The
Chemical Age

VOL LXIX 11 JULY 1953 No 1774

The
Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4.
Telegrams: ALLANGAS FLEET LONDON · Telephone: CENTRAL 3212 (26 lines)

Volume LXIX 11 July 1953 Number 1774

Poisons, Pests & People

ARE the materials we use today to protect crops from pests and disease attack too poisonous, too hazardous for workers who apply them in the field or too dangerous for human or animal consumers of the eventual foodstuffs? This is one of the most heatedly debated topics of the times, and we return to it because an eminently sensible paper by Dr. J. M. Barnes of the Toxicology Research Unit (Medical Research Council) has just been published (*Chemistry & Industry*, 1953, 625-627). It is a paper to be cherished like that of Professor A. C. Frazer which we commented upon earlier this year (see THE CHEMICAL AGE, 1953, **68**, 195). Then, on the similarly vexed matter of chemicals in foods, a pharmacologist took the position of umpire. As a medical worker specialising in toxicology, Dr. Barnes can equally examine the pros and cons of crop protection chemicals with independence and specialised knowledge. To those who condemn modern chemical sprays, we say openly: 'If you are going to argue about toxic risks, let us at least have them assessed by a toxicologist!' Rumours of countless deaths and diseases, distortions and exaggerations, of these we have read too much. The chemist is not a single-minded villain penetrating the balances of nature and agriculture with ill-considered poisons, nor are the companies who manufacture sprays and dusts devoid of social conscience and concerned only with mounting sales. We commend Dr. Barnes' objective survey to all critics of chemicals and chemists.

It is true that deaths have resulted from the application of new insecticides, weedkillers, etc. But it is not callous to point out, as Dr. Barnes does, that the number of deaths per year is smaller in all probability than the number of farm workers killed by bulls. In particular, parathion has been associated with a frightening record; nevertheless, deaths from parathion poisoning have fallen sharply in America though sales have risen very considerably. This is surely an indication that the early fatalities were caused through inexperience, that it is possible to handle this admittedly very toxic material with safety. Argument by analogy is not fully objective but it

seems remarkable that so much vehement criticism has been directed at toxic sprays of this kind, with many worthy people campaigning for their abolition—yet no one cites the monthly figures for road deaths as evidence for abolishing the car. The whole world needs more food from every productive acre, and poisons for pests save harvest losses. It is idealistic and futuristic to say that we should use only materials that are toxic to pests and non-toxic to the rest of life. Research is steadily directed towards this end. Dr. Barnes points out that already in America the safeguarding tests required for new pesticides are so exacting that manufacturers may become less interested in developing new materials. This may retard rather than hasten the birth of safer chemicals for crops.

As for the other type of hazard, the effect of trace residues upon consumers' health, let a few words from Dr. Barnes' paper be quoted: 'No case of human illness has been traced to their presence.' Human diseases attributed to DDT residues in America are peculiarly unexperienced by workers in DDT factories. Can we go so far as to accept the unusual thesis that minimal exposure to a toxic substance leads to strange symptoms whereas maximal exposure leads to none? Of bacterial organisms this might be true but it seems unlikely to be true of toxic chemicals whose effects in other examples, e.g., effects upon insects, are more or less proportional to dosage amounts. We might draw attention, though Dr. Barnes did not, to the anti-DDT alarmism in America over the mysterious X-disease of cattle. Recently research at three different centres has shown that this disease is caused by chlorinated naphthalenes which are used as additives in oils and greases. Cattle using farm machines as unofficial 'mineral licks' tend to develop the so-called X-disease. The unravelling of the facts has given DDT a clean bill. Dr. Barnes reminds us that arsenic and lead salts were much used (and still are) long before the days of modern synthetic pesticides. These are classic poisons and their residue problem is greater since they possess no volatility. Cyanides, too, have had common agricultural uses. Nicotine is as toxic to animals as any organophosphorus insecticide; even though its high volatility gives it a valuable margin of safety, it has a high skin penetration and vapour-toxicity risk. Is the chemist to be indicted for displacing the risk of an arsenical residue with that of a much smaller DDT residue? Yet how often the charge is made that 'more and more poisonous chemicals are being used.' In so many cases less toxic substances in smaller amounts per acre are giving superior pest control.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 42s. Single copies, 1s.; post paid, 1s. 3d. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784/5). LEEDS OFFICE: Martins Bank Chambers, Park Row, Leeds, 1 (Leeds 22601). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

Notes & Comments

Metallic Silicon

BEFORE the development of germanium for transistors in electrical and electronic appliances, silicon's chances in this field had a fair amount of promise. There is a new indication that interest in this use for silicon may be revived for the Du Pont Company is reported to be building a plant for producing metallic silicon, the physical form analagous with that of hard graphite carbon. The process is clearly a high-costs process for the selling price announced is as much as $430 per pound, an exceptional figure for one of the most abundant elements of the earth's crust. Widening demand is likely to bring about price easement. It may also bring about price easement for germanium for at present this element has been heading for monopoly as a transistor material.

