

21.6.53

The Chemical Age

VOL LXIX

14 NOVEMBER 1953

No 1792

★
*Substantial
Price Reduction*

ALUMINIUM ISOPROPOXIDE

Write to the Manufacturers for particulars and sample

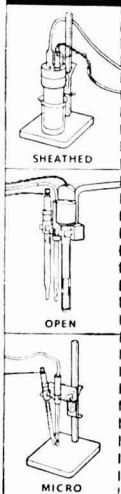


KAYLENE (CHEMICALS) LIMITED

WATERLOO ROAD, LONDON, N.W.2

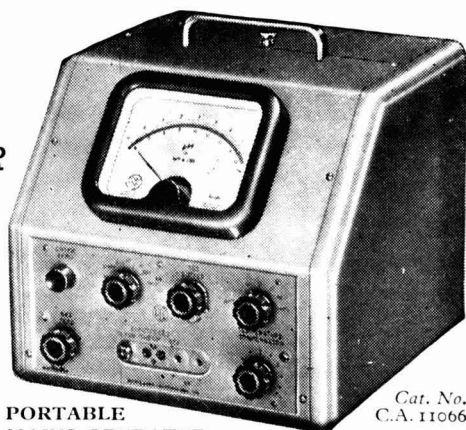
PYE UNIVERSAL pH METER AND MILLIVOLTMETER

ELECTRODE ASSEMBLIES INCLUDED



This new version of the Pye pH Meter not only retains the many excellent features of the previous model such as low zero drift, stability under wide mains variations, ease of operation and automatic temperature compensation, but it now incorporates a manual temperature compensator, complete coverage 0-14 pH and a wide range of electrode assemblies.

In laboratories covering a very wide range of research the Pye pH Meter is proving, by its convenience and consistently high accuracy, to be the outstanding instrument in its field.



Cat. No. C.A. 11066

**PORTABLE
MAINS-OPERATED
DIRECT READING 0-14pH
RANGE OF ELECTRODE ASSEMBLIES
DRIVES CONTROLLERS OR RECORDERS
MANUAL OR AUTOMATIC TEMPERATURE
COMPENSATION**

SCIENTIFIC  INSTRUMENTS

W. G. PYE & CO. LTD., GRANTA WORKS, CAMBRIDGE

FLUOR SPAR

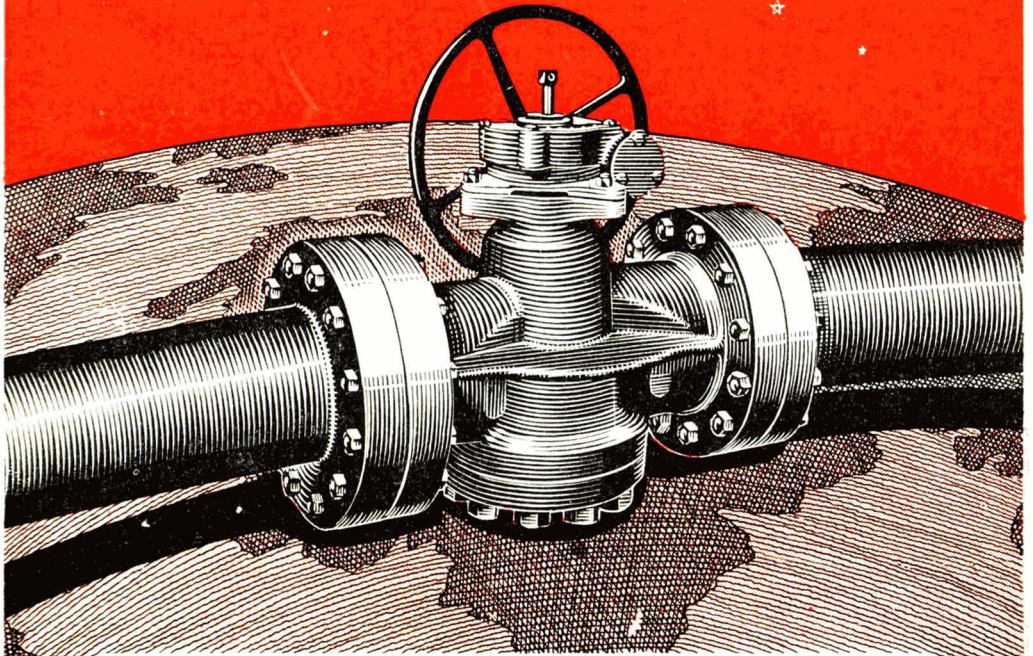
HIGH GRADE

GLEBE MINES LTD.

EYAM Nr. SHEFFIELD

Telephone: EYAM 281/2—Telegraphic Address: FLUORIDES EYAM

The valve with the *world-wide* reputation

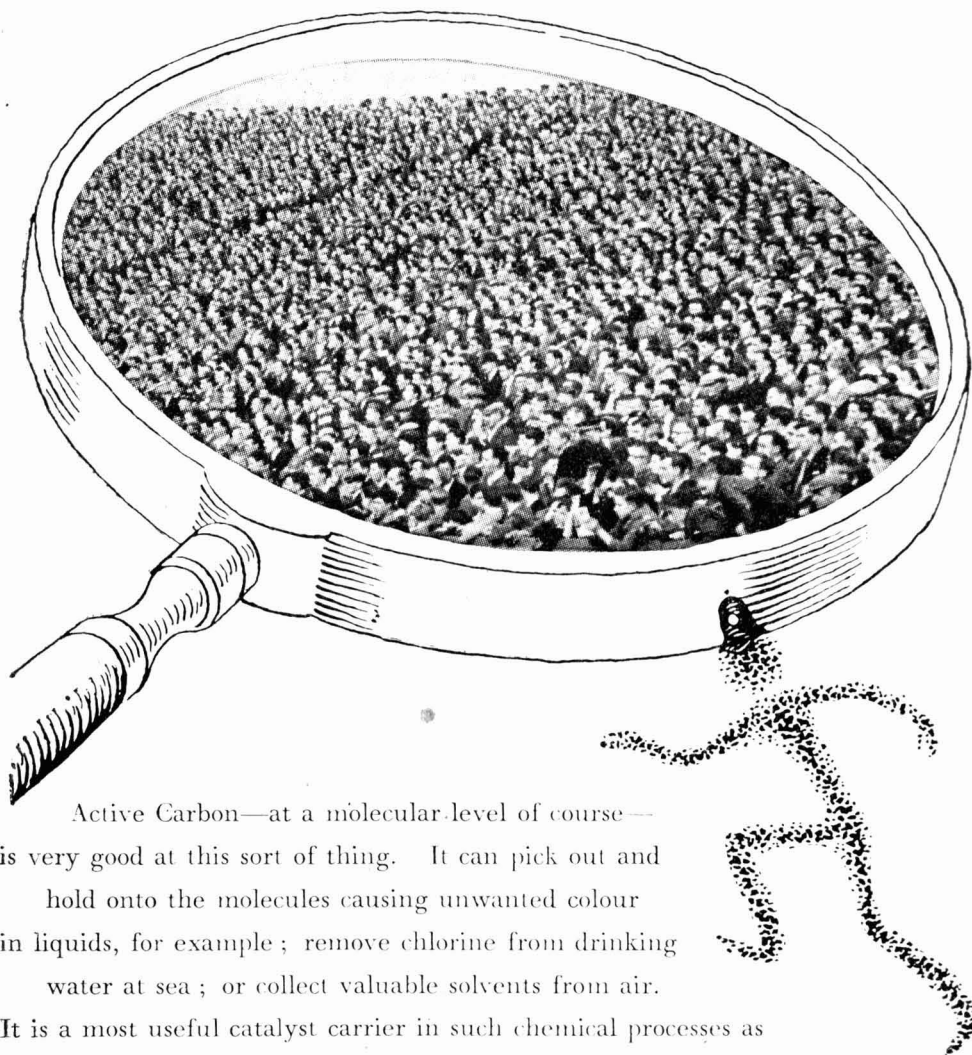


AUDCO Lubricated Valves are in daily use in the Chemical Industry throughout the world, where their effectiveness has been proved under the most adverse conditions. They handle almost all fluids and gases, whether corrosive or erosive, with equal efficiency and economy. The more recently developed Inverted Type Audco Valve shown above is recommended in place of the Standard Type on the larger-sized lines.

AUDCO
Lubricated
VALVES

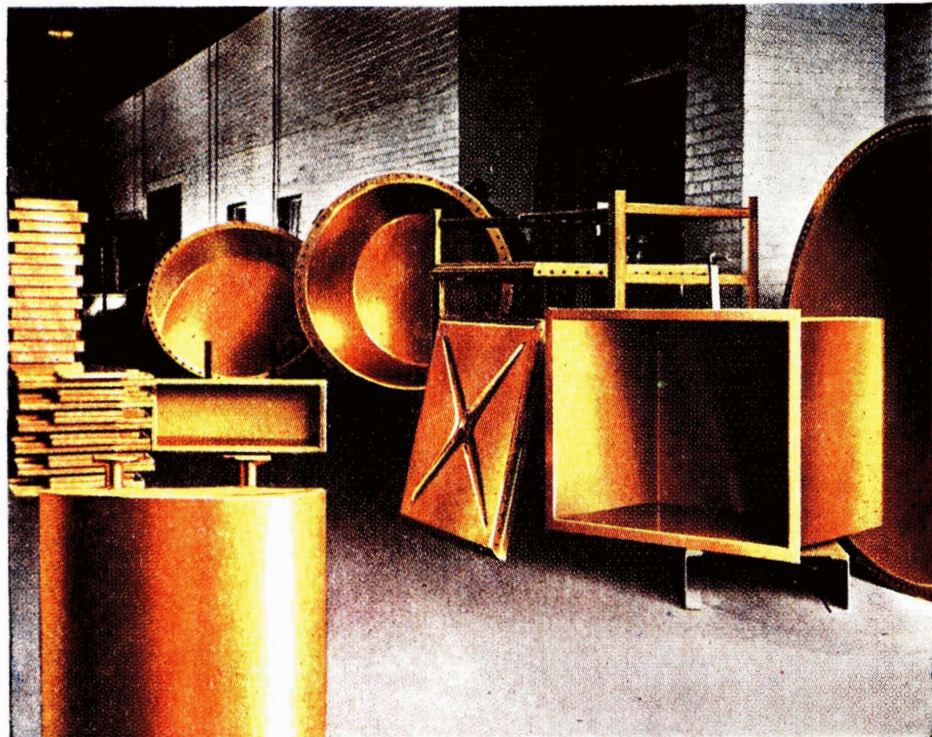
Audley Engineering Co., Ltd., Newport, Shropshire

Can you pick out the man with the rose in his button-hole?



Active Carbon—at a molecular-level of course—is very good at this sort of thing. It can pick out and hold onto the molecules causing unwanted colour in liquids, for example; remove chlorine from drinking water at sea; or collect valuable solvents from air. It is a most useful catalyst carrier in such chemical processes as the manufacture of P.V.C. If Active Carbon would be useful to your processes, the people to get in touch with are . . .

**SUTCLIFFE
SPEAKMAN**



Typical examples
of "Lithcote"
lined vessels for
a variety of
Industries

"LITHCOTE" *Linings*

NEWTON CHAMBERS & Co. Ltd., THORNCLIFFE, Nr. SHEFFIELD.
LONDON OFFICE: GRAND BUILDINGS, TRAFALGAR SQ., LONDON, W.C.2

Telephone : Sheffield (Ecclesfield) 38171

LONDON : TRAFALGAR 5865

HYDROFLUORIC ACID

**ANHYDROUS AND SOLUTIONS ALL STRENGTHS
ALSO PURE REDISTILLED 40% w/w**

FLUORIDES, Neutral

Sodium, Magnesium, Barium,
Potassium, Lead, Zinc, Ammonium,
Aluminium Lithium, Chromium.

BiFluorides (Acid)

Ammonium Sodium, Potassium.

Double Fluorides (Cryolites)

Sodium HexafluoroAluminate
Potassium HexafluoroAluminate

SILICOFLUORIDES

Magnesium, Zinc, Ammonium,
Barium, Potassium, Lead,
Hydrofluosilicic Acid.

BOROFLUORIDES

Sodium, Potassium, Ammonium,
Lead, Copper, Zinc, Cadmium,
Fluoboric Acid Solution.

OTHER FLUORIDES TO SPECIFICATIONS.

Glass Etching Acids

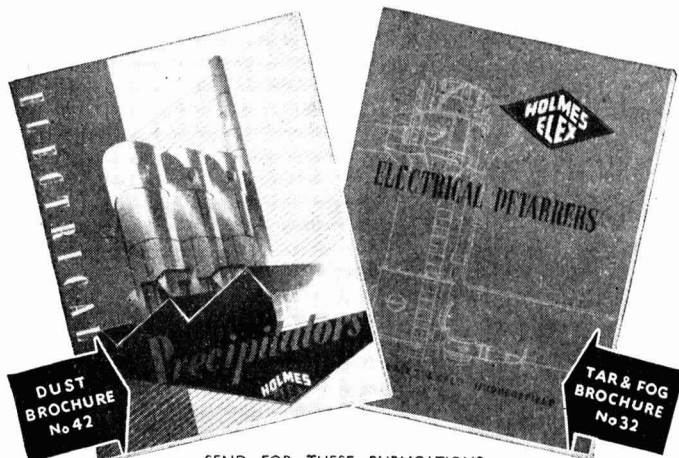
Ammonia White Acid and VITROGRAPHINE.

JAMES WILKINSON & SON, LTD.

TINSLEY PARK ROAD, SHEFFIELD, 9

Phone 41208/9 'Grams "CHEMICALS" Sheffield

ELECTRICAL PRECIPITATORS



SEND FOR THESE PUBLICATIONS

for the
Removal of
**DUST, MIST
& FOG**
from
**INDUSTRIAL
GASES**

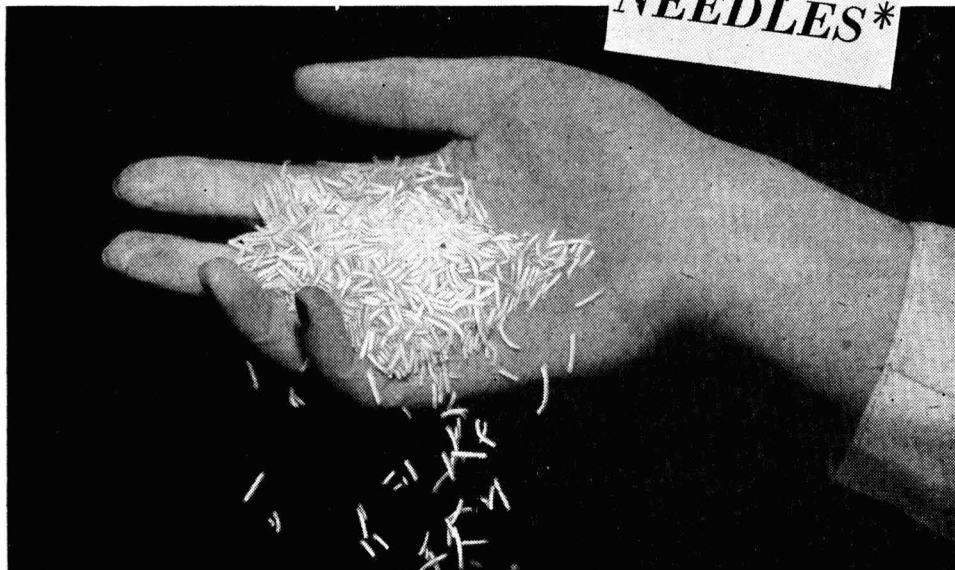
W. C. HOLMES & CO LTD · TURNBRIDGE · HUDDERSFIELD
Telephone: Huddersfield 5280 London, Victoria 9971 Birmingham, Midland 6830



Cheaper to use . . . cleaner to handle

EMPICOL LZV. 80/83% sodium lauryl sulphate in needle form, with its low content of inorganic salts, free alcohol and water, permits great flexibility in formulating toilet preparations. It can be supplied to B.P. and U.S.P. specifications.

**EMPICOL LZV-
Sodium
lauryl
Sulphate
NEEDLES***



Because of its high purity and convenient physical form it is finding many industrial applications including plastics manufacture, fire fighting foams, plating baths, etc.



CHARACTERISTICS: Pure white. Odourless in solution. Non-dusty. Easily dissolved in water. Easily reconstituted to a paste which is much firmer than ordinary lauryl sulphate pastes. Compact and simple to store, handle and weigh. In non-returnable packages.

AGENTS & OFFICES IN PRINCIPAL CITIES of the WORLD

MARCHON PRODUCTS LTD Head Office: Whitehaven. Telephone: Whitehaven 650-1-2 & 797-8-9 (6 lines).
Telegrams: Marchonpro, Whitehaven. London Office: 140, Park Lane, W.1. Telephone: Mayfair 7385-6-7.
Telegrams: Marchonpro, Audley, London.

Manufacturers of fatty alcohol sulphates (EMPICOLS) emulsifiers (EMPILANS) self-emulsifying waxes (EMPIWAXES) alkyl aryl sulphonates (NANSAS) and other detergent bases, activators and emulsifiers in powder, paste and liquid forms, and other industrial chemicals.

THE ALUMINA CO^{YD}

MANUFACTURERS OF ALUMINIUM SULPHATE

for PAPER MAKING



for WATER PURIFICATION



for COLOUR MAKING



for EFFLUENT TREATMENT



for PHARMACEUTICALS



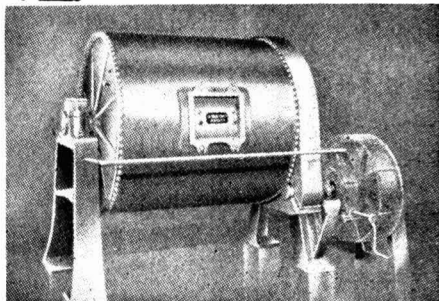
for HORTICULTURE



The above are but a few of the main uses of ALUMINIUM SULPHATE. We should be pleased to supply further details on request. Tel: Widnes 2275

IRON BRIDGE WORKS · WIDNES

BOULTON

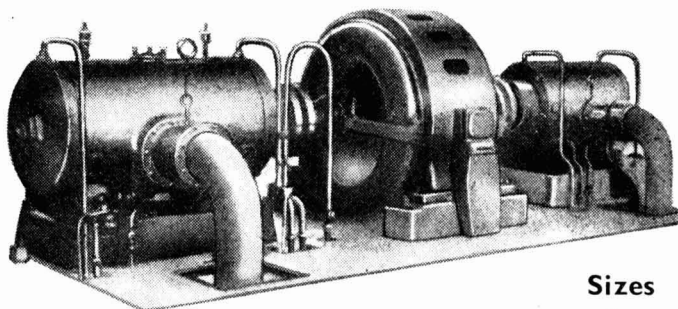


Ball & Pebble Mills
ALSO RELINING IN PORCELAIN, STEEL, ETC.

WILLIAM BOULTON LTD.
PROVIDENCE ENGINEERING WORKS
BURSLEM · STOKE-ON-TRENT

PHONE: STOKE-ON-TRENT 87234 (4 Lines) TELEGRAMS: BOULTONS BURSLEM

HOLLAND-S.L.M. ROTARY COMPRESSORS & VACUUM PUMPS



Capacities : 3-8000 cu. t./min.

Sizes to meet
all requirements

THE B.A. HOLLAND ENGINEERING CO. LTD.

Technical Offices : Lindo Lodge, Chesham, Bucks.

WORKS : SLOUGH, BUCKS.

Telegrams : Picturable, Chesham.

Telephone: Chesham 406

INTERMEDIATE PRODUCTS ANILINE DYES FAST BASES FOR ICE COLOURS

Benzol, Nitrobenzol, Binitrobenzol, Toluol, Ortho & Para Nitrotoluol, Binitrotoluol (All Grades)

Para Nitro Ortho Toluidine, Meta Nitro Para Toluidine

ORTHO TOLUIDINE PARA TOLUIDINE

Extensive Range of Oil Colours, Acid Colours, Basic Colours, Direct Colours, Pigment Colours,

Azoic Colours for Wool, also Colours suitable for all Trades

META TOLUYLENE DIAMINE META PHENYLENE DIAMINE

JOHN W. LEITCH & CO., LTD.

