lots: 5-gal. drums, £118; 10-gal. drums, £108; 40-45 gal. drums: less than 1 ton, £83; 1-9 tons, £81; 10-50 tons, £80 10s; 50 tons & up, £80.

Rubber Chemicals

Carbon Disulphide. According to quality, £61-£67.

Carbon Black. Per lb., according to packing, 8d-1s.

Carbon Tetrachloride. Ton lots, £81.

India-Rubber Substitutes. White, per lb., 1s 8¾d to 2s ½d; dark, d/d, per lb., 1s 3d-1s 5½d.

Lithopone. 30%, about £59.

Mineral Black. £7 10s-£10.

Sulphur Chloride. British, about £50.

Vegetable Lamp Black. 2-ton lots, £64 8s.

Vermilion. Pale or deep, 7-lb. lots, per lb., 15s 6d.

Coal-Tar Products

Benzole. Per gal., min. 200 gal., d/d in bulk, 90's, 5s; pure, 5s 4d.

Carbolic Acid. Crystals, min. price, d/d bulk, per lb., 1s 6½d; 40/50-gal. ret. drums extra, per lb., ½d. Crude, 60's, per gal., 8s 4d.
MANCHESTER: Crystals, d/d, per lb., 1s 4d-1s 7d; crude, naked, at works, 8s.

Creosote. Home trade, per gal., according to quality, f.o.r. maker's works, 1s-1s 9d. MANCHESTER: Per gal., 1s 2d.-1s 8d.

Cresylic Acid. Pale 99/100%, per gal., 6s 6d; 99.5/100%, per gal. 6s 8d. D/d UK in bulk: Pale ADF, per imperial gallon f.o.b. UK, from 7s 3d; per US gallon, c.i.f. NY, 95 cents.

Naphtha. Solvent, 90/160°, per gal., 5s 1d; heavy, 90/190°, for bulk 1,000-gal. lots, d/d, per gal., 3s 11d. Drums extra; higher prices for smaller lots.

Naphthalene. Crude, 4-ton lots, in buyers' bags, nominal, according to m.p.: £18-£26; hot pressed, bulk, ex-works, £38 16s; refined crystals, d/d min. 4-ton lots, £58.

Pitch. Medium, soft, home trade, f.o.r. suppliers' works, £10 10; export trade, f.o.b. suppliers' port, about £11.

Pyridine. 90/160, per gal., 17s 6d-20s.

Toluole. Pure, per gal., 5s 9d; 90's, d/d, 2,000 gal. in bulk, per gal., 5s.
MANCHESTER: Pure, naked, per gal., 5s 6½d.

Xylole. According to grade, in 1,000-gal. lots, d/d London area in bulk, per gal., 6s 2d-6s 5d.

Intermediates & Dyes (Prices Nominal)

***m*-Cresol** 98/100%. 10 cwt lots D/d, per lb., 4s 9d.
***o*-Cresol** 30/31°C. D/d, per lb., 1s.
***p*-Cresol** 34/35°C. 10 cwt lots D/d, per lb., 5s
Dichloraniline. Per lb., 4s 6d.
Dinitrobenzene. 88/99°C., per lb., 2s 1d.
Dinitrotoluene. Drums extra. SP 15°C., per lb., 2s 1½d; SP 26°C., per lb., 1s 5d; SP 33°C., per lb., 1s 2½d; SP 66/68°C., per lb., 2s 1d.
***p*-Nitraniline.**—Per lb., 5s 1d.
Nitrobenzene. Spot, 90-gal. drums (drums extra), 1-ton lots d/d, per lb., 10d.
Nitronaphthalene.—Per lb., 2s 5½d.
***o*-Toluidine.** 8-10-cwt. drums (drums extra), per lb., 1s 11d.
***p*-Toluidine.**—In casks, per lb., 6s 1d.
Dimethylaniline. Drums extra, c.p., per lb., 3s 5d.