Odours & Activated Carbon

TRACE quantity problems can be major problems. This is certainly true of the odour-contamination of foods held in cold storage. 'Flavour adulteration' is an excellent description of what can, and often does, happen when traces of one food's odour are absorbed by another food. Quantitively the amounts absorbed may be so minute as to be immeasurable; nevertheless, the flavour spoilage can be consistently detected by tasting panels. The partnership between the senses of smell and of taste is extraordinarily complex, and both the tongue and the nose are sensitive instruments. The extent to which unwanted or misplaced odours are absorbed is a function of their concentration in the air within a cold store or refrigerator. One obvious solution, therefore, is steady ventilation, the incoming fresh air always acting as a diluent. This, however, increases the costs of low temperature maintenance. Fresh air may bring dilution for odours that are present but it also brings warmth that must be cooled. Current research in America indicates that a most useful market for activated carbon or charcoal will be developed as the best answer to this problem. The continuous passage of cold storage air through a canister containing granular activated carbon successfuly prevented flavour adulteration in a number of tests. Tasting panels who had accurately detected all cases of odour-contamination were 100 per cent unable (in 11 experiments) to detect flavour deteriorations where activated carbon had been used to remove vapours from the air. Food industry chemists may find the original paper well worth study—*Journal of Agricultural & Food Chemistry*, 1953, 1, 1, 79.

Not Unknown Here

THE use of activated carbon for this purpose is not unknown in this country. Recently a British firm has marketed a small plastics-made unit holding a charge of activated charcoal for installation in domestic refrigerators. This device sells for a few shillings only. Its effectiveness depends, of course, upon the extent to which the air in the refrigerator actually passes through the unit; the USA research device had a motor-driven air blower connected with the activated carbon canister, but there very large volumes of air were being purified.

Iodine for Water?

THE halogen family has long been given pride of place in water purification. Chlorination is widely practised though a few years ago the case for bromination in swimming-bath water disinfection was strongly urged, the main advantage being the greater ease with which a liquid halogen could be dispensed and dispersed into large volumes of water. Now iodine may have its turn. Iodine itself is of little value for it dissolves far too slowly. In World War I the French army used tablets containing iodides and iodates for disinfecting drinking water. Their

efficiency was limited as acidity is needed for the iodine-liberating reaction and in any case the reaction is slow. Tablets based on oxidising agents other than iodates are moisture-sensitive and the iodine is liable to be prematurely released. New studies of this problem at Harvard (*Industrial & Engineering Chemistry*, 1953, **45**, 5, 1013) have led to the development of tablets based upon water-soluble poly-iodides. To combine stability with solubility it was found that the cation of the poly-iodide should be of large size, but itself unstable in dilute aqueous solution. Cations of large and complex size that did not decompose in water formed fairly insoluble or slowly soluble poly-iodides. Small, non-complex cations gave poly-iodides that would have little pre-use stability. The compounds tested as tablets were: tetra-glycine hydroperiodide, potassium tetra-glycine tri-iodide, aluminium hexaurea sulphate tri-iodide, and aluminium hexaurea dinitrate tri-iodide. The best formulations were those based upon the first of these four compounds. A tablet also containing disodium dihydrogen pyrophosphate as an extender and hydrolysis preventer, dissolved in less than one minute at ordinary temperatures, could liberate 8 mg. of iodine and disinfect 1 litre of natural, pathogen-containing water in 10 minutes. Acceptability tests with naval and military personnel showed much firmer preference for this poly-iodide tablet than for other disinfecting products now used, e.g., tincture of iodine, bromine-iodine combinations, or chlorine-releasing tablets. The main criterion in this marked preference was the lessened impairment of palatability, the greater convenience of speedy solubility and disinfection being only secondary. Another paper in the same journal deals with the larger-scale use of elementary iodine for water disinfection. The advantages that iodine's germicidal action is less dependent upon *p*H, temperature, and time of contact are stressed; also, nitrogenous impurities do not interfere with its action.

May be More Economical

IT is perhaps paradoxical that such belated attention is being paid to the solid halogen as a water-treating agent for its medical use as a germicide has been so long established that few such agents are more popularly known. Water treatment has largely been organised by public authorities and large corporations and the apparent cheapness of the chlorine route to hygiene has no doubt made greater appeal. In time, however, a more effective iodine route may prove to be more economical.

A photograph of the stand of J. W. Towers & Co., Ltd., Widnes, at the British Instrument Industries Exhibition which was held at Olympia, London, 30 June to 11 July

Standard Yeast's New Factory

Dovercourt Plant Possesses Many Interesting Features

A FACTORY of great interest to fermentation chemists and chemical engineers is the new yeast factory of The Standard Yeast Co., Ltd., at Dovercourt, Essex. While it has been in operation for slightly over a year now it was only last week that the trade and technical Press were given the opportunity of visiting and studying what must be one of the most advanced yeast factories in the world.

The design, engineering and construction of the factory was carried out by the Standard Development Co., Ltd., and operation is being supervised on a consulting basis for Mr. A. J. C. Olsen, M.Sc. (Danish), M.I.Chem.E., chairman and managing director, is technical director of the Standard Yeast Co., Ltd. Mr. Olsen has been associated with the fermentation industries since the 1920's so it was not surprising to find the Dovercourt factory is completely up-to-date in every aspect.