MILNSBRIDGE CHEMICAL WORKS

Telephone :
189-190 MILNSBRIDGE

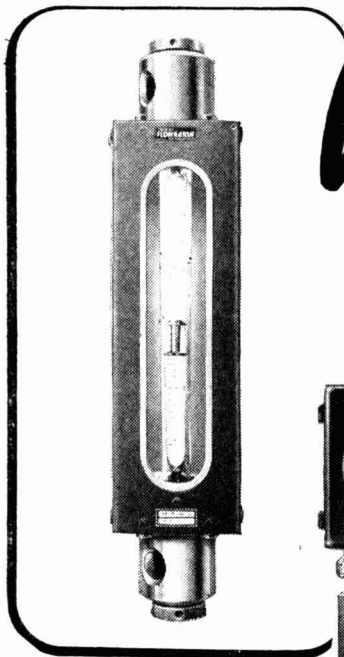
HUDDERSFIELD

Telegrams :
LEITCH, MILNSBRIDGE

INDIA
Khatau Valabhdas & Co.
Vadgadi, Bombay.

SCOTLAND
Kirkpatrick & Lauder Ltd
180, Hope Street, Glasgow C.2.

CANADA
Prescott & Co., Regd.
2209 Hingston Ave.,
N.D.G. Montreal 28, Quebec.



Whats in your line?

FLOWRATORS* (VARIABLE AREA FLOW METERS) SUPPLY THE CORRECT ANSWER

They measure flow rates of all fluids; Indicate, Record, Transmit, Control. Whether hot or cold, viscous or free, opaque or clear, corrosive or inert.

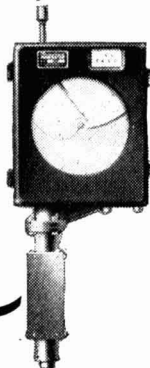
Series 100 Enclosed Indicating — (as illustrated left).

Series 300 Recording & Integrating — (as illustrated right).

Series 600 Pneumatic Transmitters — for remote reading/control.

Also Magnabond* dial Indicators, Metal tube Meters, Ratosleeves* etc.

Write for Catalogue 51—IP and state your interests please.

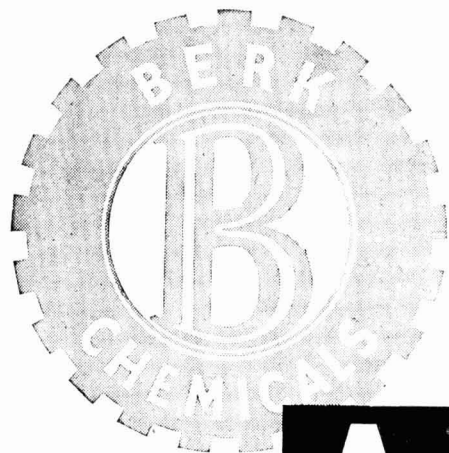


* Registered trade mark

Solway Flowrators Ltd.

ABBAY RD., PARK ROYAL, LONDON, N.W.10

Associates of : Electroflo Meters Co. Ltd., England
& Fischer & Porter Co., U.S.A.



Branches at
81, Fountain Street, Manchester, 2
65, West Regent Street, Glasgow, C.2
40, Queen Street, Belfast, N.I
Morrison, Nr. Swansea, S. Wales

Ask Berk

for

Potassium Carbonate

Calcined, 98/100 % and 96/98 %
Hydrated 83/85 %

Potassium Hydroxide

Commercial (Liquid, Solid, Broken, Flake & Powder)
Low in Chlorine (Flake and Liquid)
B.P. and A.R. (Sticks and Pellets)

Sodium Hydroxide

B.P. and A.R. (Sticks and Pellets)



Phone : CHAncery
6041 (16 lines)

F. W. BERK & Co. Ltd.

COMMONWEALTH HOUSE,
1-19, NEW OXFORD STREET,
LONDON, W.C.1.

Volume LXIX
Number 1792

The Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE · 154 FLEET STREET · LONDON · EC4

Telephone : CENTRAL 3212 (26 lines)

Telegrams : ALLANGAS · FLEET · LONDON

CONTENTS · 14 NOVEMBER 1953

Organo-Phosphorous Insecticides	1009
In the Editor's Post	1012
Spectrochemical Analysis	1013
A New Flow Meter	1019
Cast Iron Facts	1021
Rotary Economiser	1022
Disintegration Plant	1023
Indian Explosives Project	1024
The Chemist's Bookshelf	1025
Nickel Restrictions Go	1026
Home News Items	1027
Overseas News Items	1028
Personal	1029
Publications & Announcements	1031
Sulphuric Acid Returns	1033
Next Week's Events	1034
Market Reports	1036

Editor : E. A. Running

Publisher & Manager : John Vestey

MIDLANDS OFFICE :
Daimler House, Paradise
Street, Birmingham

Phone : Midland 0784/5

SCOTTISH OFFICE :
116, Hope Street,
Glasgow, C.2.

Phone : Central 3954/5

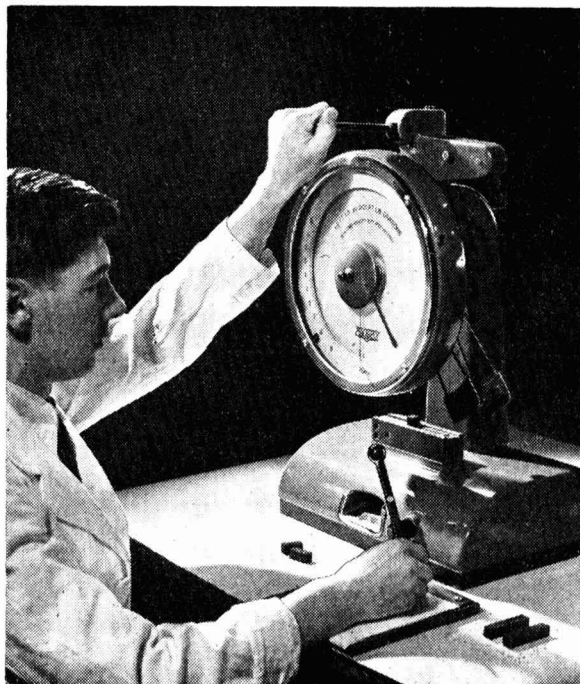
LEEDS OFFICE :
Martins Bank Chambers,
Park Row, Leeds, 1

Phone : Leeds 22601

SINGLE COPY 1/- (BY POST 1/3)

ANNUAL SUBSCRIPTION 42/-

COMBATING CORROSION



The C.I.D. at work

(Corrosion Investigation Department)

IMPACT TESTING

The many types of equipment used by St. Helens technologists include the Izod apparatus, illustrated here. It plays an important part in developing and controlling the production of that versatile servant of the chemical industry, ebonite.

St. Helens resources for the manufacture and application of anti-corrosive compounds are backed by modern facilities for research and development, and the fullest co-operation is extended to the chemical industry.

The following standard compounds are available :—

NATURAL RUBBER

A number of anti-corrosive grades for general application for temperature conditions up to 160° F. (70° C.).

HEAT-RESISTING NATURAL RUBBER

Especially for general application and where elevated temperature conditions exist—up to 212° F. (100° C.).

ABRASION-RESISTING NATURAL RUBBER

A resilient lining designed to give maximum resistance to abrasive conditions.

EBONITE (HARD RUBBER)

To give protection against very severe corrosive conditions.

FLEXIBLE EBONITE

A special grade of ebonite for use on equipment subjected in operation to physical shock and impact.

POLYCHLOROPRENE (NEOPRENE)

Suitable for conditions which involve elevated temperatures and/or oils, solvents and greases.

POLYVINYL CHLORIDE (P.V.C.)

Particularly suitable for the storage of Nitric and Chromic Acids at normal temperatures and up to 140° F. (60° C.).

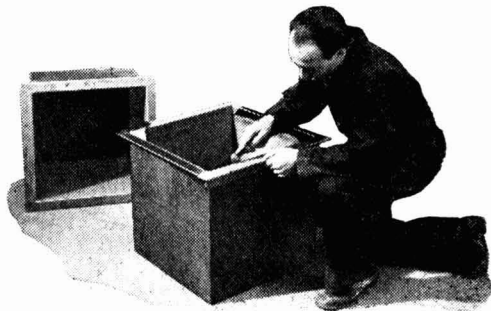
St. Helens

'CABTYRIT'

ANTI-CORROSIVE SERVICE

The above list can be supplemented by special compounds when necessary. You are invited to submit your plant protection problems to :

ST. HELENS CABLE & RUBBER CO., LTD.
SLOUGH, BUCKS. Telephone : SLOUGH 20333



The Food Front

NO one could hope to survey the entire front of advancing food chemistry today. It is significant that in the past few years two new scientific journals have been created, in Britain the monthly *Journal of the Science of Food and Agriculture*, and rather more recently in the United States, the fortnightly *Journal of Agricultural and Food Chemistry*. That there was pressing need for these specialised publications no one connected with the subjects could deny; for far too many years of hastening progress important papers on agricultural chemistry or chemical processes in food handling were either long delayed in appearance or else lost in the mass of general papers published in older journals. Even now, with these additional media for publication, some papers are not achieving the permanence of print until several months after their oral presentation at meetings. There are, of course, other well-established journals for agricultural papers; it is the modern pace of development in food chemistry that has principally created space shortage. And only a foolhardy dealer in classifications would risk defining today where food chemistry begins and ends. Certainly the much-discussed chemical food additives that retard decay or improve palatability represent only one sector of the ever-widening front.

The dehydration of food, a means both of preservation and easier distribution, is not a new practice. In the East fruits have been sun-dried for many centuries, mainly without benefit of scientific study. The intervention of chemists in food dehydration is comparatively new, and the extent to which problems of efficient dehydration are

chemical is shown by a current paper in the *Journal of Agricultural and Food Chemistry* (J. E. Hodge, 1953, **1**, 928) which discusses the biochemistry of browning reactions. This paper is unusually long and it is followed by a list of 201 references to other papers between 1940 and early 1953. Yet all that can now be concluded is that a variety of chemical reactions cause browning and that there are many gaps in our present knowledge of carbonyl-amino, non-amino-, and oxidative types of browning. Just about enough is known (and it is complex) for a broad pattern to be charted, a pattern that shows the gaps rather as Mendeleef's first table showed the missing elements. In dehydration browning is at least a nuisance and at worst a cause of total spoilage, but to elucidate its chemistry is not simply to reduce food losses. Browning in some cases of food treatment is a desirable development—in the roasting of coffee and nuts, and in as universal a process as the baking of loaves. To date the control of browning—when desirable as well as when unwanted—has rested upon empirical knowledge alone. Here is a vast subject still largely confined to research laboratories, and, as recently commented in *Food Manufacture* (1953, **28**, 422) only now is technology beginning 'to displace tradition in the dried fruits industry.'

In both this country and the United States a comparatively simple organic chemical, diphenyl, has this year shown extraordinary promise 'as a means of preserving the orange to be eaten by those who have paid for it, and not by myriads of uninvited guests.' (*The Autoclave*, 1953, **5**, [5], 13.) This sub-

stance has anti-fungal properties and if placed in a case of citrus fruit it sublimates into the case-atmosphere and prevents fruit-rotting. In British tests by a marmalade manufacturing company a case of Seville oranges wrapped in paper impregnated with diphenyl was practically unblemished by mould and free entirely from decay after 10 weeks of ordinary storage; a case of similar oranges wrapped in plain paper and kept under identical conditions had become virtually unuseable. Yet the cost of diphenyl used in this way amounts to only a few pence per case! In America this development may profoundly alter the economics of the citrus fruit industry, for the Californian plantations are farther from the major fresh fruit markets than Florida's plantations, yet Californian citrus fruit is more suited for fresh eating. Florida's produce is better suited for juice and juice concentrate manufacture, and canned orange juice has made steady inroads into the market for Californian eating fruit. Diphenyl is expected to redress this changing balance for, by reducing the losses from spoilage, it will greatly cheapen the cost of distribution (*Chemical Week*, 1953, **73**, [6], 32).

What functions antibiotics will be exercising in food preservation by 1960 is impossible to foresee. We commented a few weeks ago upon some new developments concerning fish on trawlers and beer in the brew (*THE CHEMICAL AGE*, 1953, **69**, 849). Now we learn that terramycin may be of valuable service in custard-pies (*Food Technology*, 1953, **7**, 282) for 10 parts per million in the filling will retard the growth of *Enterococci*, *Salmonellae*, *Micrococci*, and other micro-organic causes of food poisoning. The widespread addition of antibiotics to human diet is feared by many people today, and prudently so, for we cannot yet assess the long-term consequences; but time and testing often reduce apprehensions that in earlier perspective had seemed much graver. There are so many more antibiotic substances to be studied and we may well develop some that are specific anti-bacterial agents for foods and whose presence as traces in diet

will not raise questions of conflict with the medical usefulness of other antibiotics.

The fact that simple forms of combined nitrogen—urea and even ammoniacal form—can be utilised as food by ruminant animals has not been known for many years. At first thought the idea seems to outrage experience and instinct. The synthesis of more complex nitrogenous substances from these simple materials seems a task best left to the plant kingdom; but thousands of tons of urea have been utilised as cattle-feed in recent years and without ill effects, and now it is becoming known that poor-quality wastes, if first ammoniated, make useful feeding-stuffs for sheep, beef cattle, and dairy cows. Mixed with a normal diet to a 10 per cent proportion, ammoniated wastes of cellulosic kind have given as good animal growth as rations of equivalent protein nitrogen content. Some of the wastes that can thus be up-graded by ammoniation are materials that must otherwise be dumped and not always without disposal costs. If current American investigations continue in their present and promising vein, the chemist will benefit both industry in waste disposal and farming in cheapening the costs of animal feeding.

Yet all these examples are selections made at random and from a mere handful of journals. They ignore the huge and established departments of agricultural chemicals—fertilisers, insecticides, weedkillers, plant fungicides. Side by side with these major roads the developments we have cited here are mere tracks or even less than tracks. Yet one might guess without undue risk of error that in recent years the greatest amount of newspaper space devoted to the connection of chemicals with food will have dealt with chemical additives as dangers to public health. 'All this chemical stuff in the food' is still a widespread public reaction to the role of the chemist in food production and processing. At a time of rapid advance food chemistry seems over-modest; more applause for achievements and less brickbats for unproven failures would be a more worthy fate.

Notes & Comments

Thermometric Paints

PRE-WAR German studies had made useful progress towards chemical paints or pigments that would display colour changes within specific temperature ranges. Dabs of such paints or materials on factory equipment that becomes heated in operation or upon mechanisms in vehicle engines are potentially useful in both temperature control and temperature observation. A new American paper reports an impressive amount of post-war progress in this unusual field (*Industrial and Engineering Chemistry*, 1953, **45**, 2317-2320). Not merely a few colour-changing chemicals are instanced but the probability is suggested that hundreds of suitable compounds exist. As far back as 1942 A. J. Carter of the Chrysler Corporation listed 125 pigments with properties of this kind but many of these have been judged as unstable, too slow in colour change, or insufficiently sensitive to narrow temperature ranges. The latest research—by US Naval Research Laboratory workers—indicates that some of these troubles may be caused by impurities and unsuitable paint formulation.

Many Applications

FOR lower range temperatures it seems that the cobaltous co-ordination compounds monopolise the field, though the usefulness of analogous compounds of iron, zinc, nickel, and copper largely remains to be tested. These compounds are generally easy to prepare, a not unimportant aspect of efficiency. Cobaltous hexamethylenetetramine iodide changes from brownish-pink to green at 50°. At the same temperature cobaltous pyridine arsenate changes from brown to light blue-green. Cobaltous phosphate goes from pink to blue at 112°. Eight different compounds of this type, seven of them cobaltous and one nickelous, cover ascending temperature steps from 50 to 116°. Within this range, then, excellent possibilities for approximate

temperature measurement by colour genuinely exist. For higher temperatures six compounds are said to be promising, and the range covered by them is helped by the fact that three have double colour-changes, e.g., chromium ethylenediamine chloride changes from yellow to red at 117-121° and from red to black at 260-278°. The range from 120 to 270° can be covered by pigments but within this range a serious gap—from 164 to 245°—still exists. It seems difficult to believe that there are not compounds yet to be tested that will cover several steps in this gap with well-demarcated colour changes. There are so many industrial applications for temperature-indicating paints and this new and fairly comprehensive paper is likely to be widely consulted. It is not suggested that British contributions have not also been made, but the whole subject and its early potentialities are excellently surveyed in the US paper.

Present Fears are Less

FAIR is foul, and foul is Fair; the sentiments of British chemical industry are unanimous on the subject of the BIF. And in the fog and filthy air of this autumn, many other manufacturers have expressed similar opinions, as a current correspondence in *The Times* shows. The BIF, it seems, is doomed to die. We regard the event with approval, for the removal of this mammoth obstacle should reinvigorate the industrial exhibitions of this country. The truth is that the BIF has grown too big, too untidy and too useless. Who has ever visited the Fair to buy in more than one section? And then, how many customers have been lost, scared away by the overwhelming comprehensiveness, and disappointed by startling incompleteness of it all? How many instrument or chemical buyers, wandering in the upper circles of the toy section (the place is, indeed, very like an inverted Inferno) have given up the unequal struggle and returned home? There is no reason against, and every possible reason for, a series of specialised trade exhibitions, each attractively laid

out, each at a time of year most suitable; toys and fancy goods in time for Christmas, some week in July; fabrics in September, ready for the spring fashions, and so on.

. . . than Horrible Imaginings

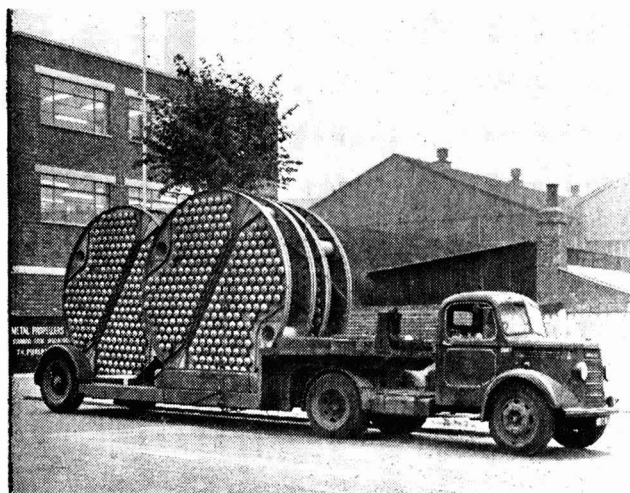
CHEMICAL industry could certainly put on a fine show. At the recent Engineering Exhibition the chemical plant section could with advantage have occupied at least four times the floor space allotted to it, and, with the co-operation of the chemical manufacturers, a most attractive independent exhibition could have been staged. There are rumours about that such a collaboration is now being discussed, and we hope soon to hear them confirmed. The venture will have our whole-hearted approval; for too many years now the chemical and engineering manufacturers in France and Germany have enjoyed the advantages of well-organised trade shows which have put all this country's efforts in the shade. If it were done when 'tis done, then 'twere well it were quickly, for every year Britain lags further behind in the export race. We have the research workers, the engineers, the salesmen and the exhibition organisers: we have our past achievements to

encourage us, and our future hopes to lure us on; we have this opportunity now to clear away the clogging cobwebs of the valueless BIF. When the battle's lost and won Britain, we hope, will at last be renowned the world over for her industrial exhibitions, each one a 'must' in hundreds of buyers' diaries, but particularly that of the British Chemical Industries.

Importance of Rubber

OIL, manganese, mica, tin and rubber came in abundant measure from the Middle East, India, Malaya and Indonesia and if control of those territories passed into hostile hands, our way of life and the resources for our defence would be gravely imperilled said Lord Bailieu, chairman of the Dunlop Rubber Company, when opening the new building of the National College of Rubber Technology at Holloway last week.

He added: 'While the shock of such a disaster would be cushioned in North America by their magnificent synthetic rubber manufacturing industry, here we should have no such insurance. Rubber—natural or synthetic—is a strategic material the supply of which is absolutely essential to any great Power in peace or war.'