Chemical Stocks and Shares

Chemical and Allied Shares Reflect Easier Trend

CHEMICAL and kindred shares have reflected the easier trend in evidence in stock markets, and were lower as compared with a month ago. Imperial Chemical were 42s 9d compared with 45s 6d a month ago, although the view persists that there are possibilities of a higher dividend for the current year. The assumption is that profits may move higher and that they would have shown a good increase last year had it not been for the fact that the group bore a large part of increased costs because of the price freeze on many of its products. Now the freeze is ending, prices must of course be expected to move more closely with prevailing market trends.

Monsanto Chemicals 5s shares were 19s 4½d and compared with a month ago, Laporte 5s shares eased from 22s to 18s 3d, despite the good impression created by the results and annual statement which indicates that more capital will be required in the future. Compared with a month ago, however, Hickson and Welch 10s shares have strengthened from 30s. 9d to 32s, while Hardman and Holden 5s shares moved up from 8s 6d to 9s 6d. Higher dividend hopes have been responsible for a rise from 12s 6d to 13s 6d in British Glues and Chemicals 4s shares. Reichhold Chemicals 5s shares eased on balance from 14s 6d to 13s 9d and Anchor Chemical 5s shares remained at 11s 6d, while Albright and Wilson were more active, but at 21s 1½d these 5s shares have not held best levels touched during the month. Yorkshire Dyeware and Chemical 5s shares held steady at 9s 6d, Lawes Chemical 10s shares eased from 22s to 20s 6d, while British Chrome Chemicals 5s shares were 9s 6d and Fisons eased to around 59s.

In other directions, Coalite and Chemical 2s shares were dealt in around 4s or virtually the same as a month ago. F. W. Berk 5s shares were 5s 10½d and William Butler 5s shares which remained under the influence of the results and higher dividend, were 6s. 1½d. There was, as usual, a good deal of activity in Borax Holdings 5s units, which after rising to nearly 33s, have come back to 30s 4½d partly owing to the reaction in Wall Street markets as these shares tend to move with that centre. British Tar Products strengthened from 7s 4½d to 7s 7½d, and Zambra 5s shares were 22s 6d. William Blythe 3s shares were 9s, compared with 10s a month ago.

British Oxygen rallied sharply to 37s 6d and there has been a considerable activity around 25s 3d in the units of the Distillers Co. owing to City talk of higher dividend possibilities. Textiles have been reactionary with Courtaulds back to 33s 3d partly because of the emphasis in the annual statement that conditions in export markets are extremely competitive.

SAC EXHIBITION

(*continued from page 1122*)

Stanton Instruments Ltd., 119 Oxford Street, London W1, showed their thermo recording balances and the new range of Ultramatic single pan balances that was introduced at the recent Instruments, Electronics and Automation exhibition.

Unicam Instruments Ltd., Cambridge, showed their SP500 quartz spectrophotometer for the precise chemical analysis of samples in solution; the SP600 visible spectrophotometer for absorption measurements in the visible region of the spectrum or for research or routine control; and the SP1400 prism absorptiometer for rapid routine testing of samples in large numbers.

The only overseas exhibitor, the *Perkin-Elmer* Corporation, Connecticut, US (European office at 30 Sonneggstr., Zurich) displayed the latest model vapour fractometer (154-B).

A wide range of electronic and nucleonic apparatus, instruments and communications were shown by *Labgear (Cambridge Ltd.)*.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents),' which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 2s 6d including postage; annual subscription £6 6d.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection on 7 August 1957

Extraction or recovery of uranium and other metals. Taverner, L., and Millin, D. **780 471**

Method of preparing halo-carbon polymers. Miller, W. T., Dittman, A. L., and Reed, S. K. **780 891**

Filters for removing suspended particles from gases. Minister of Supply. **780 709**

Apparatus for the production of ozone. Walter Instruments, Ltd. **780 476**

Removal of hafnium from zirconium-containing material. Commonwealth Scientific & Industrial Research Organisation. **780 477**