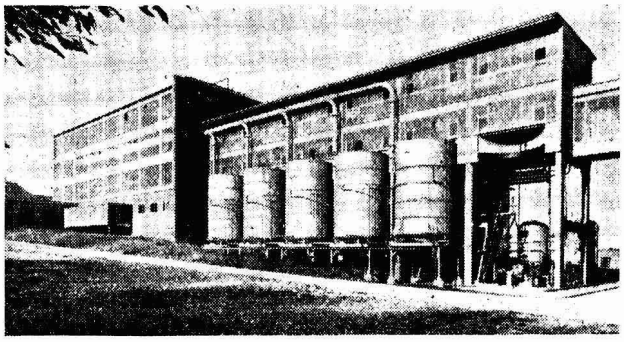
The factory, which produces from 5,000 to 10,000 tons of baker's yeast per year as well as a considerable quantity of desiccated yeast, has several interesting features. For instance, the maximum use is made of continuous processes including solution and sterilisation of molasses, dehydration of the yeast cream after separation and the preparation of chemicals. Then there is an exceptionally high use of instrumentation and automatic control. This is particularly noticeable in the fermentation control where the control of *p*H dosage of chemicals and anti-frothing oils, etc., is fully automatic. Another feature is the way in which the lay-out has been planned to rationalise production and minimise handling. The natural slope of the site is used to place storage tanks directly underneath the buildings to facilitate discharge of materials from road tankers and at the same time to permit maximum accessibility.

Another striking feature is that the fermentation tanks are placed outside the plant buildings except for small sections of the tops of the vessels which protrude into the main control room. In this way advantage has been taken of the economy of outdoor installation and of easy inspection and cleaning. The vessels are cleaned from the bottom using a high-pressure rotating spray.

The factory is on a sloping site overlooking the Stour Estuary. All materials are delivered over a weighbridge to the first block of buildings which are located just inside the gate on the highest ground. The materials pass through the plant with the least possible handling and the finished product is loaded into refrigerated vehicles at the far end of the factory which is on comparatively low ground.

The buildings consist of two production blocks and one block for laboratories and administration. The main raw material is

A view of part of the new factory showing the building housing the blower and refrigeration plant (right) and the office and laboratory block (left)



The fermentation plant (right). Part of the tops of the fermentation vessels protrude into the control room for easy examination. The vessels are raised off the ground and are cleaned from the bottom

molasses and this is supplied from nearby sugar factories. All the water required is obtained from wells on the site. For economic reasons the effluent is discharged to the sea on the falling tide with the approval of the local authorities. The floor area in the case of the two manufacturing blocks is roughly 40,000 sq. ft. allowing for the production of more than 200 tons of baker's yeast per week. The site allows ample scope for future development.

Molasses is used as the sole source of carbohydrate and much of this is sugar beet molasses. As it arrives from various sources it is discharged from road tankers by gravity into a number of tanks in the foundations of the buildings. This permits the different types of molasses to be stored separately and also allows for frequent emptying and cleaning of the tanks.

The molasses is drawn directly to a 2½ h.p. motor-driven proportioning pump which mixes it with water at a steady rate of from one or two tons per hour, 24 hours per day, throughout the week. At the outlet of this pump the molasses solution is sterilised by a continuous method with the supply line from the proportioning pump to the molasses clarifiers acting as a steriliser vessel. The solution is then passed through control instruments which automatically adjust the solution to a pre-set sugar concentration. The solution then flows to feed tanks over the fermentation vessels.

The whole process of pumping from the storage tanks and supplying the sterile molasses solution to the fermentation vessels is continuous and requires no supervision other than that for the molasses clarifiers. The speed of the proportioning pumps and the rate of sterilisation is automatically controlled and synchronised with the flow to the fermentation vessels.

The inorganic requirements for yeast production are supplied by such chemicals as ammonium phosphate, ammonium sulphate and di-sodium phosphate and these are passed direct from delivery vehicles by means of a sack elevator to the chemical stores at the top of the building. Liquid chemicals such as ammonia liquor, sulphuric acid and anti-froth oils are discharged from road tankers to bulk storage tanks built under the roadway.

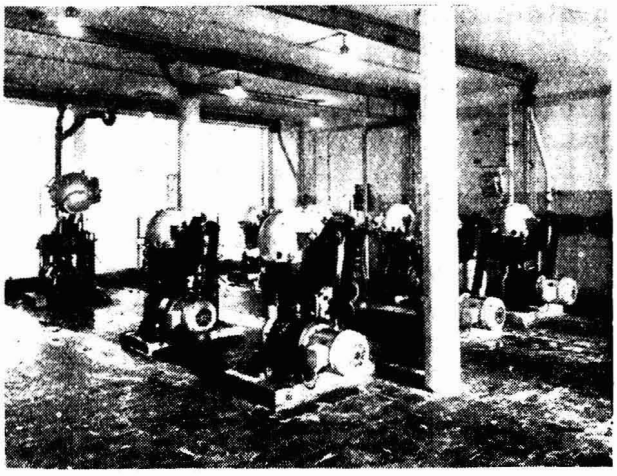
From the top floor ammonium sulphate crystals are dissolved in a continuous flow of water and automatically adjusted to a pre-set gravity, the rate of flow being adjusted to fulfil process requirements.