Six 10 ft. 6 in. stainless steel bubble trays outside the works of Metal Propellers Ltd., Croydon, prior to despatch to a large chemical works in the North of England. Metal Propellers Ltd. are sole British manufacturers of the American-designed Glitsch 'truss-type' bubble trays, most of which are made to pass through an 18 in. manhole and are delivered 'knocked down' in crates or cases, for assembly at their destination. The trays shown here are of solid construction made to meet the customers' special process requirements

Organo-Phosphorus Insecticides

Important Papers Read at Symposium

A SYMPOSIUM on 'Organo-Phosphorus Insecticides' was held in the morning and afternoon of 2 October in the Large Chemistry Lecture Theatre, Imperial College, London. It was arranged jointly by the Association of Applied Biologists, the Crop Protection Panel of the Society of Chemical Industry, the British Pharmacological Society and the Biological Methods Group of the Society of Public Analysts and Other Analytical Chemists. About two hundred people attended.

In opening the session Professor V. B. Wigg'sworth (Quick Professor of Biology, Cambridge University) remarked on the good attendance and of the diversity of interest represented by the different participating societies. He then made a general survey of the field. Although it is not known why the group of substances should be toxic, their toxicity is associated with a common chemical structure which permits a very wide range of possible substituents and great scope for the organic chemist who can endeavour, at least, to produce compounds with particular properties. When the substances are applied to plants, the plant physiologist has to consider how some of the substances act as systemic insecticides and how others undergo rapid changes in the plant.

Balance of Population

The insects themselves also have to be studied both as to how particular species are affected and how the control of a particular species may alter the balance of interacting populations of insects in the field. Elucidation of the ways in which phosphorus insecticides act within the insect might well lead to the use of compounds with high toxicity to parasites but not to predators or to man. The latter is yet another aspect which has to be studied, because the risks to man is an overriding factor influencing the scope of application of various of the compounds under consideration.

Dr. K. A. Lord (Rothamsted Experimental Station) in a paper entitled 'Insecticidal and Anti-esterase Activity of Organo-phosphorus Compounds,' which he had prepared with Dr. C. Potter, referred to investigations,

carried out at Rothamsted, to obtain information on the esterases present in different species of insects and on their inhibition by organo-phosphorus compounds. He pointed out that many previous workers appeared to have assumed that organo-phosphorus insecticides produce their effects by inhibition of choline-esterase because this had been shown to be involved in their toxic action to mammals. He pointed out that the presence of acetyl choline has not yet been demonstrated conclusively in insects: the organo-phosphorus compounds might well act by inhibiting esterases other than choline esterase.

Activity of Extracts

The experimental work, in which the esterase activity of various crude extracts from insects was examined, supported this possibility: in particular various esterases which do not hydrolyse acetyl choline were found to be inhibited by the organo-phosphorus compounds used. Furthermore TEPP at high concentrations is toxic to eggs of tomato moth at an early stage of development, although acetyl choline esterases do not appear to be present on such eggs.

Dr. J. M. Barnes (MRC Toxicology Research Unit) considered 'The Toxic Action of Organo-phosphorus Insecticides on Mammals.' He referred to the acute effects leading to death and chronic poisoning in different animals and considered to what extent the different symptoms might be explained by inhibition of choline-esterase. He pointed out that the toxicity of a substance appears to depend on the affinity for choline-esterase and the reversibility of combination, these properties varying with the substituent groupings. The marked differences in the toxicities of various of these substances to different animals is probably due to the differences in substrate patterns of the esterases present. More detailed information on these esterases might form a basis for discovering compounds selectively toxic to insects or to other animal species.

In opening the discussion on the two morning papers, Dr. B. A. Kilby (Medical School, Leeds University) referred to the clarification of the biochemistry of these

substances which had only been possible recently because the pure compounds had not been hitherto available. He felt that those substances which are relatively inert *in vitro* but which are converted to potent agents *in vivo* should be studied in greater detail to ascertain the exact mechanism of the activation.

He asked, for example, whether there was any information on the comparative efficiency of human and rabbit liver slices in the conversion of inactive to active compounds, whether anyone present had any information on the nature of the enzyme systems responsible for activation. He also asked whether there were any authenticated cases of the appearance of strains of insect resistant to these compounds. If so, it would be interesting to investigate their enzyme systems. Dr. C. Potter replied that he did not know of any well founded reports of the appearance of strains of insects specifically resistant to organo-phosphorus insecticides.

Little Evidence

Dr. H. S. Hopf (I.C.I. Hawthorndale Laboratory) stated that his work agreed with Lord and Potter and gave little evidence that inhibition of choline-esterase is the cause of death to insects. His work indicated that acetyl choline had no effect on locusts; furthermore, the relative toxicities of a series of organo-phosphorus insecticides had been shown to be quite different from their inhibition of the enzyme *in vitro*.

Dr. W. N. Aldridge (MRC Toxicology Research Unit) and Mr. F. P. W. Winteringham (Pest Infestation Laboratory) each drew attention to the danger of attempting to transfer the explanation of the causes of toxicity directly from animals to insects. Dr. Aldridge stated that, but for the fact that choline-esterase had been demonstrated to be implicated in mammals, pseudo choline esterase and B-esterase would probably have been suspected. Mr. Winteringham referred to some recent unpublished work by Fowler and Patterson, which at least supported the view that acetyl choline is present in insects, and pointed out that the suggested importance of inhibition of choline esterase had been suggested long before anyone had demonstrated the presence of acetyl choline.

In answer to a question from Dr. Aldridge whether esterase activity had been measured after giving sub-lethal doses to

insects, Dr. Lord stated that a few results had been obtained with paraoxon. There was some inhibition of choline-esterase activity and complete inhibition of general esterase activity; lethal amounts gave concentrations (estimated as if distributed throughout the insect) of about a hundred times that required to inhibit the enzyme.

In answer to a question from Dr. Barnes, Dr. E. F. Edson (Pest Control Limited) pointed out that malathion's application rate and toxicity to mammals were respectively four times greater and a hundred times less than parathion. He pointed out that entry through the skin and the volatility of these insecticides should be carefully considered in assessing the risks likely to be encountered in the manufacture and use of any new substance. He also pointed out that there is probably a fairly constant relationship between the acute L.D.50, the just non-lethal daily dose and the daily dose which just affected blood choline-esterase in mammals. Work with schradan suggested that these were approximately in the ratio 1:1:100-200.

Dr. D. F. Heath (Pest Control Limited) also referred to the surprisingly small amount of information on the toxicity from the vapour phase. Risks during manufacture are important but they can be overcome. He said that the aim should be to obtain compounds where the ratio toxicity to insects/toxicity to mammals is large: these will not necessarily show a low toxicity to mammals.

Afternoon Session

In introducing the afternoon session, Dr. J. R. Nicholls (Deputy Govt. Chemist) referred to the problems of public health raised by the introduction of the organo-phosphorus insecticides and to the need for cooperation between biologists, pharmacologists and chemists in solving them. For example, it is necessary to know the toxicity of the original compound and of its breakdown products to man, to know what the breakdown products are and of having methods of analysis. Chemical analysis is sometimes difficult as the elements sought are common in plant material and bioassay is often necessary.

In his paper on 'The Behaviour of Organo-phosphorus Systematic Insecticides in the Living Plant,' Dr. G. S. Hartley (Pest Control Limited) referred to the concern

which had been expressed that the use of systemic insecticides might result in dangerous residues in plants. He pointed out that it is not easy to reproduce in the laboratory the practical conditions where the compounds, which are water soluble, migrate within the tissues of the plant: however, the use of radiotracer techniques had provided much useful information.

Compounds behaved in different ways. With schradan and dimefox the undecomposed substance is primarily responsible for the insecticidal action: breakdown inside the tissues of the growing plant reduces the toxic content to a safe level within a reasonable period. Mipafox has not been studied in as much detail, but this substance in any event is more readily decomposed than the other two compounds.

Diethyl ethylmercaptoethyl thiophosphate when initially applied has inadequate water solubility to behave as such as a systemic insecticide. However it is rapidly converted in the plant tissues to at least two soluble and toxic substances which are those really responsible for the systemic insecticidal action.

In his paper describing 'Some Hydrolytic Aspects of Organo-phosphorus Compounds,' Dr. P. R. Carter (Albright & Wilson Limited) pointed out that published methods of analysis for phosphorus insecticides rely directly or indirectly on hydrolysis. In TEPP, for example, the complete hydrolysis to two molecules of acid provides a ready method of analysis, while in the analysis of commercial schradan, use is made of differential hydrolysis rates to determine different components. He described kinetic studies of the hydrolysis of some organo-phosphorus compounds and the use of the velocity constants as a criterion of the purity of material.

Rates of Reaction

The mathematical treatment of a method of analysis of compounds, based on the difference in rates of reaction of the components of the mixture with a given reagent, was described in some detail and the application of the method to the analysis of some phosphorus derivatives was then discussed, with particular reference to parathion and paraoxon.

In a paper entitled 'Bioassay of Organo-phosphorus Insecticides' Mr. J. F. Newman (I.C.I.) firstly discussed the uses and limita-

tion of biological tests and then considered the different procedures which have been employed at the Hawthorndale Laboratories. These included assay procedures employing mosquito larvae, adult flies and *Daphnia* and included consideration of the standardisation of test organisms and of the sensitivity and precision of each type of test.

The tests were broadly indicated as suitable for comparisons between related toxic compounds for the assay of smoke residues and for the assay of residues in fruit and foliage. The necessary extraction procedures preliminary to the determination of residues were considered. Before concluding Mr. Newman referred to *in vitro* measurements with residues from plants involving the choline-esterase inhibition.

Impurities in Bio-Assay

In answer to a question from Mr. Bacharach, Mr. Newman stated that the lines he got in his bioassay method, with similar compounds like parathion and paraoxon, were parallel but this is no guarantee that dissimilar compounds would also give parallel lines. Dr. Aldridge pointed out how impurities can confuse bioassay tests. In tests of the biological activity of some diethylphenyl-phosphates, 1.0 per cent of TEPP, which is difficult to detect chemically, can upset the results by a factor of 3 times. In such cases both chemical and biological methods are needed to assess purity.

Dr. Barnes asked Mr. Newman if parathion and paraoxon can be distinguished in his bioassay method on mosquito larvae, as parathion is thought to be converted to paraoxon *in vivo* before it becomes toxic to insects. Mr. Newman said that paraoxon appears to be slightly more toxic than parathion. Mr. Bacharach said that assay by biological methods is only a temporary substitute for chemical analysis. In tests like Mr. Newman's, where a preparation obtained from treated food, etc., is tested alongside a pure material, a comparison is made of the biological properties of the two materials and not necessarily of the amounts of the same compound in both preparations.

Dr. Edson stressed the need for a statement on the maximum permissible residues of organo-phosphorus insecticides on food, and for some estimate of their chronic toxicity to man. It was also pointed out by Dr. Bliss that organo-phosphorus insecticides

may make treated crops distasteful quite apart from whether they are poisonous.

Referring to an aspect of Mr. Newman's paper, Dr. Hartley pointed out that the fact that schradan did not kill aphids in a direct spray test is because it does not act as a contact poison. Their failure to respond was not because it is necessary for schradan to be converted within the plant, but because the aphids did not ingest the poison under the conditions of the test.

In conclusion, Dr. Thomas proposed a vote of thanks to the officers of the societies involved, and to the chairman.

IN THE EDITOR'S POST

The Over Sixty-Fives

SIR,—To read in the Press of a shortage of scientists is like a red dawn to an angry bull, it enrages but there is nowhere to charge. If, sacked at 65, one applies to the Government for a post as Senior Experimental Officer, the reply is prompt and final 'in view of your age no further notice will be taken of your application.' A Government white paper recommending the employment of older men is, under these circumstances, like a red sunset to that same angry bull.

The biblical pessimist who said a man should not live beyond three score years and ten lived to be 120, and this latter may become the normal expectation of life, if medical science continues its present rapid progress. If this expectation eventuates who is to keep the over 65's for a further 55 years? Presumably the other 20 per cent of the population is judged capable of work.

It is natural that younger men should want the older ones out of the way to make room at the top for their promotion, and, no exhortation or white paper is of any value which ignores this human factor. A possible solution lies in a 'sine wave' salary. A married man with a family reaches his maximum financial responsibility about 40-45. Thereafter his family, one by one, become self supporting and he is able to take up golf.

It should be possible to pay a man's salary in proportion to his liabilities. The Government recognises the problem by making income tax allowances for children, but this is only fractional relief. If it became

general industrial practice that a man's salary reached its maximum at say 55 and then decreased, younger men would not be so eager to attend the funeral of their elders. By way of illustration, suppose a man reaches at 55 a salary of £1,000 p.a., by annual decrements of 2½ per cent he would be earning £750 p.a. at 65, and £500 p.a. at 75, which most fit men would prefer to retirement. If necessary, as compensation, some reduction in time could be made. For example, for salary workers working from 9 a.m. to 5 p.m. it could be arranged that from 55 to 65 their time would be 9.30 to 4.30, and from 65 to 75 from 10 a.m. to 4 p.m.

For factory workers, carrying out skilled operations or handling dangerous material, such as foundry men with molten iron, some other work might have to be found. Under some such scheme it should be possible for the over 65's to cough without meeting the hopeful gleam in their younger colleagues' eyes.

Yours faithfully,

E. J. LUSH.

London, S.W.19.

Overcoming Difficult Filtrations

By C. Chapman* & M. A. Phillips†

IT is frequently found that filtration of a crystalline magma, for example, of a sodium salt of an organic acid precipitated from a concentrated aqueous solution by ethanol, is difficult to filter using ordinary filter paper.

We have found that this can be overcome by using, beneath the filter paper, a pad of glass wool or better a disc of fibre glass about 1/16 in. thick. This device is very effective and in fact we have standardised on this for all filtrations and have made up a set of these discs for use with standard sized Buchner funnels. A great advantage of these discs is their chemical inertness and they are also very easy to clean. They should, however, be handled with care as there is a tendency for glass fibres to get into the pores of the skin; we do not think that there is any great danger of silicosis in their use. Fibre glass sheet can be obtained from Fibreglass Ltd., 63 Piccadilly, London, W.1

* Associated Fumigators Ltd.

† Dr. M. A. Phillips and Associates.

MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Spectrochemical Analysis

AT a recent meeting of the Midlands Society for Analytical Chemistry, held at the University of Birmingham, Dr. R. O. Scott, of the Macaulay Institute, Aberdeen, gave a lecture entitled 'Spectrochemical Analysis by the Porous Cup Solution Spark Technique.'

In spectrochemical analysis the sample, whether metal, a powder or a solution, is vaporised and excited by means of some source of energy such as a flame, an arc, or a spark. The radiation from this source is then passed into a spectrograph and this radiation or the resulting spectral lines are recorded on a photographic plate. The intensity of the spectral line of a particular element, as derived from the photographic plate, is related to the concentration of the element, and from standard samples of known concentration, a standard concentration-calibration curve can be prepared.

Two of the many causes of errors in spectrographic analysis are (i) differences in chemical and physical properties between standards and samples, and (ii) the non-uniform volatilisation of the sample for excitation. Different elements are thus volatilised at different rates depending on their boiling points.

Overcoming Errors

The first of these, the difference in chemical and physical properties, can be largely overcome by using a solution of the sample for which standards of almost similar chemical and physical properties can easily be prepared. The second difficulty, that of volatilisation of the sample prior to excitation, is not so readily overcome and almost the only method in which this has been successfully achieved is with flame methods of excitation in which a solution is first atomised and then passed through a flame. Thus, in flame methods both the difficulties mentioned have been overcome.

Unfortunately, flame methods are not very sensitive, and previous attempts to use solutions with more sensitive sources such as arcs or sparks have not proved reproducible, and have required complicated equipment not suitable on a routine scale. The porous cup solution spark method of Feldman ap-

pears however to be more promising in having high sensitivity, good reproducibility and uniform vaporisation of the elements. Another advantage is that the equipment is readily available in any spectrographic laboratory.

The porous cup method has been developed at the Macaulay Institute for the determination of trace elements in soil extracts, plant materials, and miscellaneous samples of agricultural interest.

The porous cup method consists of filling with solution a graphite or carbon cup. If graphite is used, the base of the cup has first to be made porous either by pre-arcing or sparking the empty cup, or by heating the end in a blowpipe or by heating the whole cup in a muffle furnace. The solution gradually seeps through the porous base and a spark is passed between the base and the lower electrode of graphite.

Carbon Cup Dimensions

At the Macaulay Institute the cups are made from 5.5 mm. diameter carbon rod and not from graphite. The bore is 3.2 mm. or $\frac{1}{8}$ in. diameter with a base thickness of 0.6 mm. The point of the drill is ground with a larger included angle than is normal, to help to prevent an air bubble at the bottom when it is filled with solution. The bottom electrode is a pointed carbon rod with a 70° included angle, the point being slightly blunted to about 0.5 mm. radius.

These electrodes are prepared in a small lathe which has been modified for the preparation of almost any type of electrode. The lathe is set up for making another type of electrode, but the main points are the lever tailstock for rapid drilling or shaping with the cutter head, a scroll type chuck in which the jaws close radially to the axis, and a clutch motor, which gives instantaneous stopping and starting.

The advantages of using carbon instead of graphite are that it requires no preburn to make it porous, and that it is much cheaper than graphite.

Traces of a few impurities in the rods themselves produce a very small blank which for most purposes can be neglected, although for certain purposes further puri-

fication of the cups can be achieved by refluxing with glacial acetic acid for sixteen hours in a Soxhlet extractor, a procedure which greatly reduces, for example, the calcium blank.

Variations in the electrode dimensions do not appear to be critical. Alteration in the thickness of the base of the cups hardly alters the line intensities or the intensity ratio, and produces a very small percentage error in the concentration of magnesium. However, a base of less than 0.4 mm. is readily punctured by the spark, and even at 0.4 mm. erratic results are found, caused by unequal seeping of solution from electrode to electrode through the very thin base. Thicknesses over 1.0 mm. similarly give erratic results and variations in the burning time. The normal thickness used at the Macaulay Institute is kept to 0.60 ± 0.01 mm., but this close tolerance is not really necessary.

Suitable Solutions

The solutions used may be acid, neutral, alkaline, or even organic liquids of low inflammability. For example, engine oils can be analysed for soluble metals by this technique. It has been found that solutions acidified with acetic, hydrochloric or nitric acids are the most suitable, the strengths of the acids being 2 to 4 per cent of concentrated acid on a volume basis. Certain types of solution may not wet the electrode, and in some applications a detergent is added to lower the surface tension. If the inside of the cup is pretreated with alcohol, immediately prior to adding the sample solution, more effective wetting is obtained and in one method this is used regularly.

The solution is filled into the cup by means of a long capillary pipette, the point of which is placed at the bottom of the cup and gradually withdrawn as the solution fills the cup. A little practice is required to avoid forming an air bubble, which on sparking will expand and eject the solution. Either a known volume of liquid, say 0.1 ml., can be burnt to completion, or the cup can be filled and a constant sparking time used for standards and samples. The electrodes are held in spring-clip jaws, or in a clip of a simpler type in the arc stand. The electrodes are easily adjusted with these clips, and they can readily be dismantled for cleaning.

To vaporise and excite the sample some

form of spark-like discharge is used. This can be either a high voltage spark of the Hilger type, or a low voltage pulsed discharge such as that obtained from the Multi-source or Pfeilsticker arcs. Both types of sources have been tried, a Hilger condensed spark and a unidirectional pulsed arc of the Walsh type. Similar detectabilities of the elements can be obtained with both sources when suitable electrical parameters are chosen for each source.

The full-wave condensed spark, however, is used at the Macaulay Institute for all porous cup methods, as it requires much less complicated equipment, and for most purposes is equally as good as, if not better than, the pulsed arc. The equipment is also much more readily available in any laboratory. If the discharge conditions in the spark gap are observed by an aerial pick-up on an oscilloscope, it can be seen that, while the solution is seeping through the porous cup, an unequal number of pulses are obtained on the two half-cycles.

As soon as the solution has all been used, the tone of the spark changes and an equal number of pulses are seen on the two half-cycles. This effect is used to indicate the end-point of the burn, and also as a check that the solution is seeping through the base of the cup in a normal manner. A bad burn, caused perhaps by an air bubble, or by suspended matter clogging the pores of the carbon, can be observed by the appearance of a 'dry cup' oscillogram.

Variation in the inductance of the spark circuit results in changes of the line intensities and of the background. Increase of inductance, to make the spark more arc-like, increases the intensities of arc lines and decreases the intensity of the background, but only slightly decreases the intensities of spark lines. With the iron arc line 3490 the relative intensity increases from 1.0 to 3.33, and the iron spark line 2753 changes from 1.0 to 0.50. The intensity ratio of a magnesium spark line to an iron spark line, however, is practically unchanged.