Thermoplastic compositions. British Celanese Ltd. **780 479, 780 480**

Fertilisers containing trace elements. Farbwerke Hoechst AG. **780 733**

Herbicidal compositions containing esters and preparation thereof. Columbia-Southern Chemical Corp. **780 713**

Process and apparatus for the sterile filling of containers. Farbwerke Hoechst AG. **780 483**

Disazo-dyestuffs insoluble in water. Farbwerke Hoechst AG. **780 484**

Gas detectors and analysers. Infra Red Development Co. Ltd. **780 734**

Production of omega-amino acids and esters thereof. Otsuki, H., and Funahashi, H. **780 575**

Cosmetic preparations, soaps, deodorants and preparations for repelling insects. Dehydag Deutsche Hydrierwerke Ges. **780 801**

Catalytic hydrogenation of carbon monoxide. Ruhrchemie AG, and Lurgi Ges. Fuer Waermetechnik. **780 577**

Cracking and refining synthetic hydrocarbons. Ruhrchemie AG, and Lurgi Ges. Fuer Waermetechnik. **780 802**

Petroleum fuels. Milton, R. F. **780 581**

Containers for liquids. Black, R. A. [Cognate application 33960.] **780 853**

Derivatives of purine. Wellcome Foundation Ltd. (Burroughs Wellcome & Co. (USA) Inc.). **780 494**

Polyacrylonitrile threads, filaments, fibres and the like. Courtaulds Ltd. **780 857**

Monoazo dyestuffs. Ciba Ltd. **780 591**

Compositions in powder form. Unilever, Ltd. **780 592**

Lubricant. Esso Research & Engineering Co. **780 595**

Antibiotic compositions for use in the treatment of diseases in plants. Pfizer, C., & Co. Inc. **780 603**

Lubricating oil additives. Esso Research & Engineering Co. **780 605**

Manufacturing acetylene from hydrocarbons. Kurashiki Rayon Kabushiki Kaisha. **780 813**

Improving the waste gas fastness of dyed cellulose acetate textile materials. Badische Anilin- & Soda-Fabrik AG. **780 764**

Production of cellulose ethers. Courtaulds Ltd. **780 816**

Laminated polymer sheets. General Aniline & Film Corporation. **780 877**

Sulphur containing compounds. Boots Pure Drug Co. Ltd. **780 520**

Piezoelectric ceramic elements and transducers. B. Jaffe. **780 673**

Copolymers of unsaturated polyesters. Westinghouse Electric International Co. **780 521**

Hydrogenation of carbon monoxide. Rheinpreussen AG Fuer Berghau und Chemie. **780 880**

Continuous treatment of artificial filaments. Chimiotex. **780 620**

Regeneration of hydroforming catalyst. Esso Research & Engineering Co. **780 528**

Separation of gas mixtures. British Oxygen Co. Ltd. **780 822**

Concentrating solutions without evaporation. Chemical Construction Corp. **780 530**

Purifying acetic acid by distillation. Celanese Corp. of America. **780 535**

Stabilisation of organo-siloxanes. General Electric Co. **780 622**

Silica-filled polyamides. Du Pont de Nemours, E. I., & Co. **780 538**

Production and use of alkylation catalysts. Monsanto Chemical Co. **780 777**

Preparing polymethylbenzenes containing at least three methyl groups, particularly durene. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **780 540**

Synthetic rubbery polymers derived from polyester-diisocyanate reaction products. United States Rubber Co. **780 896**

Production of butadiene. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **780 899**

Ethanol-miscible methyl phenyltertiary-butoxypoly-siloxane. General Electric Co. **780 626**

Polyalkylene polysulphide compositions. Minnesota Mining and Manufacturing Co. **780 545**

Stabilising liquid sulphur trioxide. Industrie Chimiche dr. Baslini Soc. Per Azioni, and Sartolini, U. **780 627**

Water-soluble salts of carboxyalkyl cellulose ethers and method of converting into granular form. [Addition to 767 924.] **780 628**

Apparatus for effecting tests and chemical reactions. Laboratoires de Physique Medicale. **780 781**