Molasses and chemical solutions flow through measuring devices to the 10 fermentation vessels from small buffer tanks situated above these vessels. The rate of flow is pre-calculated and stamped on a steel tape which operates the flow regulators.

The fermentation vessels are of stainless steel and are cooled by means of water jackets, to leave the interiors completely free from obstructions except for the aeration pipes at the bottom. Both aeration devices and bottoms are of special patented design which enables easy cleaning and the introduction, through the bottom, of the high pressure rotating spray mentioned above. Patents have also been applied for for this device. By its use the vessels can be thoroughly and quickly cleaned without men entering them.

The air supply is introduced through the bottom of the fermentation vessels and is controlled by a simple type of valve with remote finger-tip control. Patents have been applied for for this as well.

Each fermentation vessel has its own instrument panel containing liquid dip gauges, air and temperature recorders,



Centrifuge room, where, after fermentation, the yeast cream is separated and washed

thermostatic cooling water controllers, sample devices, *p*H controllers, automatic anti-froth oil controllers and flow controllers for molasses and chemicals. This room also contains panels with indicator lights for plant in other parts of the buildings. The two men on duty here are in complete control of the process throughout the factory.

Fermentations are set according to a rigid programme and power and steam loads are kept at a nearly steady level day and night since all plant is run continuously.

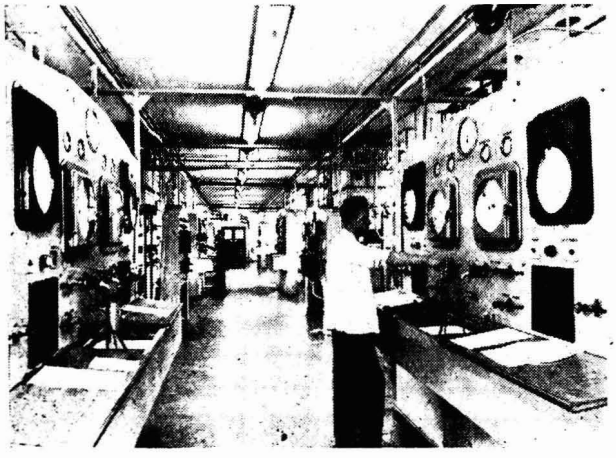
After fermentation is completed the contents of the vessels are pumped to totally enclosed separators where separating and washing of the yeast cream take place. The separator attendant also supervises the high-speed centrifugal molasses clarifiers located in the same room.

The yeast concentrate is then discharged through plate coolers which reduce the temperature to slightly above freezing point. It is then temporarily stored in insulated stainless steel vessels which are also located in the open.

Two types of filters are used—continuous vacuum filters and the high pressure plate and frame presses. After filtering or pressing the yeast passes through automatic forming, cutting and wrapping machines, and after packing in the 28-lb. cartons is carried by conveyors to the cold store for loading into refrigerated vehicles.

In the laboratory and administration blocks there are laboratories of the latest design and fitted with the latest equipment for biological work, baking tests, routine control and development work.

Undoubtedly the Standard Yeast Co. owes a great deal to the Standard Development



The control room for the fermentation plant

Co., Ltd. This company is grouped around a team of fermentation experts with 30 years' experience in yeast and allied industries in many parts of the world. Mr. Olsen, for instance, has been associated with the fermentation industries since the 1920's when the Danish scientist, the late Sören Sak, revolutionised the yeast industry by developing methods for producing yeast without alcohol. He has designed, built and managed yeast plants in many different countries including the United States.

The company has excellent facilities for research, their services have been found especially useful by independent producing companies. In some cases complete plants have been modernised while in others, new methods have been introduced.

Synthesis of Pyridines

CHEMISTS and petroleum engineers employed by Phillips Chemical Company, Port Adams, Texas, have developed a commercially practical method for producing methyl vinyl pyridine (MVP) and other valuable pyridines, synthetically, from petroleum raw materials. A special plant is now under construction.

As a preliminary step, acetaldehyde is converted into paraldehyde. The latter is prepared by the trimerisation of 3 molecules of acetaldehyde to 1 molecule of paraldehyde in the presence of a small amount of sulphuric acid catalyst. The combined acetaldehyde and sulphuric acid are fed continuously into the polymerisation reactor, the exothermic heat of reaction being removed by cooling water in an external heat exchanger. The acid catalyst is neutralised and the paraldehyde is purified by fractionation.

The next step is the synthesis of methyl ethyl pyridine (MEP). It consists of a liquid phase reaction of paraldehyde with ammonia. In addition to the main product, a certain amount of 2-picoline, 4-picoline, and heavy pyridine by-products are formed. The reaction effluent goes to separation equipment and excess ammonia is recycled to synthesis.

The main dehydrogenation reaction produces 2-methyl 5-vinyl-pyridine; and also a certain amount of pyridine, as such, 2-picoline, 3-picoline, 3-ethyl-pyridine, lutidine (2,5-dimethyl-pyridine), and 3-vinyl-pyridine by-products.

Chemical Engineering

European Federation Inaugurated

A EUROPEAN Federation of Chemical Engineering was formally inaugurated at a foundation meeting held in the Maison de la Chimie in Paris on 20 June. The purpose of the Federation is to promote European co-operation in the fields of chemical engineering and equipment.