Elements Difficult to Excite

Elements such as antimony, arsenic, tellurium, and other elements difficult to excite, show the best detectability with the more spark-like conditions, and for any particular element there is probably an optimum condition. At the Macaulay Institute a compromise is taken and the full-wave spark

for both sets of porous cup equipment with about 0.03 mH inductance is used.

One of the causes of error in spectrographic analysis generally is non-uniform volatilisation of the elements. Partly to overcome this, but mainly for other reasons, what is known as an internal standard is now used, which may be an element already present in the sample, or which is added to the sample in a known amount.

For the analysis of a particular element the intensity ratio of the analysis line to a line of the internal standard is measured. To obtain good reproducibility of intensity ratios the internal standard should have, as well as other attributes, a similar volatility to that of the element being determined, and in practice this is usually rather difficult to achieve.

With the porous cup method, however, the spark is striking fresh solution of the sample during the exposure and elements of different volatility are not preferentially vaporised. Curves may be plotted showing the variation of the intensities of the lines of different elements with the time during the exposure. Such curves have all a similar shape, showing that elements even as volatile as arsenic and mercury are being vaporised at the same rate as copper and zinc. Thus it is not so important that the internal standard has the same boiling point as the trace element in this method.

Comparison of Detectability

A comparison has been made of the detectabilities of many of the elements under a standard set of conditions and those of Wilska and Feldman. The results obtained by the present author were with 0.1 ml. of solution in the cup, a Hilger full-wave spark, and the source, which was 20 cm. from the slit of a Hilger medium spectrograph, focused on the collimator by a lens in front of the slit. The solutions were generally in 2 per cent hydrochloric acid. Feldman and Wilska both used 0.32 ml. of solution, Feldman using 10 per cent sulphuric acid as the solvent and Wilska 3 per cent nitric acid.

The detectabilities were in good agreement, even when only 0.1 ml. of solution was used. Some of the differences can be explained by the different sources used. For example, Wilska, who had the most spark-like source, had the best detectabilities for As, Bi, Cd, Sb and Zn.

The detectabilities of most of the elements

lie between 0.1 and 10 ppm. Certain elements are much more sensitive, Be and Mg being of the 0.01 ppm. order which is equivalent to one thousandth of a microgram in the cup. The alkalis have poor detectabilities of about 100 ppm. Elements which are generally insensitive often have reasonably good limits of detection, such as those for As, Bi, Hg, P, Sb, Te and Zn.

These limits of detection can be lowered in several ways. The simplest is to use more solution, either by using a longer cup, or by increasing the length of an ordinary cup with a piece of rubber tubing, or by refilling the cup during an exposure. For a particular element or group of elements, change in the electrical parameters of the spark can increase detectability. Change in the external optics, by focusing on the slit of the spectrograph, or by bringing the source as near to the slit as possible without overfilling the collimator can also improve the limits. Selenium, for example, can be improved to better than 100 ppm. by using 0.4 ml. of solution and focusing the source on the slit.

Change in Line Intensities

As mentioned earlier, one of the main troubles in spectrographic analysis generally, is the changes caused in line intensities by differences in the chemical and physical composition of the samples and standards. In a solution method, chemical differences in composition can be easily eliminated by making the standards of a similar basic composition to the sample. Physical differences, such as viscosity, should seldom occur except perhaps in such cases as the analysis of oils of certain organic liquids, and in work using aqueous solutions there is no need to check on the effect of physical differences.

The effects of up to 1 per cent of Na, K, Ca and P on certain trace elements have been examined. Percentage errors were given, e.g. when a solution of 100 ppm. of arsenic in a 0.3 per cent Na solution was read from a standard arsenic curve prepared from solutions containing no sodium, 109 ppm. of arsenic were found, giving a percentage error of +9 per cent.

Even with 1 per cent of extraneous element present the maximum error is of the order of ± 30 per cent. Arsenic, for example, shows a positive error of 20 to 30 per cent with 1 per cent of sodium or calcium.

Bismuth is practically unaffected, while mercury shows a tendency to be depressed, which however may be due to variable precipitation of the mercury solutions. Phosphorus shows a fairly constant depression of 20 to 30 per cent, while cadmium and zinc are slightly depressed. On the whole, the errors caused by these extraneous elements are relatively small, as the standards employed for any particular analysis would be made to have approximately the same major composition as the samples to be analysed, and these effects would be almost entirely eliminated.

Similar results have been found with other trace and extraneous elements. A two hundred and fifty times excess of calcium over 2 ppm. of magnesium showed an error of only -1.6 per cent.

Crystallisation on Cup

A physical effect of solutions, which can be inconvenient, is the crystallisation or deposition of salts on the outside base of the cup, which tends to choke the pores of the carbon and cause the solution to boil. This effect appears to depend on the salt used, and occurs with 2 per cent of calcium present in the solution, or with about 2.5 per cent of sodium.

Initial interest in this technique at the Macaulay Institute was for the determination of magnesium in soil and plant materials. Magnesium, which is important in agriculture, is difficult to determine quickly in a large number of samples. Previously the Lundegardh flame spectrograph method was used, but it is rather unsatisfactory for magnesium as the sensitivity is not great and the accuracy is rather poor. The working range with the flame is from 5 to 100 ppm. of magnesium in the solution, which is not sufficiently low for the direct determination without concentration of magnesium in the acetic acid extract of soils. Magnesium is now determined directly in the acetic acid extract of soils, and also in plant ash solutions by the porous cup technique with a working range of from 0.25 to 10 ppm. in the solution.

For soils, 10 gm. of soil are shaken for two hours with 400 ml. of 2.5 per cent acetic acid. After filtration, 45 ml. of this is mixed with 5 ml. of an M/10 iron chloride solution as internal standard. This mixture is used for analysis. Standard solutions are made similarly in a 2.5 per cent acetic acid base

solution. For plant materials: 1 gm. of plant, after ashing and acid extraction, is diluted to 50 ml. A 2 ml. aliquot of this with 5 ml. of M/10 iron chloride solution is diluted to 50 ml. with 2.5 per cent acetic acid, and this mixture used for sparking.

The standard solutions for plant analysis are made up in a base consisting of KH_2PO_4 , K_2SO_4 , NaCl and CaCl_2 of appropriate composition.

A Hilger small quartz spectrograph is employed with a slit 1.5 mm. long, a 15,000 V spark source with a condenser of 0.001 μF capacity and an inductance of 0.02 mH. The carbon cups are 30 cm. in front of the slit with no lens. 0.1 ml. of solution is placed in the carbon cup and sparked till the solution has all come through, the end-point being observed on the oscilloscope, or by the change in the note of the spark. No pre-spark time is given. One recording is made on the plate for each of the twenty samples.

Since a small quartz spectrograph is used, line curvature makes plate calibration by a step sector difficult, and for this reason the plate is calibrated by means of a group of iron lines of known relative intensities. These iron lines are already in each spectrum since iron was added as the internal standard.

To carry out the photometry, the densities of the group of iron lines are read with a microphotometer in two of the spectra. The densities of Mg 2802 and Fe 2714 are then read in each of the spectra.

The characteristic curve of the plate is now drawn. This is a curve which relates the density read from the plate to the intensity of the radiation. This curve is obtained by plotting the density of the iron lines against the known log. relative intensities of these lines.

The Seidel Function

It has been found preferable to plot a function of density, known as the Seidel function, which straightens the curve, and makes its accurate drawing easier. From this curve the log. intensity ratio of Mg/Fe is now found corresponding to the Mg and Fe densities read on the microphotometer. The amount of magnesium in the sample is thereafter found from a concentration-calibration curve of log. intensity ratio against log. magnesium concentration which has been derived from spectra of standard solu-

tions. The whole calculation can be done very rapidly with the Respectra calculating board.

A detailed comparison has been made of the determination of magnesium in twenty-four samples of plant materials by three methods, the porous cup spark, the Lunde-gardh flame and the titan yellow colorimetric method. For a single reading by the porous cup method the reproducibility is ± 3.8 per cent, compared to ± 9.4 per cent for the flame, and ± 2.5 per cent for the colorimetric method. Normally with the flame, duplicate readings are used and this lowers the standard deviation in practice to ± 6.6 per cent. When the colorimetric method is taken as standard, the porous cup gives results 2.1 per cent low, and the flame 5.5 per cent high. However, it is exceedingly difficult to know which method gives the correct results, although the porous cup and the colorimetric methods give the best agreement.

This method for magnesium has been applied to milligram samples. For example, magnesium has been determined in a 2 mg. sample of a bacterial extract, using a similar method to that for plant materials but with smaller volumes of solution.

Another method which has been developed is for the determination of magnesium and manganese simultaneously in plant samples. It is necessary to use a medium spectrograph since the manganese line is not sufficiently separated from iron lines in the small instrument. The method is essentially similar to that described before, except that a stronger plant ash extract is used to obtain greater sensitivity for the low manganese content.

The line pairs used are

Mg 2790/Fe 2753 for 7.5-300 mg. Mg/litre, and

Mn 2576/Fe 2578 for 0.25-10 mg. Mn/litre. A step sector is used with the medium spectrograph and in this case the photometry is done by the blackening curve separation method using Seidel densities.

Copper & Zinc in Soils

Another application is in the determination of acetic acid-soluble copper and zinc in soils. This is a problem which for a long time has caused trouble, since the blank for copper after chemical treatment is liable to be much greater than the 0.5 to 5 micrograms of copper present in the extract. The

porous cup method now appears to be the answer.

The acetic acid extract from 12.5 gm. of soil is evaporated to dryness, treated with nitric acid to oxidise organic matter, and taken up in 10 ml. of a solution containing 250 ppm. of lithium and 25 ppm. of cadmium as internal standards. This solution is sparked in the porous cup.

Standard solutions of similar major composition and containing from 0.05 to 6.0 ppm. of copper and 2.5 to 300 ppm. of zinc are used to prepare the concentration calibration curves.

The lines used are Cu 3247/Li 3232 and Zn 2138/Cd 2144.

The last method to be described is that for the determination of boron. Traces of boron, as is well known, are not easily determined by any method. Spectrographically the main difficulty is the large amount of boron already present in ordinary grades of carbon or graphite. Boron-free carbon is available at a price—a price in the region of 5s. to 10s. per determination.

Boron-Free Cups

With ordinary carbon porous cups and counter electrodes the boron blank is relatively small, especially when salts are present in the solution, and is the equivalent of 1 to 2 ppm. B in the solution. This is still too great and special cups have been made, which consist of a tube of cheap carbon, to which discs of boron-free carbon have been cemented by means of Durafix. After drying, the base is drilled to give a base thickness of 0.50 mm. The counter electrode now in use is a rod of boron-free carbon, which is resharpened by hand with a pencil sharpener type of cutter. These cups and points, using about threepence worth of boron-free carbon per determination, show no visible boron blank.

The solution sometimes has initial difficulty in getting through the base of these cups, and as a routine procedure the inside of the cup is first wetted with alcohol, the excess is shaken out and then the sample solution is added.

So far these have only been used for the determination of boron in plants and fertilizers, again using standard solutions of similar major composition to the samples.

For plants, 1 gm. is treated with 0.1 gm. of calcium acetate to prevent loss of boron on ashing, and, after ashing, the ash is

gently extracted with 5 ml. of a solution containing 125 ppm. of Li in 4 per cent hydrochloric acid. This solution is used for sparking.

For fertilisers, a water extract of the sample is used, the concentration depending on the type of fertiliser. Boronated turnip fertilisers require a 1 per cent solution, while Chilean nitrates require a 5 per cent solution. After addition of the lithium internal standard solution, this solution is used for sparking.

The porous cup, with a rubber tube extension, is treated with alcohol, and then filled with about 0.3 ml. of the extract. A 10-second pre-spark time is given and a two minute exposure. The solution is not burnt to completion.

A step sector is employed, and the log-intensity ratio of B 2497/Li 3232 is found by the blackening curve separation method. The range is from 0.3 to 10 ppm. of boron in the extract.

Recovery values, when standard solution was treated as plant material, with drying, ashing and extraction, are all within ± 3 per cent.

Interesting Industrial Applications

An interesting industrial application is the determination of 20 to 50 per cent of zinc in brass, a method developed by Young and Berriman of the Admiralty laboratory. They used a medium spectrograph, a Hilger spark, graphite cups, and 0.1 ml. of a 1 per cent solution of the brass in hydrochloric and nitric acids. With a single determination of percentage standard deviation was ± 2.0 per cent and a 3 mg. sample was sufficient for duplication determinations.

A similar method was used by Scribner and Corliss for the determination of about 3 per cent of tin and zinc and 2 per cent of lead and nickel in bronze. A 1 gm. sample was dissolved in 4 ml. of concentrated hydrochloric acid and 16 ml. of concentrated nitric acid and diluted to 40 ml. This solution was sparked in a porous cup. Copper, the base metal, was used as the internal standard. They obtained very good agreement with chemical methods and much less erratic results than when the metal itself was sparked in a spectrographic method.

Another application is in the analysis of metals in new oils. Gambrill, Gassmann and O'Neill determined 0.01 to 0.2 per cent of phosphorus, barium, calcium and zinc

by filling the porous cup with the oil and giving a one minute exposure. No effects due to viscosity were found for oils in the range SAE 10 to 40, and only slight effects with oils of SAE 60 and upwards.

It is considered that any spectrographic laboratory would find this technique valuable for many miscellaneous problems as well as for certain routine determinations.

In the subsequent discussion, Dr. Scott remarked that the method would probably be unsuitable for the determination of magnesium in its alloys because the accuracy would not be sufficient.

The sensitivity of the magnesium determination is such that it is not necessary to focus on the slit with a small source.

The porous cup technique is not suitable for the determination of fluorine in plants. The discharge tube method has been used.

The method is being developed elsewhere for the determination of impurities in tungsten. Presumably it would be applicable if the trace elements were dissolved.

In conclusion, Dr. Scott acknowledged the work of several colleagues which had been referred to in the course of the lecture. Mrs. Johnston who developed the method for available copper in soils, Dr. Ramirez-Munoz, of Madrid, who worked at the Macaulay Institute for a period, and studied the extraneous element effects and Dr. Black for the earlier work on boron.

Irradiated Plastics

IN the House of Commons last Monday Mr. Ian Winterbottom (Nottingham Central) asked the Minister of Supply if he was aware of the great interest aroused in the US by the work of Dr. Charlsby at Harwell, on the effects of irradiating various plastics (including polythene, polystyrene and neoprene) in a nuclear reactor. (THE CHEMICAL AGE, 68, 632; 69, 743). The first inquiries had reached Dr. Charlsby in 15 days, and General Electric Co. of America at once took the discovery up and it was already in limited production. What licence fees were being paid by the American exploiters and what action was being taken to encourage British industry to use it?

Replying, Mr. Sandys said that patent rights had been applied for, and information was freely available to British industry which would be as quick off the mark as industry in the United States.

A New Flow Meter

Production of a Standardised Range of Instruments

IN the tradition of mercurial flow meters produced by George Kent since 1895 is their latest model, the 'KU,' just released by their design staff. Incorporating the most modern ideas in this field, it is the fruit of a concentrated design effort aimed at producing an even more thoroughly practical and highly accurate tool for industrial flow measurement and control. Moreover, it represents the first step in an important new policy of standardisation. This standardisation will embrace the 'presentation' mechanism, i.e. the case and front mechanism, including recording, integrating, indicating and automatic control systems of a new range of meters to be known as the 'Commander' class. The 'KU' is thus the first of the Kent 'Commander' class, and later additions to this class will use a variety of measuring elements.

The 'KU' meter is available for the recording, indication, integration, and automatic control of the flow of oil, water, air, gas, steam and most industrial liquids; and it works in conjunction with a Venturi tube, Dall tube or orifice in the fluid pipe-line. Its interchangeable mercury chambers are steel forgings, designed to receive maximum differential pressures of 25, 50, 100, 200, 400 or 600 in. of water (air-on-mercury basis). The 25-in.-head chamber withstands a test pressure of 500 psi., and all other chambers 4,000 psi., the maximum working pressures being 250 and 2,000 psi. respectively. Special joints are used on the chambers: the nuts can be tightened with the fingers to hold the full test pressure.

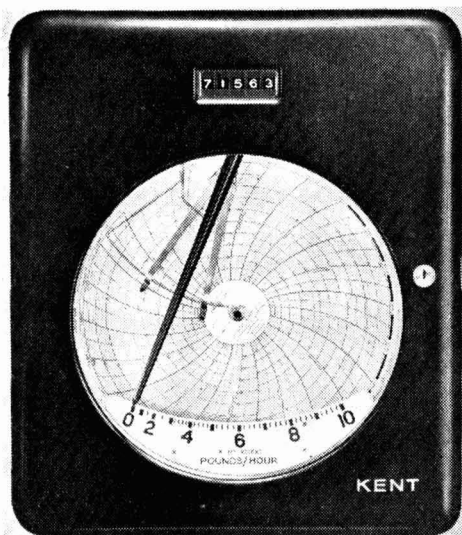
The new-design float (in the downstream chamber), subject of a patent application, rises for an increase in differential pressure. The extension of the U-tube is thus downwards, and the easily separable control head is a standard unit. Only a new upstream mercury chamber and U-tube are required for a range change, which can be made on site. An adjustable throttle valve in the downstream leg of the U-tube damps out the effect of a pulsating-flow characteristic. Streamlined over-load valves provide a safeguard against loss of mercury on excess or reverse loads. The control head includes two mild-steel forgings specially designed to

reduce the number of joints to a minimum.

The movement of the float is carried to the 'presentation' mechanism through a grease-packed, hat-leather-type gland, designed to reduce friction to a minimum. A jewel thrust bearing is provided for the gland spindle.

The presentation mechanism can accommodate up to two pens and a pointer, as illustrated, the second pen being for pressure measurement from a pre-calibrated Bourdon tube unit mounted in the case. Over-range protection is provided for the pens in both directions of movement. The pointer rotates on the same axis as the pens, indicating on a crescent-shaped, 8-in.-long scale. The pen is an integral part of the pen arm, the whole sliding easily in or out of an aperture on the pen spindle arm and automatically locating itself. Light and finely tempered, the pen arm maintains the correct pressure of the pen on the chart without being subject to any torsional movement due to frictional loads.

The charts comply with British Standard recommendations. The printing and layout have been arranged so that all relevant



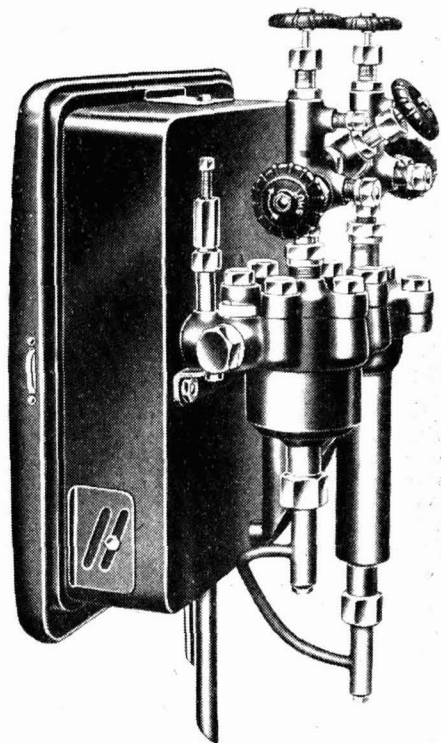
The 'Commander' class 'KU' flow indicator/integrator/recorder

figuring is the right way up when the chart is viewed, the flow variable increasing vertically and the time figures increasing to the right. The charts may be decimal or direct reading and for daily or weekly rotation, using a mechanical or electrical clock of British Standard type.

The integrator, electrically or mechanically driven, is a separate pre-calibrated unit. The entirely new electrical type has a large five-figure cyclometer counter, a range of up to 10:1, and a minimum step error, and is unaffected by vibration. The mechanical type uses a direct linkage to operate a tractor-wheel frame instead of the conventional cam, greatly reducing the power absorption from the instrument.

The case and door of the meter are aluminium die-castings, of British Standard dimensions, the case acting only as an envelope for the mechanism, which is mounted on a separate plate. With the door open, the mechanism is masked by two easily removable plates, the lower forming the platform for the chart and also carrying the meter data plate.