Recovery of waste gases in the synthesis of urea from ammonia and carbon dioxide. Montecatini Soc. Generale Per l'industria Mineraria e Chimica. [Addition to 664 375.] **780 683**

Purification of sewage and industrial effluents. Filtration Consultants Ltd. **780 639**

Promoted reduction of aromatic nitrogen compounds. Allied Chemical and Dye Corp. [Addition to 701 128.] **780 631—780 632**

Plasticising and tackifying agents and rubber compositions containing same. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **780 905**

Benzoic acid derivatives and their preparation. Laboratoires Dausse, and Recherches et Techniques Appliquees. **780 636**

Method of coating glass. Midland Silicones Ltd. **780 553**

Colchicum compounds. Uclaf. **780 557**

Organo-poly-siloxane compositions. Midland Silicones Ltd. **780 914**

Cyclopentanopoly - hydrophenanthrene compounds and pharmaceutical compositions containing them. Merck and Co. Inc. **780 915—780 916**

Protective film-forming compositions for preventing skin injury by aqueous solutions and processes for their manufacture. Veb Fettchemie, formerly Veb Fettchemie und Fewa-werk. **780 918**

Preparing basic polyvalent metal salts of organic acids. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **780 642**

1:2-Epoxycyclo-octane. Badische Anilin- und Soda-Fabrik AG. **780 643**

Production of zirconium sulphates. National Lead Co. **780 564**

Separation of undesired oversized or heavy particles from liquids, liquid mixtures or suspensions. Nichols Engineering and Research Corp. **780 931**

Apparatus for measuring the viscosity of viscous liquids. Vereinigte Glanzstoff-Fabriken AG. **780 932**

Preparation of stable dispersions. Cassella Farbwerke Mainkur AG. **780 700**

Alkyl-substituted tetrahydronaphthindanones. Givaudan, L., and Cie. Soc. Anon. **780 648**

Herbicidal compositions containing carbamic acid esters and preparation thereof. [Divided out of 780 713.] Columbia-Southern Chemical Corp. **780 714**

Open to public inspection on 14 August 1957

Continuous measurement and recording of the conductivity of electrolytic solutions. Elliott Bros. (London) Ltd. **781 058**

Coloration of polymers and copolymers of vinyl chloride. Soc. Anon. Des Manufacturers des Glaces et Produits Chimiques de St.-Gobain, Chauny and Cirey. **781 161**

Derivatives of amino triazine-formaldehyde condensation products. Ciba Ltd. **781 265**

Process and apparatus for the treatment of solid substances with gases in a fluidised bed. Chemiebau Dr. A. Zieren Ges. **781 285**

Rendering fibrous material water repellent. Farbwerke Hoechst AG. **780 967**

Polyesters. Farbwerke Hoechst AG. **781 169**

Cobaltiferous azo-dyestuffs. Ciba Ltd. **781 286**

Acylmercapto compounds. Ciba Ltd. **780 943**

Process for carrying out acylations. Ciba Ltd. **780 944**

Motor fuel, lubricating oil and grease additives. Ethyl Corp. **781 065**

17-α-Hydroxysteroids of the pregnane, allo-pregnane and pregnene series. Farbwerke Hoechst AG. **780 970**

Synthesis reactor for the hydrogenation of carbon monoxide in a liquid medium. Rheinpreussen AG Fuer Bergbau und Chemie. **780 971**

Linear polyamides. Imperial Chemical Industries Ltd. **781 289**

Glass-to-metal seals. Telefunken Ges. **781 066**

Production of uranium metal. United Kingdom Atomic Energy Authority. **780 974**

Metal oxides and ferrites. Standard Telephones and Cables Ltd. **780 975**

Preparing formals suitable for use as synthetic lubricants. Esso Research and Engineering Co. **780 977**

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Chemical Age

Index to Volume 77

January to June, 1957

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

PEOPLE IN THE NEWS

Q

R

S

T

U

V

W

Y

Z

AUTHOR INDEX

BOOK REVIEWS

OBITUARY

REPORTS

WILLS