The Federation owes its origin to efforts begun in 1951, and which assumed a more concrete form during the course of the European Convention for Chemical Engineering and the ACHEMA X Chemical Engineering and Equipment Exhibition held in 1952.

The following scientific and technical societies were represented at the inauguration of the Federation:—Asociación Nacional de Químicos de España, Madrid; Association des Ingénieurs et Techniciens Chimistes de Belgrade, Belgrade; Colegio de Ingenieros Industriales, Madrid; DECHEMA Deutsche Gesellschaft für chemisches Apparatewesen, Frankfurt a.M.; Gesellschaft Deutscher Chemiker, Frankfurt a.M.; Instituto de Ingenieros Civiles de España, Madrid; Kemian Keskusliitto-Kemiska Centralförbundet, Helsinki; Nederlandse Chemische Vereniging, 's-Gravenhage; Sociedade Portuguesa de Quimica e Fisica, Oporto; Société de Chimie Industrielle, Paris; Société des Ingénieurs Civils de France, Paris; Schweizerischer Chemiker-Verband, Zürich; Schweizerische Gesellschaft für Chemische Industrie, Zürich; Schweizerischer Ingenieur- und Architektenverein, Zürich; and Verein Deutscher Ingenieure, Fashgruppe 'Verfahrenstechnik,' Frankfurt a.M.

Several other scientific and technical societies—some in Norway, Denmark, Luxemburg and Austria—have signified their early intention of joining the Federation.

Management Committee

The activities of the Federation are managed by a committee of management comprising Herbert Bretschneider, Germany; Hans C. Egloff, Switzerland; Francis A. Freeth, Great Britain; and Jean Gérard, France. The General Secretariats of the European Federation of Chemical Engineering are in the Maison de la Chimie, 28 Rue Saint-Dominique, Paris, and in the Dechema-Haus, Frankfurt am Main, Rheingauallee, 25.

Physical & Chemical Structure of Coals

BCURA Continues its Studies

THE main effort in chemical research of the British Coal Utilisation Research Association, Leatherhead, Surrey, in 1952, was devoted to fundamental studies of the physical and chemical structure of coals, with increasing emphasis on the nature and influence of the associated mineral matter; special attention was given to the bearing of these studies of the production of active carbon from coal on carbonisation, and on the direct chemical utilisation of coal.

In direct research the greatest proportion of effort was spent on a long-term programme connected with the chemical utilisation of coal; next in importance was the investigation of physical structure, comprising mainly the X-ray examinations and the work on active carbon production, and third was the embryonic programmes on thermal decomposition of coal and on its mineral constituents including boiler deposits. The work is fully described in its annual report for 1952 published by the BCURA.

In each of these broad divisions of the programme, much work has been done to establish methods of investigations and basic data before any clear conclusions can be formulated. It is, therefore, inevitable that the specific new results described in the report do not accurately reflect the amount of effort involved.

Significant Results

Among the new results, the following are of particular significance:—

(*a*) an absolute standard has been calculated against which theories on the structure of the coal molecule may be tested. This takes the form of atomic radial distribution curves, derived from X-ray measurements, which have been obtained from a number of vitrinites covering a wide range of rank;

(*b*) some success has been obtained in fractionating coal extracts;

(*c*) treatment of Northumberland coal with chlorine trifluoride has led to its complete conversion into volatile and virtually colourless products, no tar being formed.

(*d*) treatment of coal with nitrogen oxides has been found to reduce its tendency to produce smoke when burnt;

(*e*) examination of the inner layers of bonded boiler deposits by an X-ray method has suggested a possible explanation of their strong adhesion to the metal surfaces.

Most of the current investigations are at an early stage of progress. Several processes and materials which arose out of earlier work—for example the oxidation of phenanthrene, the inter-conversion of phenols, the manufacture of reactive chars and other carbon products, coal-solvent binders, zircon refractories—are ready for industrial assessment. Work on these within the association has therefore finished.

Gravimetric Method

The analytical laboratory has continued to contribute increasingly to nearly all the programmes of the association. Among new developments is the introduction of a gravimetric gas analysis apparatus for the determination of small quantities of combustible gases in flue gas; for this purpose the gravimetric method is faster than the volumetric and at least as accurate.

As a result of modifications made to the Bone and Wheeler gas analysis apparatus on the advice of J. W. Wood, of Leeds University, the absolute accuracy of analysis of a sample of producer gas is now sufficient for calculation of calorific value and material balances. The standard deviation of repeat measurements for all constituents is 0.4 per cent absolute, and the analysis is completely selective.

Work has been carried out in connection with the redrafting of B.S. 1016, 'Analysis and Testing of Coal and Coke'; for example, alternative methods of determining nitrogen and chlorine in coal have been compared and assessed.

The research activities of this laboratory are increasing in importance, and, in addition to the development of new methods of analysis, include work on the mineral constituents of coal.

In industrial technical research one of the principal tasks in hand is to find ways of burning efficiently the finer sizes of coal—often of high ash content—which tend to be produced in increasing quantities as a result of the expansion of mechanised

mining. It is possible to achieve high steam raising efficiency in conventional types of plant if these fines are correctly conditioned. Boiler studies have been concerned in general with all the problems from fuel characteristics.