It should be emphasised that spare parts for those Kent instruments which the 'KU' meter will eventually replace, will be available for 10 years from the date of last sale of such replaced products. This is in accordance with Kent's standard practice.



Rear view, showing mercury chambers and control head

Standard Flow Symbols

THE British Standards Institution have just issued a revision of BS.974 'Symbols for use on flow diagrams of chemical and petroleum plant.' Since this British Standard was originally published in 1941, several other standards for graphical symbols in branches of engineering allied to chemical engineering have been issued. Certain discrepancies between corresponding symbols necessitated a revision of BS.974:1941.

The committee have taken into consideration the following British Standards:

BS.1553—Graphical symbols for general engineering.

Part 1. Pipes and valves.

Part 2. Power generating plant.

Part 3. Compressing plant.

BS.1646—Graphical symbols for instrumentation.

In addition certain British Standards which, though not yet issued, had reached

the final proof stage; a series of symbols submitted by the Ministry of Supply; and others used by various industrial organisations were reviewed. Those considered suitable were adopted or appropriately modified. In their selection the committee proceeded on the principle that, in order to keep the number of basic symbols to a minimum, only those symbols most necessary should be adopted, reduced to their simplest form, and be sufficiently pictorial to enable the units of the plant so represented to be readily recognised. The committee have endeavoured to avoid the use of any symbol which might be identified with a proprietary article. Symbols are intended to indicate the function of a unit of plant, although they may differ in shape from the form of construction of various types of such units all fulfilling the same purpose.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 3s. 6d.

Cast Iron Facts

A Varied Programme of Research by BCIRA

WORK during the past twelve months, and the research programme for the coming year, is described in the 32nd annual report of the British Cast Iron Research Association, published last month. The investigations being carried out fall naturally under ten headings.

The subversive effect of certain elements in the production of nodular structures containing magnesium has been studied further, and the beneficial effects of cerium have been confirmed. The influence of other elements has been investigated, and it has been found possible to produce nodular graphite structures with cerium-free mischmetal, in which the major constituent is lanthanum. Methods have been developed and published for the chemical analysis of several residual elements. Future work will include a study of under-cooled graphite, the solidification sequences in grey cast irons, and the influence of melting temperature on thermal arrests and structure.

Following the development of satisfactory apparatus and techniques, work on the influence of gaseous elements has made considerable progress. The most significant advance has been the recognition of the powerful carbide-stabilising effect of nitrogen. The nitrogen content is varied by treatment of the molten metal with such compounds as sodium ferrocyanide and calcium cyanamide, and the effect of nitrogen can be neutralised by the addition of a small amount of aluminium. A chemical method for the estimation of total nitrogen has been evolved and published. This work is to be continued.

Spectrographic Analysis

It is hoped to apply direct-reading spectrographic analysis (with the ARL quantumeter) to the estimation of carbon and phosphorus in cast iron and pig iron.

Work in progress on enamelling includes a study of the causes of blistering. Briefly, it appears that the trouble is caused by the evolution of gases from interaction between graphite, iron oxide, and the enamels.

The determination of load/deformation curves for various types of moulding and core sands has continued, and the physical properties of sand at elevated temperatures

are to be studied. The Association has constructed a suitable apparatus for making shell moulds, and is to consider developments in this field.

Impact Properties Studied

Work has been carried out on the impact properties of nodular cast irons with varying silicon and phosphorus contents, and the embrittling influence of these elements demonstrated. It has been shown that the results can be interpreted in terms of two transition temperatures, one related to the energy required to propagate a crack, and the other related to the energy required to initiate a crack. Future investigations will include a study of the factors influencing temper embrittlement in ferritic nodular and blackheart malleable irons, and of the influence of sulphur on the transition temperature of whiteheart malleable cast iron. The advantages of a balanced S/Mn content in whiteheart malleable have been demonstrated, and work on the influence of hydrogen in the annealing atmosphere on the rate of graphitisation of blackheart malleable has been completed.

Research on soundness has been mainly concerned with changes in mould dimensions when the molten metal is poured in, and future work includes a study of methods of limiting mould cavity dilation.

The effect of casting temperature on chill formation has been studied, and it has been shown that the slower the rate of cooling of the melt to the casting temperature, the deeper is the chill. The characteristic effect of casting temperature was not obtained with low sulphur contents, and oxygen has been shown to have little or no effect on chilling tendency. The influence of other residual elements will be investigated.

The most striking development during the year has been the work on the control of respirable dust from pedestal or stand grinding wheels. The coming year's programme includes the industrial development and application of an extractor unit.

The operational research section will investigate factors influencing foundry productivity in relation to nature and output of product, equipment, layout and planning.

Rotary Economiser

New & Improved Developments Incorporated

MESSRS. Simmon (Engineers) of Vienna have, during recent years, been experimenting with new and improved developments of rotary economisers which have now been incorporated into their models.

Their rotary economiser is an induced draught fan with impeller constructed from copper gilled tubes forming a heat exchanger and used for pre-heating the boiler feed water. It forms a self-contained unit which is far smaller than the cast iron tubular economiser of the type used hitherto and of the same duty. It can be placed in any convenient position in the main flue between the boilers and the chimney base, without any brickwork setting.

The feed water flows through the hollow impeller entering the rotary economiser through one end of the hollow shaft and is discharged at the other end. The ends of the shaft are fitted with special glands.

Deposits Prevented

Due to the high speed of the impeller no soot or fly ash is deposited on the copper tubes or gills. Provision is however made for easy cleaning of the heating surface, both internally and externally.

The inside of the heat exchanger tubes can be examined by removing screwed plugs which are fitted in junction boxes on the tube elements. The unscrewing of a few plugs is quite sufficient for flushing the total number of heating elements for chemical descaling and a further advantage is the fact that by lifting the top part of the casing the whole of the heating elements are freely exposed for examination.

The 'Simmon' economiser is built for very high working pressures and temperatures. In addition to the big advantage of the utilisation of waste heat from boilers and industrial furnaces the economiser will solve many difficult problems because its installation does not necessitate increased chimney draught. It does not offer any resistance to the flow of the flue gases and generates its own draught, being an induced draught fan and economiser in one.

The power consumption is surprisingly low and the drive can be arranged to suit the local conditions

Due to the small water content, the rotary economiser tends to balance the working conditions. With increased boiler load and higher flue gas temperature, the boiler feed water is automatically heated to a higher temperature, thus reducing the boiler load.

Grit arresting equipment can also be incorporated when required with little further expense and without very much additional space requirements. The scroll of the rotary economiser is then used for grit separation and a grit collector is installed in any suitable position. This combination of economiser with induced draught fan and grit arrester will be specially welcome in many instances.

There is a wide field of application for use in boiler houses and also for waste heat boilers especially as the economiser can be fitted into new or existing installations.

The 'Simmon' rotary economiser, already well known on the Continent, is now represented in this country by Heat Economy Ltd. (13-21 Hoxton Street, London, N.1).

Plastic Pipe-lines

Experiments in the use of rigid extruded plastic instead of steel in construction of pipelines for oil and gas are being conducted in Alberta. For oil transport, a test is being made with a 1,000-foot section made from PVC produced in Canada by Canadian Resins & Chemicals Ltd., and by the Monsanto company. According to a recent report in New York the first cross-country oil pipeline made entirely of plastic has been put into operation over a 9-mile stretch in the Williston Basin, in Montana. The line is moving 2,500 barrels a day under pressure of 90 psi. Made of Tenite butyrate plastic, the extruded pipe is said to weigh only 13 lb. per 20 ft., compared with 153 lb. for the same length of steel piping.

Sprouting Control

Thirteen of Hawaii's 28 sugar plantations are reported to be experimenting with maleic hydrazide to control first-season tasseling.

Disintegration Plant

Range of Reitz Equipment Going Into Production

FOLLOWING the first appearance in this country of the Reitz laboratory angle disintegrator—shown at the recent Chemical Plant Exhibition—George Scott & Son (London), Ltd., announce that they are going into production with a range of Reitz equipment. This will comprise the two versions of the disintegrator (the laboratory angle and the vertical, both operating on the same principle), the 'Pre-Breaker' and the 'Thermascrew.'

The disintegrator gives an even particle-size reduction and separation of any material into a primary and a secondary product. It can be used for crushing, grinding, pulverising, pulping, shredding, triturating or defiberising. Alternatively, it can effect continuous and intimate combining or integrating of solids and liquids or combinations of either, for homogenising, blending, dispensing, beating, dissolving or mixing.

Direct Drive Motor

A self-contained direct drive motor is mounted above and directly coupled to a vertical shaft which is supported top and bottom by heavy duty ball-bearings. The rotor, carried on the shaft, comprises a number of arms, each having a broad face or hammer of manganese or stainless steel, hardened on the leading edge. A perforated, heat-treated carbon steel screen completely surrounds the swept area of the rotor. The heavy cast-iron body supports the shaft, while the differential discharge pans are carried below the body.

The material is introduced to the machine at the top of the shaft above the rotor, which is revolving at high speed. Centrifugal force throws it outwards against the screen. The action then taking place may be described as a combination of a centrifuge and an attrition mill. The primary product is forced through the screen and out through the main discharge. The secondary product remains inside the screen and is passed out through the secondary discharge. A variation in screen size is obtainable to give smaller or greater particle size, as required. The machine is capable of handling wet, sticky materials continuously without clogging.

The vertical type can be obtained in a range from 5 to 400 hp., with rotor diameters from 8 in. to 24 in.; the angle type ranges from one-half to thirty hp., with rotor diameters from 4 in. to 12 in.

Where material is too large to be fed directly into the disintegrator, a 'pre-breaker' should be placed in the disintegrator feed line. This pre-breaker, utilising high torque at relatively low speeds, can crush and break a variety of materials such as wood, cork, ore, pulp board, and asbestos shingle scrap. It is gravity-fed through a large hopper, and deflectors carry the material horizontally through a series of stationary anvils and rotating hammers which break it up before it enters the disintegrator.

Simple in construction, all parts are readily accessible for cleaning. It is non-clogging, and, due to the unique method of utilising torque, it requires less power. There is a range of sizes, from 6 in. to 18 in. diameter rotor. Lengths are from 30 to 48 in., and power units from one half to 100 hp.

The Reitz 'Thermascrew' is a screw type conveyor with hollow shaft and screw and jacketed trough. Heating or cooling medium is circulated through the hollow portions, while material passes through the 'Thermascrew,' contacting both jacket and screw. When operating as a batch heat exchanger, it functions as a jacketed kettle or ribbon mixer, with a hollow single or twin rotor. It can be fitted for vacuum drying and evaporating or with a supplementary air feed for drying, heating, or cooling.

For continuous operation, the range is from a 9 in. to 24 in. screw diameter, with effective lengths from 12 ft. to 20 ft., while the power required varies from one half to 5 hp. Batch operated 'Thermascrews' have a 16 in. screw, a length of 12 ft. and a 5 or 10 hp. motor.

Plastics Exposition Arranged

The sixth American National Plastics Exposition will be held in Cleveland, Ohio, for one week from 6 June, 1954. The exposition is sponsored by the Society of the Plastics Industry, Inc.

Indian Explosives Project

Government Agreement with I.C.I.

AS a result of agreements reached between Imperial Chemical Industries Ltd., and the Government of India, a new company is to be established in India to manufacture the country's requirements of commercial blasting high explosives. The company will be known as Indian Explosives Ltd. Initially, Rs.2 crores (£1,500,000) of capital will be issued, of which 80 per cent will be subscribed by I.C.I. and 20 per cent by the Government of India. The balance of the capital required will be met by loans.

A site has been selected for the factory near the Bihar coalfield, the coal mining industry being the principal consumer of industrial explosives in India. I.C.I., through their Nobel Division, will be responsible for planning the layout of the works and providing designs for the plant and equipment, and will be responsible for its erection and setting to work. I.C.I. will also provide all the technical knowledge required to operate the factory, as well as information on research. I.C.I. will provide initially all management staff required and a number of key workers. The factory will give direct employment to about 400 persons in all. I.C.I. has undertaken to train Indians to take over responsible positions.

By agreement with the new company, I.C.I. (India), who have been acting as agents in the import of explosives manufactured by I.C.I. in the United Kingdom, will handle the distribution and sales of Indian-manufactured explosives. I.C.I. (India) will operate the extensive series of magazines which they own throughout the country and will continue to give the technical service to which consumers in India have become accustomed. I.C.I. (India) will also act as secretaries to the new company.

KID Additions

THE Board of Trade have made the Safeguarding of Industries (List of Dutiable Goods) (Amendment No. 5) Order, 1953, adding the following nineteen chemicals to the list of chemicals liable to Key Industry Duty:—

2-Amino-5-diethylaminotoluene; 2-amino-5-diethylaminotoluene hydrochloride; 2-amino-5-diethylaminotoluene oxalate; 2-amino-5-diethylaminotoluene sulphate; 2-

amino-5-diethylaminotoluene sulphite; ammonium 4-chloro-2-methylphenoxyacetate; azobenzene-4-carboxylic acid; azobenzene-4-carboxyl chloride; *p*-*tert*butylphenol; 7-chloro-4-(4-diethylamino-1-methylbutylamino) quinoline diphosphate; 8-chlorotheophylline; cortisone acetate; 1,2-dichloropropane; diphenylmethyl cyanide; di-*n*-propylene glycol; 5-nitrofurfuraldehyde semicarbazone; pimelic acid; potassium 4-chloro-2-methylphenoxyacetate and sodium 4-chloro-2-methylphenoxyacetate.

The Order, which came into operation on 9 November, is published as Statutory Instruments 1953, No. 1951. Copies may be obtained (price 2d. net, by post 3½d.) direct from HM Stationery Office, Kingsway, London, W.C.2, and branches, or through any bookseller.

It is not intended to make any change in the present arrangements under which cortisone acetate is imported solely on behalf of the Ministry of Health and the consequential amendment to the Open General Licence has been made with effect from 9 November.

Injunction Granted

AN injunction restraining John Summers & Co., Hawarden Bridge Steelworks, Shotton, Flintshire, from discharging cyanide effluent into the Dee estuary, was obtained in the Chancery Division last week by six owners of Dee salmon fisheries. It was said that at least 1,000 salmon had been poisoned. The hearing lasted eleven days.

The fishery owners, who also claimed damages, asserted that in addition to the last spring run of salmon being substantially destroyed by effluent from the works, it also killed many smolts migrating to the sea.

Defendants maintained that before the writ was issued they had begun certain alterations to the plant. The alterations, since completed, were designed to remove cyanide from the effluent or to prevent a quantity injurious to fish from reaching the estuary.

Mr. Justice Roxburgh said that when the defendants began discharging the effluent from their new plant into the estuary they were embarking upon a dangerous experiment with poison without due consideration, but when they discovered what was happening they acted with considerable despatch. Granting the injunction, he said there would be an inquiry as to damages.



The Chemist's Bookshelf

STRUCTURE AND MECHANISM IN ORGANIC CHEMISTRY. By Professor C. K. Ingold. G. Bell & Sons, Ltd., London. 1953. Pp. x + 828. £3 17s. 6d.

It is a stimulating experience for the chemist to hear one of the most eminent of his profession speak on the topic which has held pride of place in his researches over a period of many years, particularly when these researches have been of fundamental importance in the development of general principles in so vast a field as organic chemistry. One such privilege was enjoyed, some three years ago, by the students of Cornell University, when Professor Ingold, in his capacity as the George Fisher Baker Non-resident Lecturer, delivered a course of lectures on reaction mechanisms in organic chemistry. The many thousands of chemists who would have liked to have attended these lectures now have the opportunity of reading about them in Professor Ingold's new book, entitled 'Structure and Mechanism in Organic Chemistry.'

With the aid of a number of distinguished colleagues, duly acknowledged in the preface, he has collected, sifted and moulded a vast amount of information from the literature into a most scholarly and lucidly written treatise, in which modern concepts are presented against their historical background. It is not necessary to wade through pages of almost unintelligible mathematical treatments, for the author has been content to provide verbal pictures of what is entailed in such processes, and has then given clear statements of the conclusions to which they lead. Thus the non-mathematician is able to see why it is that the covalent bonds of carbon are distributed tetrahedrally, instead of being obliged merely to accept the assurances of his more mathematically-minded colleagues.

The main emphasis of the book is on reaction mechanisms, principally homogeneous, rather than on structures, and the size of the volume is kept within reasonable bounds by a policy of judicious selection. The opening chapter deals with concepts of valency, which are presented first of all from the classical

viewpoint, then interpreted in terms of quantum mechanics and atomic and bond orbitals, and finally correlated with the stereochemistry of single covalent, olefinic and acetylenic bonds. Thereafter chapters are devoted to interactions between, and within, molecules, to physical properties of molecules, to the aromatic nucleus, and to a classification of reagents and reactions. Thus the stage is set for detailed studies of selected types of reactions, involving substitutions, additions, eliminations and rearrangements.

The book has been written chiefly for the university student, but there can be very few graduate chemists who would not derive great benefit, and at the same time real pleasure, from its carefully-chosen words. A particularly valuable feature of the book is its many tables and diagrams, which provide useful summaries and clarifications of the main arguments. Although there is no doubt that well-thumbed copies of 'Ingold' will be consulted for many years to come by undergraduates, the beginner will probably find the opening chapters rather formidable, and will only really begin to appreciate them during the final year of his Honours Course. —E.J.B.

THE FURANS. By A. P. Dunlop and F. N. Peters. Reinhold Publishing Corp., New York; Chapman & Hall, London. 1953. Pp. xix + 867. £7 4s.

The manufacture of furfuraldehyde from oat-hulls was pioneered by the Quaker Oats Company in America in the 1920's, in an attempt to utilise an embarrassing by-product from their factories. Furfuraldehyde and derived chemicals have applications in almost every industry, and the growing demand has outstripped supplies based on oat-hulls; today, the bulk of furfuraldehyde is produced from corn-cobs. This monograph on furan chemistry fills a gap in chemical literature; it is appropriately written by two senior executives of the Quaker Oats Company.

The first part of the book is devoted to

the aromatic furan derivatives, which are systematically surveyed in fifteen chapters occupying 707 pages. The alkyl, alkenyl and aryl furans are discussed first, then halogen and nitro derivatives, then alcohols, carbinols, amines, aldehydes (including furfuraldehyde), ketones, acids, and esters. There are useful chapters on the structure of the furan ring, on hydrolytic and ammonolytic cleavage of furans, and on their catalytic hydrogenation. Condensed furan ring systems, dihydrofurans, and tetrahydrofurans have been omitted deliberately. Each chapter contains valuable sections in smaller type in which details of individual compounds are summarised.

The second part of the book comprises 76 pages, in which the technological applications of furfuraldehyde and its derivatives are surveyed. In this large field (in which there are about 3,500 patents) it has been necessary to make a critical selection from the available information. Topics covered in-

clude application as synthetic intermediates, as solvents, and for making plastics and resins. The polyfurfuryl alcohol resins are particularly valuable constructional materials for chemical plant. Patents in the furan resin field are listed in an appendix (31 pages).

The book is an American Chemical Society Monograph, and conforms to the high standards expected in that series. The book is rather bulky; the use of thinner paper would have given a book of easily manageable proportions. Literature references are very full to the end of 1950, and there are some references to even later work.

The price is very high; nevertheless, all scientific libraries should possess a copy of this book, which provides an enormous fund of information for the organic chemist in industry or the university, and contains much to fascinate and instruct the advanced student or teacher.—W. WILSON.

OEEC Frees Nickel

Common List of Restrictions Suspended

THE Council of the Organisation for European Economic Co-operation has decided to suspend forthwith the common list of restrictions in the use of nickel, nickel alloys and nickel-plating, and the application of measures limiting the use of nickel in case-hardening and constructional steels. Member countries are at liberty to decide whether to suspend or maintain restrictions on the national level in accordance with their own requirements.

This action follows a decision by the International Materials Conference that allocation of nickel should cease on 30 September, the gap between supply and demand having narrowed sufficiently to permit such a step. The Canadian Government had already announced the abolition of all major controls, and the US had decided to revoke its own controls on 1 November. Since these two countries together consume some 70 per cent of the available world supplies of nickel, a new situation in Western Europe was created, which justified the new decision.

Since the above information was issued, it has been announced that all restrictions on the use of nickel in this country have been removed by the Board of Trade and the Ministry of Supply with effect from 6

November. Copies of the revoking Orders—the Nickel Prohibited Uses (Board of Trade) (Revocation) Order 1953, S.I. 1953 No. 1605, and the Nickel Prohibited Uses (Minister of Supply) (Revocation) Order 1953, S.I. 1953 No. 1607—are now obtainable at HM Stationery Office. The Minister of Supply has withdrawn the Alloy Steel Directions restricting the use of nickel in the manufacture of alloy steels.

Information on Plastics

WHAT is believed to be a unique service operated by a trade association on behalf of its members is reported on by the British Plastics Federation. Its information bureau, founded nine years ago to provide technical information on plastics, is now dealing with more than 5,000 inquiries a year. The library includes almost all technical journals from all parts of the world dealing with plastics. As part of the information service these journals, now numbering 150, are regularly abstracted. The abstracts are classified for reference, and are also published and circulated by subscription. Twelve monthly issues are published in two forms—printed on one side only, or printed on both sides. The charge is the same for each—£10 10s. a year post free—and they are obtainable from the Federation offices, 47 Piccadilly, London, W.1.

HOME

French Professor as Guest

Nottingham University has invited France to send a professor as a guest to work for a month or so in their Department of Pharmacy in order that he may familiarise himself with their programme and teaching methods.

Tungsten Ore Cheaper

The official UK selling price for tungsten ore has been reduced by 25s. a unit to 245s. for wolfram and 230s. for scheelite. Since mid-September there has been a series of reductions, bringing the prices down in all by 82s. 6d. a unit.

UK Uranium

Replying to a question by Mr. G. Nabarro in the House of Commons on Monday, the Minister of Supply, Mr. Duncan Sandys, said that although pockets of uranium ore occur in many places in Cornwall, the quantities so far found would not justify the expense of mining and treatment. The Government's decision to rely on uranium from overseas was therefore not a question of policy, but of necessity.

Antimony Prices Down

Associated Lead Manufacturers Ltd. announced this week that it has reduced its prices for antimony and antimony products. Oxide is down by £5 a ton, metal by £15, and crude and black powdered antimony by £10 a ton.

Steel Production

October steel production in the UK reached the record total of 355,000 tons a week, compared with an average of 327,800 tons a week during October, 1952. Pig iron production was also at a record level, averaging 221,500 tons a week as against 204,200 tons a week in October last year.

Extensive Price Reductions

Vinyl Products Ltd. have announced extensive price reductions in their range of Vinamul emulsions based on polyvinyl acetate and polymethacrylate resins, and many of their Vinalak polymer solutions. These became operative for all deliveries on and after 2 November, 1953, and were made as a result of larger polymerisation plant becoming operative at Carshalton, Surrey.

Lactic Acid Prices

The list of British Chemical Prices in THE CHEMICAL AGE on 31 October (p. 926) gave lactic acid prices as follows:—Dark tech., 44 per cent by weight, £74 per ton ex-works 1-ton lots; dark chemical quality, 44 per cent by weight, £102 per ton. Bowman Chemicals Ltd., Moss Bank Works, Widnes, have asked us to amend these figures to £67 and £109 respectively.

Dalton Exhibition

The Royal Institute of Chemistry announces that the Dalton Exhibition on 'Measurement, Use & Application of Radioactive Substances' will be held in the gas showrooms, Town Hall, Manchester, on 26-27 November. On the latter day the eighth Dalton Lecture, 'The Development of Radiochemistry & Radiation Chemistry,' will be delivered in the Town Hall by Sir John Cockcroft.

Drug Standardisation Lecture

A special meeting of the Biological Methods Group of the Society of Public Analysts and Other Analytical Chemists will be held at 8 p.m. on Thursday, 19 November, 1953, at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, when Dr. Chester I. Bliss, of the Connecticut Agricultural Experimental Station, Newhaven, USA, will give an address entitled 'The Standardisation of a Drug in Production as Illustrated by Adrenal Cortical Extract.' Visitors will be welcome at the meeting, and it is hoped that as many as possible will avail themselves of this unique opportunity.

Co-operative Petrol Refinery

The International Co-operative Petroleum Association is planning to establish a refinery either in the United Kingdom or Western Germany to meet the oil needs of co-operative societies in Western Europe, said Mr. Tom Naudet, director of technical research, ICPA, when speaking recently in Glasgow. He also indicated that it was planned to open an office in London to facilitate operations in sterling and so avoid the complication of dollar operations. The ICPA now has five refineries at work and more than 1,000 oil wells in active use and is marketing its output in 15 countries.

OVERSEAS

Malayan Tin Shipments

Malayan tin shipments in October totalled 5,379 tons, compared with 4,727 tons in September, making the total for the first ten months this year 52,471 tons, compared with 54,421 tons in the corresponding period of 1952.

Indian Oil Discovery

The most intensive programme of oil exploration yet undertaken in India is to be carried out in the next few months in the Brahmaputra Valley of Assam, according to a statement by the Assam Oil Company. This new assessment of the valley's petroleum possibilities has been decided upon as a result of the recent discovery of oil near the main Digboi oilfield.

Brazilian Plants Erecting

The Nitro Quimica Brasileira Cia. is to erect a number of chemical plants in Brazil with technical aid supplied by Italian companies. Plants already under construction include an aluminium foundry with an output planned at 30 tons per day; a nitric acid works (15 tons); a synthetic ammonia plant (25 tons); PVC plant (6 tons); a urea unit (25 tons); a sodium sulphide plant (2 tons); and a liquid chlorine works (8 tons).

Anglo-Argentine Trade Protocol

Informed quarters in Buenos Aires are quoted as expressing the belief that the 12-months' Anglo-Argentine trade protocol signed there on 31 December last year would probably be extended for six months, thus closing a six-months' gap between the protocol and the five-years' commercial and financial treaty between the two countries.

Canadian Potash

The right to develop Canada's only known commercial deposit of potash has been given to the Potash Company of America, who have agreed to spend more than \$3,000,000 on installations and improvements at Patience Lake, Saskatchewan. Mr. Brocklebank, Minister of Resources, has announced that the Provincial Government has signed an agreement with the American company giving them a three-years' permit to continue prospecting on 100,000 acres east of Saskatoon.

South African Titanium Discovery

Investigations following the discovery last year of titanium deposits at Morgan Bay, 40 miles north-east of East London, South Africa, have shown that Morgan Bay has one of the richest concentrations of titanium in the world.

USA Lead & Zinc Duties

The USA Tariff Commission has been asked by the National Lead & Zinc Committee to recommend that duties on lead and zinc imports be increased by 50 per cent over the rates fixed on 1 January, 1945. Mr. O. Herres, chairman of the committee, claimed that the USA lead and zinc industries were being put out of business by excessive imports.

Rubber for China

A Washington message states that officials of the Foreign Operations Administration said that the USA was greatly concerned at the Indonesian decision to resume the sale of rubber to Communist China. This type of trade, it was pointed out, conflicted directly with the United Nations' embargo on strategic materials to the Chinese Communists.

Japanese Fibres Rapid Expansion

Plans to increase Japan's acetate fibre production 16-fold in the next five years have been announced by the Ministry of International Trade and Industry and five acetate firms; production of 48,000,000 lb. of fibre by 1958 is planned. The Mitsubishi Company is reported to be negotiating with the Celanese Corp. of America for technical assistance contracts. Equipment will be purchased from the US, Switzerland, and Germany.

Mercaptan from Waste Gases

Methyl mercaptan is to be produced from hydrogen sulphide in refinery waste gases by a newly formed American company, Thiochemicals Inc., of Port Arthur, Texas. Arrangements have been made with a nearby oil refinery to pipe waste gas to the plant, and the product will be sold to food manufacturers, who will synthesise methionine for incorporation in food-stuffs.

PERSONAL

The Nobel Prize for Chemistry has been awarded to PROFESSOR HERMANN STAUDINGER, of Freiburg University, for his discoveries in macro-molecular chemistry. Professor Staudinger's work has been concerned with many aspects of organic chemistry, but particularly with the structure of the linear polymers. By the application of physico-chemical methods he has elucidated the composition and structure of such molecules as polystyrene, polymerised formaldehyde, and cellulose, and examined the properties of rubber. He has had a wide influence, not only through his own researches, but also as a teacher. Born in 1881 at Worms, he became head of the organic chemistry department of Karlsruhe Chemical Institute in 1907, and in 1912 was appointed to the chair of chemistry at Zurich Technical High School, where he remained until 1926. He then went to Freiburg, where he is now head of the research institute for macromolecular chemistry.

DR. C. L. WILSON, Reader in Analytical Chemistry, Queen's University, Belfast, and chairman of the Belfast Section of the Royal Institute of Chemistry, has just returned from a four or five days' visit to Holland where he delivered several lectures on ultramicroanalysis to the students of analytical chemistry in the Technische Hoogeschool, Delft, at the invitation of the Dutch Ministry of Education. The Technische Hoogeschool has a highly developed school of microchemistry, both in teaching and research, under the direction of PROFESSOR C. J. VAN NIEUWENBURG, who, until recently was the President of the Analytical Section of the International Union of Pure and Applied Chemistry.

MR. LORING E. HARKNESS, Jr., has been appointed chief industrial Engineer of the Plastics Division of Celanese Corporation of America. The department will be engaged in co-ordinating efforts to improve the efficiency of the manufacturing operation of the plastics plants. Mr. Harkness, recently with Dan River Mills Inc., was also associated with Aluminum Company of America for many years.

MR. L. A. DAVIES, who has been a director of J. M. Steel & Co., Ltd., since 1938 and has served the company in all for a period of over 51 years, retired on 31 October. To mark the occasion a silver salver was presented by the directors and staff of the company as a token of their esteem and in appreciation of his long and loyal service.



MR. JOHN H. LAWRENCE, managing director of Jenolite Ltd., left this week for a tour of India, Malaya, Australia, New Zealand and the USA, his main object being to open up new markets in India and Malay and to visit Jenolite distributors in Sydney, Auckland, San Francisco and in Cleveland (Ohio). Mr. Lawrence will also try to obtain US Government approval for new processes in America. At the same time Jenolite Ltd. announce the appointment of new agents in British North Borneo, Brunei State and Sarawak. They are Ker-Lindsay (Far East) & Co., of Kuala Belait, Brunei State, British Borneo.

MR. G. T. RANDAL DAVIES, M.P.S., overseas marketing manager of Evans Medical Supplies, Ltd., left by air this week to survey the market for ethical products in a number of countries in Central and North America and in the Caribbean area. He will visit Evans Medical's agents in Mexico, El Salvador, Guatemala, Nicaragua, Panama, Venezuela, Colombia, Peru, Cuba, Trinidad and Jamaica, and plans to return to the UK towards the end of January.

MR. TONY ABEL, a paint manufacturing chemist, of St. Annes-on-Sea, was married on 7 November to MISS SHIRLEY MITCHELL SCOTT, an orthopaedic physiotherapist at Bradford Royal Infirmary, daughter of Mr. and Mrs. C. Scott, of Wayside, Sunnyridge Avenue, Pudsey.

We have been asked to add the name of MR. H. H. LUSTY (Bakelite Ltd.) to the list of members of the British Plastics Federation Publicity Committee which appeared in THE CHEMICAL AGE on 7 November (p. 979).

The following awards of medals have been made by the Royal Society:—the Copley Medal to PROFESSOR A. J. KLUYVER, For.Mem.R.S., for his distinguished contributions of a fundamental character to the science of microbiology; the Davy Medal to SIR JOHN LENNARD-JONES, K.B.E., F.R.S., for distinguished work on the applications of quantum mechanics to the theory of valency and to the analysis of the intimate structure of chemical compounds; and the Hughes Medal to SIR EDWARD BULLARD, F.R.S., for important contributions to the development of the physics of the earth.

MR. H. EARLE THOMPSON has resigned as vice-president of the Carbide and Carbon Chemicals Company, New York, in order to devote his full time to his responsibilities as vice-president (engineering), Union Carbide and Carbon Corporation. At the same time, MR. J. G. DAVIDSON, president, Carbide and Carbon Chemicals Company, announced that MR. L. J. BOWDITCH, vice-president, Carbide and Carbon Chemicals Company, will take up the responsibilities relinquished by Mr. Thompson and will have under his direction all construction and design for the company.

The contribution made by MR. W. H. HENMAN to the British non-ferrous metals industry was acknowledged last week at a complimentary dinner in Birmingham, when fellow-members of the British Non-ferrous Metals Federation presented him with a canteen of cutlery and a pair of binoculars. MR. H. E. JACKSON, federation president, said Mr. Henman began as a chemist with Henry Wiggin & Co. in 1900, later becoming works manager. In 1919 he was appointed managing director of Headley Birch and after this firm was merged with John Wilkinson & Co. in 1920 he became managing director and chairman of both companies. He was president of the federation from 1949-1951; chairman of the Nickel Silver Association for ten years; member of the executive committee of the Cold Rolled Brass & Copper Association from 1923-1953 (including four years as chairman); and a

member of the council of the British Non-ferrous Metals Research Association. He was a Fellow of the Institution of Metallurgists and of the Institute of Metals.

MR. EDWARD CLAYTON, of Hyde (Lancs), is the first employee to complete 50 years' service at I.C.I. (Leathercloth Division), Ltd., Hyde. He has had awards for 25, 30 and 40 years' service, and now a special gift has marked his half century.

MR. DEREK PAGE, a 26-years-old chemist, of Lymm, has been adopted prospective Labour candidate for the South Fylde Parliamentary Division.

Obituary

The death has occurred of MR. TURNER EWING, M.A., D.S.O., for many years a prominent figure in Scottish industry. Until his retirement ten years ago, he was senior partner in Duncan, Flockhart & Co., chemical manufacturers and chemists, of Edinburgh. He filled many posts with distinction, including a period of service as Master of Edinburgh Merchant Company.

MR. ROBERT A. WITHERSPOON, former chairman of the executive committee of Shawinigan Chemicals, Ltd., and a pioneer in the building of Quebec's electro-chemical industry, has died at the age of 76. Born in Rochester, N.Y., he graduated from the University of Rochester and began his career as a laboratory boy. In 1900 he was appointed an electro-chemical engineer with the United Barium Company in Niagara Falls, N.Y. Four years later he became superintendent of the Shawinigan Carbide Company, which later became the Canada Carbide Company and eventually the carbide division of Shawinigan Chemicals, Ltd.

MR. WILLIAM BRAITHWAITE, sales manager of James Wilkinson & Son, Ltd., chemical manufacturers, Attercliffe, Sheffield, has died at the age of 55. He had been in the heavy chemical industry for 30 years, and was responsible for the surveying of the Eyam district of Derbyshire for fluorspar. Thanks to his work, excavation of fluorspar and lead was begun at Eyam in 1936, and in 1946, a separate company, Glebe Mines, Ltd., was formed to work the mine. Mr. Braithwaite was a director.

Publications & Announcements

BRITISH Jeffrey-Diamond swing hammer shredders are at work in industrial installations in many parts of the world. They will reduce fibrous materials to coarse or reasonably fine products, or they can be used as primary units where multi-stage reduction is necessary to obtain really fine products. The material to be reduced is fed to the machine through an opening above the rotor, and is discharged through the base. On entering the machine, it falls directly into the path of the hammers and receives a primary reduction while in suspension. It is then swept forward for further reduction on the lower portion of the breaker plate, the breaker bar directly under the breaker plate, and the screen or grid in the base. Catalogue No. 1488, describing the machines, may be obtained from British Jeffrey-Diamond Ltd., Wakefield, Yorks.

* * *

PHILIPS Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2, have recently introduced a new X-ray Diffraction Unit which, it is claimed, covers the immediate as well as the long term needs of any research worker engaged in this field. Known as the PW.1010, the new unit employs the well-known Philips system of interchangeable 'sealed-off' X-ray tubes with different anode materials and having high-transmission mica beryllium windows. The need for a separate and continuously operated vacuum system is thus eliminated. The equipment has only to be switched on and it is ready for use. The high tension generator employs a single thoriated tungsten filament valve and the smoothed DC output is stabilised electronically to within 0.1 per cent. Variations in mains voltage up to 10 per cent plus or minus are compensated for automatically, and the stabilisation is unaffected by frequency drift. Each working position on the camera table is provided with an electro-magnetically operated shutter controllable manually or by built-in time switches. A comprehensive system of interlocks guards against mishaps resulting from failure of mains or water supplies and incorrect handling. The PW.1010 is offered with a wide range of precision cameras although any type of camera can be employed, including a Weissenberg goni-

meter. For this reason provision is made for the X-ray tube to be used either vertically or horizontally or by means of a cable, away from the unit altogether. The high degree of stabilisation makes the PW.1010 particularly suited to Geiger-Counter spectrometry with or without an automatic recorder. The equipment is stated to comply with the recommendations of the International Commission on X-ray Protection.

* * *

FOR fitting to their hot water tanks, G. A. Harvey & Company (London), Ltd., have designed a new type of manhole and cover, which will be shown for the first time on their stand (No. 150/1, Row G) at the Building Exhibition at Olympia, 18 November-2 December. The main advantage of the new design is that by preventing the thread of the bolts from coming into contact with water, corrosion and the consequent risk of shearing the bolt heads is eliminated. Further, no hemp, red lead or other jointing material is required when fixing the cover as the indiarubber ring supplied with the tank enables a perfect seal to be obtained (the firm claims) in much less than the usual time. The advantages of hot galvanising will be stressed in the display of tanks, cisterns and indirect cylinders. Wirework and perforated metals of every description will be on show.

* * *

TWO publications by the Radioactivity Division of the Canadian Department of Mines—Technical Papers Nos. 3 and 4—describe, respectively, a colorimetric method for the determination of copper with 2,2'-diquinolyl, and a fluorimetric method for the determination of aluminium with 8-hydroxyquinoline. The methods are rapid and simple, and particularly suitable for routine work, and the fluorimetric procedure has proved superior to gravimetric and colorimetric methods, especially for low aluminium values in the presence of iron or phosphates.

* * *

WE have received from Dr. M. M. Kostevitch of Buenos Aires a number of copies of a paper (in the original Russian) on 'Trinitromannan and Alpha-cel'ulose.' Interested readers may obtain a copy by application to this office.

Chemical Pressure Vessels

THE British Standards Institution has set up a section to deal with the approval in the UK of air receivers, boilers and chemical pressure vessels intended for export to Canada. Initially the BSI and the chief of the Boiler Inspection Department of Quebec drew up arrangements to cover the necessary service and these have now been extended by agreement with the Canadian Standards Association's Committee on Canadian Boiler Regulations to all Canadian provinces, whose chief inspectors have agreed to accept equipment manufactured in the UK provided that: (1) the necessary registration with Canada has been effected; (2) the equipment has been constructed in accordance with the relevant Canadian specifications; and (3) the necessary inspection during and after construction has been carried out by an accepted inspection agency.

The section of BSI dealing with this matter has been set up in association with the BSI/CSA Approvals Agency for electrical equipment so that it will be convenient for UK manufacturers of equipment that have to comply not only with the Canadian Electrical Code, but also with the requirements of pressure vessels such as electrode boilers and electrically-operated pressure vessel accessories. Manufacturers are invited to apply to the Institution for full information and help.

Europe's Largest Refinery

WITH a new 3,250,000 tons a year distillation unit now on stream, Pernis Refinery (near Rotterdam), in the Netherlands, becomes the largest refinery in Europe (including the UK) with an annual crude capacity of nearly 10,000,000 tons. Built at a cost of £2,000,000, the new unit—designed by Shell—has taken just over a year to erect.

Before the war, Pernis Refinery was of comparatively small size with a capacity of 1,000,000 tons of oil products a year. It suffered heavy damage during the war but rehabilitation was started in 1946. Since that time, the size has gradually been increased until it is now the most comprehensive refining complex in continental Europe.

This has been done at a cost of over £25,000,000 and the refinery, in addition to four distillation units, now includes such facilities as thermal cracking and reforming

units, a catalytic cracking unit, polymerisation plants, lubricating oil and bitumen plants and treating facilities to which a lubeoil de-asphalting and extraction plant now under construction will be added.

There is also a plant for making synthetic detergents, one for the manufacture of base materials for plastics on a polyvinyl chloride basis and another for making Epikote resins, used as a very resistant compound in the paint and varnish industry. Also, sulphur is recovered on a large scale. A plant for the production of a number of chemical solvents is under construction as well as a plant for the manufacture of the new insecticides dieldrin and aldrin.