Another side to this national problem has been to discover and develop new methods of using such fines. The association has thus been investigating (a) the cyclone method of burning fine (crushed, but not pulverised) coal and (b) methods of pelleting, and has achieved a useful measure of success in both.

Cyclone Combustion

The cyclone combustion principle developed in America is one which should readily lend itself to use with this material; it involves the burning of fine material in a chamber in which it is swirled round in an atmosphere of air, the ash fusing and running down the walls and the larger particles being burned out on the walls. American practice, however, has demonstrated that harmful deposits are likely to be formed on the superheater tubes in cyclone heated watertube boilers.

Burning of fine coal by the cyclone method has been under investigation in BCURA principally under an arrangement with the DSIR in connection with the effort to develop a coal-fired gas turbine. The potential merit of the method lies in the prospect of obtaining almost 100 per cent combustion efficiency, obviating preliminary pulverisation and enabling removal of ash in liquid form, with the possibility of using it as a building material after granulating under shock of quenching. A principal difficulty in operating the first experimental cyclone chamber at Leatherhead, namely the blockage of air inlets by ash accretions, has now been largely overcome by a modification in design.

A serious remaining problem is to avoid volatile and particulate inorganic matter being carried forward in hot gases and leading to bonded deposits on turbine blades. Experience with parallel problems in watertube boiler plant, as studied under the boiler availability programme, is likely to be invaluable in solving this particular problem.

Field studies of gas producer practice, concerned earlier with optimum fuel-bed depth and automatic control of feed, have been continued more recently in the direction of remedying the problem of tar deposition in the mains and of maintaining a level bed in producers by mechanical means. Attention in the future will be directed to obtaining gas of higher calorific value either by using modified blast or by modifying producer design. Preliminary work has shown that slurry pellets can be gasified without difficulty.

The year 1952 marked the end of the third quinquennium of the BCURA and the first part of the report is devoted to the progress made since its foundation in 1938. Virtual completion of the station, previously conducted in scattered and improvised premises, was marked by the opening on 24 June last of the building devoted to the study of domestic fuel utilisation.

Membership of the association is now a partnership of 130 private firms and groups and of the four nationalised industries (coal, gas, electricity and transport).

The impact of industry on the work of the association is steadily increasing as shown by the rise in membership and a greater demand by members for service and increasing licensing of inventions.

Researches have now acquired a momentum considered to justify an endeavour to expand the complement of qualified staff within the next few years from its present number of 80 to about 100. To enable this, one additional building, and an increased income of some £50,000-£60,000 a year would be required. This, and the fact that through exigencies of the present time the DSIR has been obliged to fix conditions of grant-aid during the forthcoming quinquennium on a basis less favourable than hitherto, make it highly important for the association to attract new industrial income.

Copies of the annual report (price 7s. 6d.) may be obtained by non-members on application to the Technical Administrative Officer, BCURA, Randalls Road, Leatherhead, Surrey.

Saskatchewan Potash

The possibility of a major potash development in Central or East Central Saskatchewan is being studied by the Potash Company of America. Exploration work by the company is reported to have cost about $400,000 so far. Test holes are being drilled about 12 miles south of Saskatoon. Estimates of the cost of a mine and surface plant range as high as $12,000,000.

American Scientific Activity

Chemical Industry Expands Phenomenally

CHEMISTRY plays a prominent part in the scientific activity in the USA, where the amount spent on research and development has increased by 270 per cent during the last decade and it is estimated that $2,930,000,000 will be spent in 1953, of which sum more than half will be provided by the Government.

Details of the distribution of scientific effort within the Federal, industrial and university institutions are given in the 'British Commonwealth Scientific Office Review of Science in the USA for the Year Ending June, 1952,' published by HMSO, 2s. 6d. (USA, 65 cents). This is the fifth in a series of annual reviews from the North American office of BCSO, but the first to be published. It has been produced jointly by the five Missions in Washington from the United Kingdom, Canada, Australia, New Zealand and South Africa, which form a valuable link for the exchange of scientific and technical information.

Under the stimulus of the armaments programme (the report states), the chemical industry in the USA expanded at a phenomenal rate during 1951. Capital expenditure in the chemical industry proper topped $1,200,000,000 and was planned to exceed $1,500,000,000 in 1952. Despite an increase in the Federal Reserve Board index for industrial chemicals from 488 for October, 1950, to 563 for October, 1951, the overall position was still one of shortages in many fields.

Greater Shortage Expected

In spite of a 2 per cent increase in elemental sulphur production for 1951 over the 1950 figure, the shortage of sulphur amounted to 1,400,000 tons, and it was expected that this would increase to 1,750,000 tons by the end of 1952. Hopes that the development of newly discovered deposits at Garden Island Bay, Louisiana, would ease the shortage were not likely to be realised until 1953, when production from this source was expected to reach 500,000 tons per year.

Every encouragement had been given to projects and research aimed at easing the sulphur shortage. More than 20 plants were under development in 1951 for the recovery of sulphur from sour refinery and natural gases. The Dorr Company had installed or begun installation of almost 40 Fluosolid roasters mainly for the production of sulphur dioxide from pyrites and other sulphide concentrates. At Copper Cliff, Ontario, Canadian Industries Limited had started building an oxygen flash smelter which would produce a 70 per cent sulphur dioxide gas from sulphide materials. Recovery of sulphur from the low grade deposits in Wyoming, using the hot water leaching method due to the Chemical Construction Corporation, had not proved possible, but alternative methods were under consideration.