New Grades of Carbon Black

ARRANGEMENTS have been made for the manufacture, in the United Kingdom, of Kosmos and Dixie grades of furnace carbon black previously produced only in the USA. This was announced by Mr. Oscar Nelson, president of United Carbon Co. Inc., Charleston, West Virginia, on the eve of his departure from Europe at the conclusion of a prolonged visit.

A long-term agreement has been reached whereby United Carbon Co. Inc., is making its technical knowledge and engineering experience available to United Carbon Black Ltd., Swansea, for the purpose of establishing standards and ensuring control of quality.

Mr. Nelson's visit follows many months of exhaustive studies by the technical personnel of United Carbon Co. Inc., both at Swansea and in their engineering department in America. As a result of these studies, modifications of existing plant and processes are already in progress and plans have been made for the construction of additional capacity at Swansea.

The modifications now in progress will result in the production of a general purpose furnace to be marketed as Dixie 45 and Kosmos 45 by the selling agents of United Carbon Co. Inc., namely, Anchor Chemical Co. Ltd., and Chance & Hunt (a section of Imperial Chemical Industries Ltd.). It is planned to produce other types of furnace black similar to the grades manufactured by United Carbon Co. Inc., in the USA. These arrangements will enable customers of United Carbon Co. Inc., to obtain prompt delivery of furnace blacks of the highest quality against payment in sterling.

Sulphuric Acid Returns

A SUMMARY of monthly returns of production and consumption of sulphuric acid in the UK from 1 July to 30 September, issued by the National Sulphuric Acid Association, Ltd., shows that stocks decreased during that period from 63,076 tons to 62,304 tons.

The following tables have been abstracted from the summary:—

Data referring only to acid makers' returns	SULPHURIC ACID AND OLEUM (Tons of 100% H ₂ SO ₄)		
	Chamber & Tower only	Contact only	Chamber Tower & Contact
Stock 1 July, 1953	30,375	32,701	63,076
Production	150,229	302,104	452,333
Receipts	28,670	31,103	59,773
Oleum feed	—	1,464	1,464
Adjustments	—46	—54	—100
Use	86,061	114,564	200,625
Despatches	96,286	217,331	313,617
Stock, 30 September, 1953	26,881	35,423	62,304
Total capacity represented	196,680	382,730	579,410
Percentage production	76.4%	78.9%	78.1%

RAW MATERIALS (Tons)

Data referring only to acid makers' returns	Pyrites	Spent oxide	Sulphur and H ₂ S	Zinc concentrates	Anhydrite
Stock, 1 July, 1953	127,561	195,526	47,934	83,715	880
Receipts	109,090	70,515	54,769	34,998	43,419
Adjustments	+1,776	+897	—184	+82	—
Use	96,173	69,149	57,789	45,761	43,389
Despatches*	374	12,731	123	—	—
Stock, 30 September, 1953	141,880	185,058	44,607	73,034	910

* Including uses for purposes other than sulphuric acid manufacture.

CONSUMPTION IN THE UNITED KINGDOM (1 July—30 September)

TRADE USES	Tons 100% H ₂ SO ₄
Accumulators	2,431
Agricultural purposes	8,275
Bichromate and chromic acid	2,006
Bromine	3,724
Clays (fuller's earth, etc.)	2,282
Copper pickling	803
Dealers	3,115
Drugs and fine chemicals	3,375
Dyestuffs and intermediates	18,166
Explosives	7,496
Export	609
Glue, gelatine and size	98
Hydrochloric acid	11,667
Hydrofluoric acid	2,898
Iron pickling (including tin plate)	21,734
Leather	1,039
Lithopone	3,352
Metal extraction	911
Oil refining and petroleum products	14,237
Oils (vegetable)	2,758
Paper, etc.	1,342
Phosphates (industrial)	240
Plastics, not otherwise classified	4,587
Rayon and transparent paper	59,263
Sewage	2,601
Soap and glycerine	7,454
Sugar refining	145
Sulphate of ammonia	67,527
Sulphates of copper, nickel, etc.	3,893
Sulphate of magnesium	1,246
Superphosphates	106,186
Tar and benzole	6,161
Textile uses	5,068
Titanium oxide	46,452
Unclassified	36,451
Total	459,592

New Textile Institute Fellows

MR. O. R. STEELE, B.Sc., M.A., Ph.D., of Princeton, N.J., who has been elected a fellow of the Textile Institute, received his doctorate from Princeton in 1949 after being engaged in research on the fine structure of trimethyl cellulose. As a post-doctoral fellow of the American Textile Research Institute, where he was head of the Physical Organic Chemistry Section and later director of the Wool Research Project, his work was concerned chiefly with studies of the structure of keratin fibres and its relation to mechanical behaviour—using, among other techniques—X-ray diffraction and infra-red microscopy. Dr. Steele is now in charge of fundamental textile research with Rohm & Haas Co., Philadelphia, for whom he formerly worked as a research chemist. Another newly-elected fellow of the Textile Institute is MR. W. S. SONDELM, M.Sc.Tech., A.T.I., textile technologist and test house manager, Ashton Brothers & Co., Ltd., Hyde, Cheshire. He was educated at Leipzig, Caterham and Manchester College of Technology, graduating in 1939 and receiving his master's degree in 1941. He was elected an associate of the Institute in 1944. He is chairman of the Yarn Quality Discussion Group of the Lancashire Section of the Institute.

Next Week's Events

MONDAY 16 NOVEMBER

Society of Chemical Industry

Bradford: Technical College, 7 p.m.
C. S. Whewell: 'Chemical Aspects of Textile Technology.'

Institute of Physics

Birmingham: Imperial Hotel, 6.30 p.m.
Annual meeting. Dr. J. H. Fremlin:
'Nuclear Structure: The Experimental Approach.'

Institute of Metal Finishing

London: Burlington House, Piccadilly, 6 p.m. Demonstration of Research and Control Technique in Electrodeposition.

Institute of Metals

Sheffield: Mappin Hall, St. George's Square, 7.30 p.m. Joint meeting with Sheffield Metallurgical Association and Sheffield Society of Engineers and Metallurgists.
D. Tabor: 'Indentation Hardness.'

TUESDAY 17 NOVEMBER

Royal Institute of Chemistry

London: Battersea Polytechnic, S.W.11, 7 p.m. Joint meeting with Battersea Polytechnic Chemical Society. W. S. Wood: 'The Manufacture and Uses of Hydrogen Peroxide.'

Society of Chemical Industry

London: Royal College of Science, S.W.7, 2.15 p.m. Joint meeting of Agricultural Group with Crop Protection Panel. Symposium: 'Grassland Management' and 'The Treatment of Turf.'

Chadwick Public Lectures

London: Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.1, 5.30 p.m.
Dr. John A. Logan: 'The Public Health Significance of Environmental Control by Engineering Means.'

Institute of Petroleum

Manchester: Engineers' Club, Albert Square, 6.30 p.m. L. Soual and R. C. Cobby: 'The Blending of Lubricating Oils—Continuous and Batch Methods.'

WEDNESDAY 18 NOVEMBER

Royal Institute of Chemistry

London: Kings College, Strand, 6.30 p.m.
Annual general meeting. H. J. T. Ellingham: 'Prospect.'

Institution of Chemical Engineers

London: Caxton Hall, 5.30 p.m. Film 'The Stanlow Story.'

Society of Chemical Industry

Stirling: Golden Lion Hotel, 7.30 p.m.
H. Hepworth: 'Some Reflections on the Pharmaceutical Industry.'

Royal Society of Arts

London: John Adam Street, Adelphi, W.C.2, 2.30 p.m. Opening of 200th session, HRH the Duke of Edinburgh presiding. Inaugural address by the Earl of Radnor.

Pharmaceutical Society of Great Britain

London: 17 Bloomsbury Square, W.C.1, 7.30 p.m. Professor H. Berry: 'General Survey of the British Pharmacopœia, 1953: Pharmaceutics.'

Midlands Society for Analytical Chemistry

Birmingham: The University, Edmund Street, 7 p.m. B. Bagshawe: 'The Analytical Chemistry of Tungsten and Molybdenum, with Particular Reference to Steel and Allied Metals.'

THURSDAY 19 NOVEMBER

Royal Institute of Chemistry

Gillingham (Kent): Medway Technical College, Gardiner Street, 7.30 p.m. B. J. MacNulty: 'Some Recent Advances in Fluoride Analysis.'

The Chemical Society

London: Institution of Civil Engineers, S.W.1, 7.30 p.m. Centenary lecture by Professor A. Tiselius: 'Some Applications of the Separation of Large Molecules and Colloidal Particles.'

Bangor: University College of North Wales, 5.45 p.m. Joint meeting with University College Chemical Society. Professor F. S. Dainton: 'Electron Transfer Reactions.'

Bristol: The University, 7 p.m. Joint meeting with RIC and SCI. Professor N. K. Adam: 'Mechanism of Detergent Action.'

Durham: University Science Buildings, South Road, 7.45 p.m. Joint meeting with RIC and SCI. H. M. Powell: 'Some Inter-molecular Compounds.'

Exeter: Washington Singer Laboratories, 5 p.m. Professor A. R. Todd: 'The Synthesis of Nucleotide Co-enzymes.'

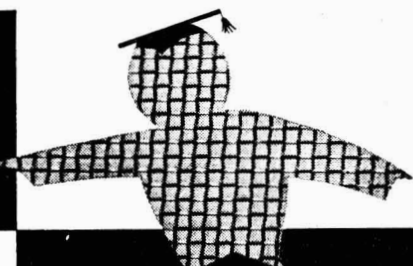
Liverpool: The University, 5 p.m. Joint meeting with RIC, SCI and BAC. Dr. J. S. Anderson: 'The Mechanism of the Reaction Between Gases and Solids.'

Manchester: The University, 6.30 p.m.

[continued on page 1036]

F I N E WOVEN WIRE

**PLAIN, TWILLED
WEAVES, HOLLANDER
CLOTHS**



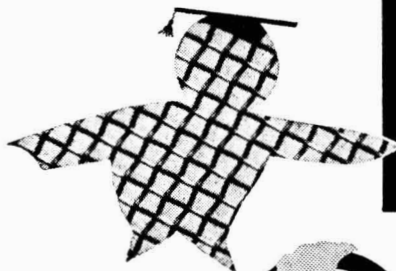
**UP TO 300 MESH
PER LINEAR INCH**



**IN ANY COMMERCIAL
METAL**



ALWAYS SPECIFY



Established 1799



Greenings

N. GREENING AND SONS LTD

**BRITANNIA WORKS
WARRINGTON · ENGLAND**

Phone : WARRINGTON 1901

Grams : **GREENINGS, WARRINGTON**

Joint meeting with RIC and SCI. Dr. J. L. Edgar: 'Manufacture of Chemicals from Petroleum.'

Society of Chemical Industry

London: Institution of Structural Engineers, 11 Upper Belgrave Street, S.W.1, 6 p.m. E. H. Nevard: 'Reasons and Methods for Timber Preservation.'

British Ceramic Society

London: Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.1, 10 a.m. Autumn meeting of Refractory Materials Section.

London: Olympia, 11.10 a.m. General meeting of Building Materials Section.

London: Dorchester Hotel, Park Lane, 7 p.m. Society's annual dinner.

Institute of Welding

London: The Polytechnic, Regent Street, W.1, 7 p.m. D. C. Dixon: 'Productivity in the Fabrication of Structural Steelwork.'

Institute of Metals

Birmingham: Imperial Hotel, Temple Street, 6.30 p.m. J. W. Cuthbertson: 'Recent Advances in Electrodeposition.'

Liverpool: The Temple, Dale Street, 7 p.m. L. Rotherham: 'Metallurgical Problems Connected with the Development of Atomic Energy.'

Middlesbrough: Cleveland Scientific and Technical Institute, 7.15 p.m. Discussion: 'The Training of a Metallurgist.'

FRIDAY 20 NOVEMBER

The Chemical Society

Aberdeen: Robert Gordon's Technical College, 7.30 p.m. Joint meeting with RIC and SCI. N. P. Inglis: 'The Production, Fabrication and Properties of Titanium.'

Birmingham: The University, 4.30 p.m. Centenary lecture by Professor A. Tiselius: 'Some Applications of the Separation of Large Molecules and Colloidal Particles.'

Swansea: University College, 6 p.m. Joint meeting with RIC and University College Chemical Society. Professor J. Monteath Robertson: 'The Scope and Application of X-ray Methods in Organic Chemistry.'

Institution of Chemical Engineers

Huddersfield: College of Technology, 7 p.m. Graduates' and Students' Section. G. T. Matthews: 'Low Temperature Separation of Gases.'

Newcastle-on-Tyne: Chemical Engineering Department, Stephenson Building, 6.15 p.m. Graduates' and Students' Section. W. T. Cosby: 'Electrical Precipitation.'

Institute of Physics

London: Institution of Electrical Engineers, Savoy Place, W.C.2, 10 a.m. Autumn conference of the X-ray Analysis Group.

Manchester: The University, 6.45 p.m. Professor S. Tolansky: 'The Use of Optical Methods for the Study of Surface Microtopography.'

British Ceramic Society

London: Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.1, 10 a.m. Autumn meeting of Refractory Materials Section (cont'd.).

London: Drayton House, Gordon Street, W.C.1, 9.45 a.m. Building Materials Section visit to Building Research Station.

Market Reports

LONDON.—There has been nothing of outstanding interest either in prices of industrial chemicals or market conditions during the past week. Contract deliveries continue to cover good quantities, and new business for home account has been on satisfactory lines but again the emphasis is for spot or nearby requirements. Overseas demand is on the quiet side, though the export inquiry for some of the coal tar products, such as creosote oil, phenol and cresylic acid, is fairly good. Prices in the tar products section are steady and unchanged.

MANCHESTER.—Steady to firm price conditions have been experienced during the past week on the Manchester market for heavy chemical products and only in odd cases is there any indication of uneasiness. Deliveries under contracts covering a wide range, including chemicals for the textile and allied trades, are being steadily called for and a fair amount of replacement business on home-trade account has been reported. Export bookings have been on a moderate scale. A few sections of the fertiliser trade are active, but otherwise the market has not yet fully emerged from its seasonal dullness. Most of the light tar distillates are meeting with a steady demand.

GLASGOW.—Another good week's trading has been reported from all sections of the trade, although buying has been mostly on a spot basis with little business placed for forward delivery, which is not surprising in view of the uncertain state of some of the markets.

B.D.H. REAGENTS

*for all responsible laboratories
and for every aspect of laboratory
practice*

**B.D.H. Organic and Inorganic Chemicals
for Research and Analysis**

'AnalaR' Reagents

Micro-Analytical Reagents

Organic Reagents for Delicate Analysis

Indicators

Microscopic Stains

Amino Acids

Sugars

Forensic Reagents

Prepared Reagents for Clinical and

General Analysis

B.D.H. Concentrated Volumetric Solutions

THE BRITISH DRUG HOUSES LTD.
B.D.H. LABORATORY CHEMICALS GROUP
POOLE · DORSET



CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

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

BRITISH TITAN PRODUCTS CO., LTD. invites applications from GRADUATE CHEMISTS AND CHEMICAL ENGINEERS

to assist in control of Chemical Plant Operations
at its
Billingham (Co. Durham)
and
Grimsby (Lincs.)
Factories

previous experience of plant work not essential.
Salary dependent on age and qualifications. Staff Bonus and Superannuation Schemes. Application Forms may be obtained from—

THE SECRETARY OF THE COMPANY,
KRONOS HOUSE,
COPPERGATE,
YORK.

CHEMICAL ENGINEER, preferably with some industrial experience, required for interesting development work in inorganic chemical factory. Starting salary in the range of £550 to £750 per annum. Reply in confidence, to **BOX No. C.A. 3213, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FIRST-CLASS CHEMIST required by progressive Public Company in the North-West for research and development on synthetic resins and allied materials. Good Degree and previous experience desirable. Salary range, £1,000-£1,300 per annum. A Staff Superannuation Scheme is in operation. Applicants are requested to give details of their age, qualifications and previous experience **BOX No. C.A. 3277, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

INDUSTRIAL CHEMIST required to assist in Technical Department of Company engaged in production of Magnesium and Magnesium Alloys. Duties will include investigation of problems arising in production departments, and in developments of new processes. Essential qualifications are Honours Degree in Chemistry, or Associateship of the Royal Institute of Chemistry, with at least five years' experience of industrial production of inorganic chemicals. Contributory Staff Pension Scheme in operation. Applications, in writing, with full details and positions held, to **PERSONNEL MANAGER, MAGNESIUM ELEKTROKORPORATION LIMITED, CLIFTON JUNCTION, NEAR MANCHESTER.**

FOR SALE

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

FOR SALE

MORTON, SON AND WARD, LIMITED

offer
MIXERS

"**MORWARD**" "U-shaped" Trough **MIXERS** in any size up to 3 tons.
MIXERS, Horizontal or Vertical, Jacketed on Unjacketed made to requirements. Several in stock.

JACKETED PANS

In stainless steel or mild steel, with or without mixing gear.

500g. Jacketed **AUTOClave** with detachable cover. 150 lb. in jacket.

500g., 300g. and 200g. **AUTOClaves** in mild steel, riveted construction with detachable covers.

HYDRO EXTRACTORS

From stock: 72 in. to 36 in., by **BROADBENT**, and 42 in. by **WATSON LAIDLAW**, all electric, thoroughly reconditioned, complete with starters, and guaranteed.

PUMPS

A large selection in stock, 2 in. to 6 in., new and second-hand.

INQUIRIES INVITED

**MORTON, SON & WARD, LIMITED,
WALK MILL,
DOB CROSS, NR. OLDHAM,
LANCS.**

'Phone: Saddleworth 437.

STAINLESS STEEL PLATE HEAT EXCHANGER by A.P.V. CO., LTD. Type HH. 76 plates 43 in. by 16 in., total projected area 346 sq. ft.

Hydraulically operated opening and closing gear.

STAINLESS STEEL CRYSTAL DRIER by MITCHELL,

3 ft. 6 in. diam. by 1 ft. 6 in. deep. **STEAM**

JACKETED flat bottom with two S.S. paddles

underdriven through bevel gearing from direct-

coupled 1 h.p. 400/3/50 geared motor. Jacket

working pressure, 15 lb. per square inch.

M.S. SPIRIT EXTRACTION PLANT, comprising 3 ft.

diam. by 5 ft. deep extractor with dished bottom

jacketed for 5 lb. per square inch working pressure,

condenser, separator, storage tank.

KESTNER HORIZONTAL TUBULAR EVAPORATOR,

having six turns copper tube 1½ in. bore by 6 ft.

long, complete with copper reception pot.

STEAM JACKETED COPPER STILL, 150 gallons

capacity. Fitted swan-neck, sight and light

glasses, etc., and complete with copper coil con-

denser. Jacket working pressure 40 lb. per

square inch.

STEAM JACKETED COPPER BOILING PAN, 100 gallons

capacity. Bolted-on cast-iron jacket suitable for

40 lb. per square inch working pressure.

DOUGH MIXER, having "U" trough 1 ft. 5 in. by

1 ft. 7 in. wide at top by 2 ft. deep. Sheet brass

trough, cast-iron ends, G.M. agitator. Belt driven

and arranged for hand tilting.

M.S. HORIZONTAL "U" TROUGH MIXER, 3 ft. by

1 ft. 9 in. by 2 ft. deep. Fin-type agitating gear

belt driven through helical gearing from fast and

loose pulleys. Arranged for hand tilting.

Cast-iron **VACUUM DRYING OVEN** by **TAYLOR**,

4 ft. by 2 ft. 10 in. by 4 ft. 6 in. front to back,

having ten steam-heated M.S. platens pitched at

3 in. Hinged door at each end. Steam working

pressure 15 lb. per square inch.

HARRISON-CARTER DISINTEGRATORS, sizes 2½ and

00. Belt driven.

PROCESS & CHEMICAL ENGINEERING CO., LTD.,

6/8, NORTHUMBERLAND PARK,

TOTTENHAM,

LONDON, N.17.

'Phone: Tottenham 2436 (3 lines).

FOR SALE

600

PROCESS PLANT

PASCALL PIN DISC MILL, Type No. 1, motorised 400/3/50. Conical feed hopper approx. 24 in. diam. Permanent magnet of chute type. Discharge chamber enamel lined, with bagging outlet 5½ in. diam.