Manganese Extraction

A wide programme of research into methods, particularly chemical methods, for the improvement of low grade ores had been carried out with considerable success by a number of Government Departments working in co-operation with industry. This might be illustrated by the methods designed for the extraction of low grade manganese ores which combine acid leaching with electrolytic deposition.

In Canada a plant was being erected for the production of copper, nickel and cobalt by a process which involved leaching of a mineral concentrate with ammonia.

A wide search for new sources of selenium had been initiated, and while the Eagle Picher Company remained the sole producer of germanium, a number of zinc producers were actively concerned with modifying their production processes to permit the recovery of this trace metal.

Efforts had been made to solve the problems associated with the utilisation of hardwoods in the preparation of cellulose pulp. A plant now producing 100,000 tons of dissolving pulp a year gave hardwood prehydrolysis treatment prior to sulphate pulping. A second plant using the same process was under construction. Pilot scale experiments aimed at pulping scrub oak by a continuous Kraft process were being undertaken in Florida.

Much progress had been made in the utilisation of glass fibres, probably the most significant advances being in the field of

fibre-reinforced plastic laminates. As an example, several firms had recently started to produce pipe made of this material capable of withstanding pressures of 1,200-1,400 p.s.i.

Paper made entirely from glass fibre was now being produced by four different manufacturers, and paper consisting of pure quartz had been prepared on a pilot scale in the experimental mill of the Bureau of Standards. The paper had excellent electrical properties, high resistance to heat, moisture, chemicals and micro-organisms and was an excellent air filter.

Synthetic Mica

Progress had been made in the production of synthetic mica. Production of synthetic sheet was under pilot plant investigation, and hot press mica ceramics were available for commercial production.

According to the report a threatened shortage of benzene had so far been largely off-set by imports from Europe; the projected increases in styrene and phenol production would lead to an increasing shortage by the end of 1952. The deficit would ultimately be met by benzene produced by conversion of naphthenes present in natural petroleum. An interesting development in this field was a process used by the Sun Oil Company for the extraction of aromatics from petroleum fractions by selective adsorption on silica gel. The aromatics were subsequently eluted with a mixture of xylenes. About 13,000,000 US gallons per year of benzene were being produced in one plant by this process. (US gallon = 5/6 British gallon).

There had been a marked increase in the use of petroleum products for the production of chemicals. Foremost in the utilisation of the gaseous hydrocarbons were the plastic and synthetic fibre industries. In the plastic field there had been a number of highlights in the utilisation of ion exchange resins. A continuous ion exchange process had been designed by the Stanford Research Institute. Ion exchangers had been prepared on which the functional groups were phosphate radicals and others had been prepared on which it is possible to carry out redox-reactions. Ion exchange membranes had been utilised in an electrical process for the de-salting of sea water.

The introduction of butadiene-styrene latex-based paints had caused a revolution in the paint industry, and production was growing extremely rapidly. New silicone alkyd copolymers, for use in the preparation of coatings which resist corrosion, heat, and abrasion, had been widely acclaimed.

Progress in cold rubber production had received a new stimulus from a process enabling 25 per cent of petroleum-based oil to be incorporated in the rubber latex, without impairing the quality of rubber produced.

There had been no slackening in the research effort applied to pharmacological and biological chemistry. The production of antibiotics, under the effect of the demand for animal feed supplements, had grown to twice that for 1950. The first plant designed exclusively for the synthesis of an antibiotic, in this case chloromycetin, was due to start production in early 1952. The commercial synthesis of cortisone had been facilitated by a series of new methods for the introduction of a keto group into the 11 position of the nuclei of various steroids, the most exciting of these being the possibility of introducing the keto group by means of a microbiological oxidation using a species of *Mucorales* mould.

First total synthesis of a steriod was announced in 1951 and this was quickly followed by the synthesis of cholesterol and a number of hormones.

The field covered under the title of Biochemistry of Food Processing and Preservation was mainly concerned with the chemical mechanisms of deterioration in the protein, carbohydrate and lipid constituents of foods.

Food Chemistry

Use and control of chemicals (particularly antioxidants) in foods and the increasing amount of work being done in the USA on the sterilisation of food (as well as of pharmaceuticals and so on) by electron beams and by radiation from radioactive fission products is of direct interest to workers in the Commonwealth.

At the Eastern Regional Laboratory of the Bureau of Agricultural and Industrial Chemistry, investigations were in progress on the nature and control of reactions of the browning type in maple products, on large-scale separation of some of the amino acids from protein hydrolysates by fractional distillation of the N-acetyl esters, on the evaluation of the water-holding capacity of casein in relation to its polar groups and on the

number, nature and reactivity of its free amino groups.

The use being made at this laboratory of the newly developed fatty acid complexes with urea for the separation of unsaturated fatty acids and of their autoxidation products was of particular interest, as was the use of the polarograph for the estimation of hydroperoxide, peroxide, α,β-unsaturated ketones and β-unsaturated aldehydes in autoxidising fatty esters.