No. 3 **KEK MILL**, comprising M.S. galvanised bin 48 in. diam. by 29 in. deep, tapering to two 8 in. diam. outlets. Grinding chamber 18 in. diam. Underdriven through enclosed gearing with bare shaft extension. Suitable for grinding fibrous materials.

Unused **Vertical MIXER** by Brierley, Collier, with stainless steel lined pan 18 in. diam. by 10 in. deep, jacketed 15 lb. w.p., with spiral-type agitator. Fast and loose pulley drive.

500 gal. **C.I. MIXING VESSELS**, 5 ft. diam. by 5 ft. deep. Anchor-type agitator, driven through bevel gears, and fast and loose pulleys.

Two **VERTICAL MIXERS**, 3 ft. 6 in. diam. by 2 ft. 6 in. deep, of ¾ in. mild steel plate. Twin underdriven scraper agitators. Hinged cover with 12 in. diam. feed. Bottom side 5 in. diam. outlet. Motorised 400/3/50.

Three Peerless **MIXERS**, 80-qt. capacity, fitted integral motor, 400/3/50, with various whisks and beaters. M.S. **Lead-lined MIXER**, 2 ft. 3 in. i.d. by 3 ft. deep, with 12 in. cone bottom, 2 in. flanged bottom outlet. Vessel totally enclosed, lead-covered paddle type agitator. Motorised 400/3/50.

GEORGE COHEN SONS & CO., LTD.,
WOOD LANE, LONDON, W.12.
Tel.: Shepherds Bush 2070 and
STANNINGLEY, NR. LEEDS.
Tel.: Pudsey 2241.

C. BARBER, LTD.

C.I. FILTER PRESS, 25½ in. square, by **MANLOVE ALLIOTT**, plate and frame type, 13 chambers, arranged for washing. Excellent condition.

TWO HYDRO EXTRACTORS, 72 in., by **BROADBENT**. (One new and unused.)

TWO "HORMANN" 30 cm. Stainless Steel FILTER PRESSES.

STORAGE BINS in stainless steel, cylindrical, with covers. 40/12/14/10 gallons capacity.

CANNON STEAM-JACKETED ENAMEL-LINED PANS, 10 and 25 gallons. All new and unused.

DOULTON 25-gallon COPPERS with lids. **NEW** and unused.

WELDED VESSELS of all types, in mild steel or stainless Fabricated to customer's specifications.

TWIN ROLL FILM DRYER by **MILNE**, with steam-heated rolls 28 in. diam. by 60 in. long. Motorised 400/440 volts, 3-phase.

C. BARBER LTD.
SILVERDALE GARDENS
HAYES MIDDLESEX

Telephone—Hayes 2735/6

ONE TORRANCE MICRO TWIN-ROLLER MILL. Cast rolls, 14 in. by 8 in. Water cooled. Fast and loose pulley-drive.

TWO DE LAVAL SEPARATORS, VEE-BELT DRIVE. Good condition.

THOMPSON & SON (MILLWALL), LIMITED,
CUBA STREET, LONDON, E.14. TEL. EAST 1844.

SELWOOD FOR TANKS

ONE—500 gallon Enamel Lined **STORAGE TANK**, ex-milk storage. Cork-insulated motor-driven agitator fitted. Mounted on adjustable legs.

One—800 gallon **DITTO.**

Full details of these and other Tanks on application to:—**WILLIAM R. SELWOOD, LIMITED, CHANDLER'S FORD, HANTS.** Phone: 2275.

FOR SALE

8 brand new jacketed **STERILIZING VESSELS**, 7 ft. long by 3 ft. diam., complete with fittings.

3 excellent **VACUUM OVENS**, complete with vacuum pumps, trays and belongings.

2—18 in. **KEK PLATE MILLS**, complete with feeders delivery bins, motors and entablature.

9 Worsam **ROTARY PRESSES.**

POWDER DRESSING or **SIFTING MACHINES**, various sizes.

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

1 Johnson **FILTER PRESS**, 47 plates, 32 in. square, centre feed, bottom corner open delivery.

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

24 in., 30 in. and 36 in. **HYDRO EXTRACTORS**, self-balancing, swan-neck type, self-emptying bottom, belt and motor driven.

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

5 sets of A.A. **CRUSHING ROLLS** for linseed, cottonseed, etc., 48 in. long, belt driven, with feed hopper, side frames, baseplate and striking gear.

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

"U" shaped horizontal jacketed **MIXER**, 7 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven.

3—5 roll **REFINERS**, fitted chilled iron, water-cooled rolls, 40 in. long, 16 in. diam. belt and gear driven, with clutch drive suitable for motor, by Baker Perkins, Ltd.

1 No. 1A water-cooled **CIRCULATOR MILL.**

6—Excellent Nickel-lined Jacketed **TILTING PANS**, 60 gallons capacity and for 40 lb. working pressure.

1—**MICRO-PULVERISER**, size 2, complete with motors and all belongings.

2—Brand New Enclosed Aluminium **TANKS**, approximately 11 ft. long by 4 ft. 9 in. wide by 7 ft. 3 in. deep.

5—Excellent Porcelain **DISC MILLS.**

1—Aluminium **STILL**, steam jacketed, dished top and bottom; approximately 4 ft. 8 in. diameter by 6 ft. deep.

RICHARD SIZER, LTD.,
ENGINEERS,
HULL.

Telephone 31743.

ECONOMIC BOILERS—9 ft. diam. by 12 ft. 6 in. Foster Yates, 200 lb. w.p.; 8 ft. diam. by 14 ft. Paxman, 180 lb. w.p. Twenty others, all sizes.

Whessoe Open Top Riveted Steel **MIXING TANK**, 13 ft. diam., by 15 ft. deep, 9/16 in. plate.

NEW GALVANISED PIPING. Immediate delivery. Johnson Filter **PRESSES**, 25 in., 18 Frame, practically new.

TWO 35 ft. long by 9 ft. diam. Lead-lined TANKS. **ONE Stainless CONICAL HOPPER**, 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.

TWO Broadbent WATER-DRIVEN CENTRIFUGES, 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.

SIX O.T. TANKS, 7 ft. diam., 14 ft. deep, rubber and brick lined.

Six Aluminium **CONDENSERS**, 14 ft. long by 2 ft. 6 in. diam. 386 Tubes, ¾ in. o.d.

FORTY Riveted RECEIVERS, 8 ft. 6 in. long, 5 ft. 9 in. diam., 76 lb. w.p.

CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in. **NEW VALVES** in Stainless, Gunmetal, Enamel Lined.

Free Catalogue. "Watkins Machinery Record," available

FRED WATKINS, (BOILERS) LTD.,
COLEFORD, GLOS.

FOR SALE, approximately 8 tons **DDT POWDER.** Price 2s. 2d. per lb., ex-works. Apply **BOX No. C.A. 3276, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FOR SALE

CHANGE-PAN or **PONY MIXER**, 25 gallons, detachable pan revolves in opposite direction to agitators. Extra pans available. Self motorised. A.C. **WINK-WORTH MACHINERY, LTD.**, 65, HIGH STREET, STAINES. Tel.: 1010.

WANTED

CASH Buyers all grades of Non-Ferrous Metal Scrap, Residues. Send details—**D. HARRIS**, 28 GEARY ROAD, DOLLIS HILL, LONDON, N.W.10.

INDUSTRIAL BY-PRODUCTS, LTD., 16, Philpot Lane, London, E.C.3, will be pleased to receive particulars of any by-products, waste materials and residues for disposal.

SERVICING

CRUSHING, GRINDING, MIXING and **DRYING** for the trade.

THE CRACK PULVERISING MILLS LTD.
Plantation House,
Mincing Lane,
London E.C.2.

GRINDING, CRUSHING AND GRADING

FINE GRINDING LTD.,
BLACKHOLE MINE, EYAM
TELEPHONE EYAM 227

PULVERISING of every description of chemical and other materials for the trade with improved mills, wharfage, and storage facilities. **THOS. HILL-JONES, LTD.**, "INVICTA" WORKS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON." TELEPHONE 3285 EAST.

WET AND DRY GRINDING, Micronising, Grading and Mixing of Minerals and Chemicals for all trades. Also suppliers of ground zircon, sillimanite, fused silica, precision casting materials and a wide range of ground minerals.

W. PODMORE & SONS, LTD.,
SHELTON, STOKE-ON-TRENT,
Phones **STOKE-ON-TRENT 2814 & 5475**

PATENTS & TRADE MARKS

KINGS PATENT AGENCY, LTD. (B. T. King, A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. **ADVICE Handbook**, and **Consultation free** Phone: City 6161.

For Classified Advertising
THE CHEMICAL AGE

Gives direct and immediate penetration. Is the recognised liaison between buyer and seller.

Accepts advertisements up to first post on Tuesday for insertion in that week's issue.

Gives a reduced rate for more than three insertions and

PULLS IN RESULTS

WHICH Chemical or
Pharmaceutical Industry

wishes to be

REPRESENTED
in the
NETHERLANDS?

Leading, well-known
Dutch commercial-house
will gladly undertake some more
representations

Write to

Box No. C.A. 3278,
THE CHEMICAL AGE, 154, FLEET
STREET, LONDON, E.C.4.

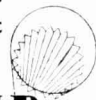


Enquiries and orders
or "Postlip" Papers
should be addressed
to our Sales Repre-
sentatives:—

TECHNICAL PAPER
SALES LTD. 9,
BRIDEWELL PLACE,
LONDON, E.C.4.

A NEW FIBRE-FREE
FILTER PAPER

The complete wet-
strength equivalent
of the standard



POSTLIP
mill 6:3

EVANS, ADLARD & CO. LTD.

WINCHCOMBE • GLOS.

SPECIALIST ENGINEERS TO THE
CHEMICAL AND ALLIED TRADES

WOODEN VATS, DRUMS and **PADDLES**
PUMPS of various types
DRYING MACHINERY
CHOPPING and **CRUSHING MACHINES**
AGITATING and **DISSOLVING VATS**
STAINLESS STEEL DRYING TRAYS
HANGING CLIPS for skins and leather board
SPECIAL PURPOSE MACHINERY

EDWARD WILSON & SON LTD.

Aintree Road, Bootle, Liverpool, 20

Telephone :
Bootle 2291/2

Telegraphic Address :
Motion, Liverpool 20

SPECIALISTS IN
BULK LIQUIDS
TRANSPORT

Acids • Oils • Spirits
 and General Chemicals

Harold Wood & Sons, Ltd.

Wormald Street, Heckmondwike

Telephone : HECKMONDWIKE 1011/5

Telegraphic Address : "Transport" Heckmondwike

London Office : 22 SOUTH MOLTON ST., LONDON, W.1

Telephone : Mayfair 6060

"Fullersite" SLATE
 FILLER

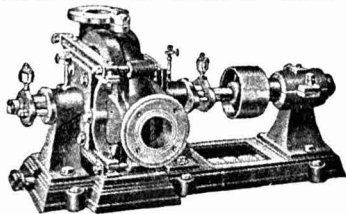
for

BITUMINOUS PRODUCTS, PAINTS,
 MOULDED RUBBER GOODS,
 PHARMACY, CERAMIC WARE

apply :—**PENRHYN QUARRIES LTD.**

Port Penrhyn, Bangor
 N. Wales

For all kinds of Acid Lifting, Haughton's Centrifugal
 and Plunger Pumps in Regulus and Ironac Metal



Send for Illustrated List

HAUGHTON'S METALLIC CO. Ltd.

30, ST. MARY-AT-HILL, LONDON, E.C.3

JOHN KILNER & SONS (1927) LTD

ESTABLISHED 1867

Calder Vale Glass Works, Wakefield, Yorks.

PHONE : WAKEFIELD 2042 GRAMS : GLASS, WAKEFIELD

SPECIALISTS IN

Carboys • Demijohns
Winchesters

The Outstanding Issue
 of the Year



A MILESTONE IN
 CHEMICAL TRADE
 JOURNALISM

The 1954 *Chemical Age* Annual Review Number will be a digest of an eventful year. It will record progress in instrumentation, modern laboratory equipment, new plant and machinery, the rapid strides in inorganic, organic, analytical and physical chemistry and the manner in which these advances have been applied to chemistry in industry. It will be a permanent record of chemistry in 1953.

The Chemical Age
 Annual Review Number
 January 9th 1954

BOOK YOUR ADVERTISEMENT
 NOW AND GET THE
 BEST CHOICE OF POSITION

INDEX TO ADVERTISERS IN THIS ISSUE

	Page		Page
Alumina Co., Ltd. (The)	1000	Kestner Evap. & Engineering Co., Ltd.	1042
Audley Engineering Co., Ltd.	995	Kilner, John, & Sons (1927), Ltd.	1041
B.A. Holland Engineering Co., Ltd. (The)	1000	Leigh & Sons Metal Works, Ltd.	1042
Berk, F. W., & Co., Ltd.	1002	Leitch, John W., & Co., Ltd.	1001
Blundell & Crompton, Ltd.	Cover Three	Marchon Products, Ltd.	999
Boulton, William, Ltd.	1000	Newton Chambers & Co., Ltd.	997
British Carbo-Norit Union, Ltd.	1042	Pascall Engineering Co., Ltd. (The)	Back Cover
British Drug Houses, Ltd. (The)	1037	Penrhyn Quarries, Ltd.	1041
Bryan Donkin Co., Ltd (The)	Back Cover	Pye, W. G., & Co., Ltd.	Cover Two
Classified Advertisements	1038, 1039, 1040	St. Helens Cable & Rubber Co. Ltd.	1004
Foyle, W. & G., Ltd.	1042	Solway Flowrators, Ltd.	1001
Gethings, B., & Son	Cover Three	Sutcliffe, Speakman & Co., Ltd.	996
Glebe Mines, Ltd.	Cover Two	Technical Paper Sales, Ltd.	1040
Greening, N., & Sons, Ltd.	1035	Wilkinson, James, & Son, Ltd.	998
Guest Industrials, Ltd.	Cover Three	Wilson, Edward, Son, & Co., Ltd.	1040
Harris (Lostock Gramam), Ltd.	Cover Three	Wood, Harold, & Sons, Ltd.	1041
Haughton's Metallic Co., Ltd.	1041		
Holmes, W. C., & Co., Ltd.	998		
Kaylene (Chemicals) Ltd	Front Cover		

Solvent Recovery Plant

Carbon Adsorption System

British Carbo-Norit Union, Ltd.
176, Blackfriars Rd., London, S.E.1

KEEBUSH

Keebush is an acid-resisting constructional material used for the construction of tanks, pumps, pipes, valves, fans, etc. It is completely inert to most commercial acids; is unaffected by temperatures up to 130°C; possesses a relatively high mechanical strength, and is unaffected by thermal shock. It is being used in most industries where acids are also being used. Write for particulars to—

KESTNER'S

5 Grosvenor Gardens, London, S.W.1

THE WORLD'S GREATEST BOOKSHOP

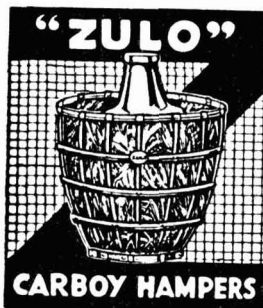
FOYLES

★ FOR BOOKS ★

All new Books available on day of publication. Secondhand and rare Books on every subject. Stock of over three million volumes

Subscriptions taken for British, American and Continental Magazines

119-125 CHARING CROSS RD., LONDON, W.C.2
Gerrard 5660 (16 lines) ★ Open 9-6 (inc. Sat.)
Nearest Station: Tottenham Court Road



CARBOY HAMPERS

LEIGH & SONS METAL WORKS

Orlando LTD.
St., BOLTON

CARBOYS: PACKED CARBOYS
CARBOY FILTERS AND BARROWS.
SAFETY CRATES TOP PROTECTORS.

"VULCAN"

BRAND

CARBOY HAMPERS

PACKED CARBOYS

SAFETY CRATES

PROTECTING HOODS.

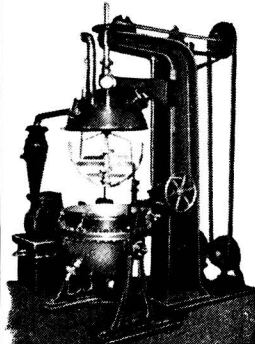


HARRIS
(LOSTOCK GRALAM) LTD.

LOSTOCK GRALAM,
NORTHWICH

COPPER PLANT

for the CHEMICAL TRADES



Steam jacketed copper Boiler and Mixer to tilt, with vacuum pump, and jet condenser. Cover and agitator raised by bevel gear and hand-wheel.

STILLS
RECTIFYING
COLUMNS
CONDENSERS

—
Autoclaves
Calandrias
Vacuum Pans
Boiling Pans

Pipework,
Coils, etc.

ESTABLISHED 1835

BLUNDELL & CROMPTON
LIMITED

WEST INDIA DOCK RD., LONDON, E.14
Phone: E2: 3838 (13 lines) Grams: Blundell,
& 1406 Phone: London

CONSTRUCTIONAL ENGINEERING

FOR
THE

CHEMICAL INDUSTRY

STRUCTURAL
STEELWORK
STEEL
CHIMNEYS
ETC.

RIVETTED
& WELDED
STEEL PLATE
FABRICATIONS
ETC.

B. GETTINGS & SON
BOROUGH ENGINEERING WORKS
HARE STREET • BILSTON

Phone: BILSTON 41325
Grams: 'GETTINGS,' Bilston

Trichlorethylene

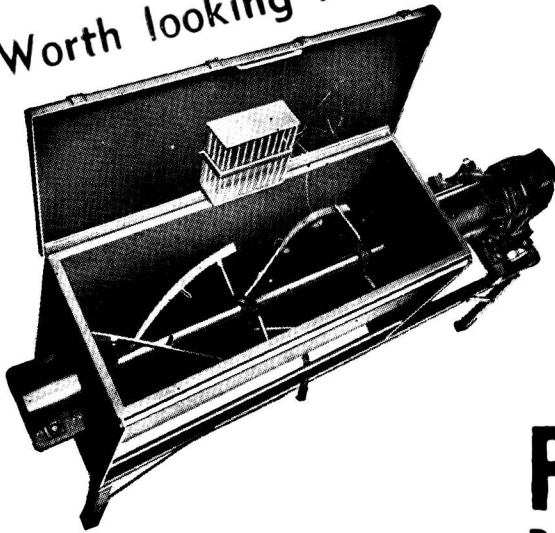
Available for
prompt shipment



A Harris & Dixon Company
Guest Industrials Ltd.
Raw Materials Division

81, Gracechurch Street, London, E.C.3
Telephone: Mansion House 5631 (16 lines)
Telegrams: Guestind. London

Worth looking into!



Write for list 611

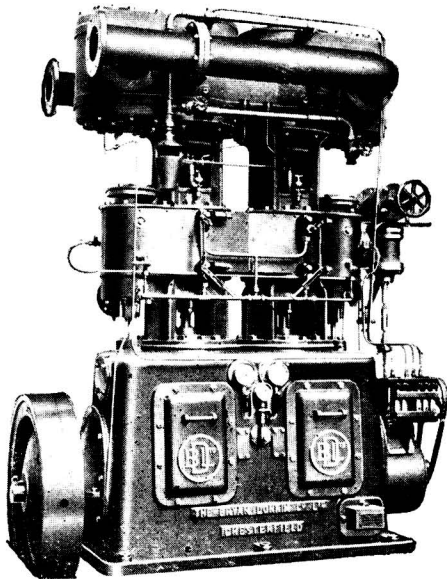
For efficient mixing it is essential that the materials are evenly distributed throughout the mass. Pascall Mixers produce this result quickly and economically.

They have many features of interest such as removable agitators, self-emptying troughs, safety devices, etc. Eight sizes available with trough capacities between 2 cu. ft. and 20 cu. ft.

PASCALL POWDER MIXERS

THE PASCALL ENGINEERING CO., LTD, 114 LISSON GROVE, LONDON, N.W.1.

DONKIN COMPRESSORS



**High Speed Vertical
Reciprocating Type**
for pressures up to 100 lb.
per sq. in.

*Automatic Control
Forced Lubrication
Easy Accessibility
to Working Parts*

THE BRYAN DONKIN CO. LTD.
CHESTERFIELD