At the Western Regional Laboratory, where deteriorative mechanisms in dried egg have been under investigation for some years, the relative merits of removal of glucose by yeast and by enzyme had been compared, and the advantage seemed to lie with the yeast-fermentation process. Work was also being carried out on the deterioration of shell eggs during storage in relation to individual constituents and on the development of fishy off-flavours in turkey meat in relation to highly unsaturated fat in the diet.

Some progress had been made at the Northern Regional Laboratory in the difficult fractionation of vegetable phospholipins by counter current methods, and the long awaited demonstration of the Amadori rearrangement in aliphatic N-glycosides and of its probable relation to browning had been made.

Investigations of the mechanism of trace metal inactivation by chelating agents, a process capable of producing marked improvements in the stability towards autoxidation and reversion of soya bean oil and shortenings, had also been carried out. The researches being actively pursued by a team of some 50 members of the production and properties of dextrans for use as blood plasma extender, while not strictly in the food field, were sufficiently close in scope to warrant inquiry. Much fundamental knowledge on the nature and properties of these substances and on the optimum conditions for their production had been collected and large scale production had commenced and was expected to expand rapidly.

Antibiotics as Growth Promoters

Also not strictly in the field of food preservation and storage (but nevertheless of interest because of its possible effects on the composition and properties of meats) was the rapidly increasing use of antibiotics in the feeding of farm animals, particularly pigs and poultry. Opinions differed as to how much food was saved. However, when antibiotics were used under the conditions which exist on many American farms, it appeared that the animals were ready for market in about 80-85 per cent of the time.

Most authorities seemed to agree that there was about a 10 per cent saving in the amount of food needed to bring table poultry to the stage when they could be marketed. Some authorities also believed that there was a similar 10 per cent saving in feeding pigs, but others felt that the saving in food was in fact small and that the advantages lie mainly in the fact that the animals were ready for market more quickly.

Resists Microbial Spoilage

Another interesting development, as yet still under investigation, was the demonstration at Ohio State University that infusion of a carcase of beef with an antibiotic immediately after slaughter imparts greatly increased resistance to microbial spoilage, both internal and external, of the meat, and was particularly valuable when facilities for rapid cooling of the carcase were not available.

Special techniques of chromatography, now one of the most valuable tools of the biochemist, had been developed at the Pasadena Laboratory of the Bureau of Agricultural and Industrial Chemistry, at the California Institute of Technology, and at several other laboratories.

The retarding effect of freezing and thawing on the subsequent growth of bacteria on meat was among projects related to meat quality and preservation under investigation at the USDA Meats Laboratory at Beltsville.

In recent years there had been a remarkable development of the US scientific apparatus industry, in the production of refined testing equipment, and of physical methods for rapid chemical analysis, for example, by means of the direct-reading spectrophotometer. Sanction had been obtained from MSA to purchase such equipment as was not manufactured in Europe for the laboratories of DSIR and the industrial research associations, and contracts had been placed for some 140 items, costing $670,000. Although some deliveries had been delayed because of conflicting defence contracts, 132 items had been shipped to the UK by the middle of 1952.

New Gas Process

Continuous & More Efficient

RECENT reports in our pages (pp. 733, 739) of the increase in the use of natural gas and oil gas in the USA, and the corresponding rapid decline in the use of coal, add interest to the news that Du Pont is to stick to coal as a CO source at Belle Works in West Virginia (*Chemical Week*, **72**, 23, 36).

However, an entirely new process has been developed, which is claimed to give more efficient conversion of coal and less pollution than in the present water-gas method; it is known as the coal-partial-combustion process.

Low-fusion-ash coal can now be used instead of the higher-grade coking coal. A mixture of CO and H_2, known as synthesis gas, is produced by feeding finely ground coal into a ceramic-lined furnace where it is burned in the presence of steam and a 'deficiency of oxygen' at a carefully controlled temperature.

Synthesis gas is an excellent starting point for several Du Pont products. They are probably the only firm, for instance, to manufacture ethylene glycol by synthesis of glycollic acid from formaldehyde and CO, followed by esterification and hydrogenation. Ammonia and urea can also be produced: CO reacts with steam to give CO_2 and H_2; the hydrogen is led to an ammonia process, and the ammonia will react with the CO_2 to give urea.

The bulk of ash from the furnaces will be removed as slag, and lightweight particles will be removed from the exhaust in filters. If the new process comes up to expectation it will eventually replace all the coke ovens and gas generators at present in the plant, giving a continuous and more efficient process, and reducing atmospheric pollution to a low level.

The method involved eight years' research and an outlay of $1,600,000; installation of a full-scale unit is calculated to cost $4,000,000.

War Damage Claims

THE Financial Secretary to the Treasury, Mr. J. A. Boyd-Carpenter, was asked in the House of Commons recently, by Mr. G. W. Odey (Beverley), to make a statement on the incidence of the excess profits levy on the accrued interest which will be included in the proposed settlement on 1 October, 1953, of outstanding claims under the business scheme of Part II of the War Damage Act, 1943.

In a written reply Mr. Boyd-Carpenter said: 'I am advised that for tax purposes the accrued interest will rank as income arising on the date when it becomes payable. The Chancellor of the Exchequer agrees that the Government's decision to settle outstanding claims during the present financial year should not have the effect of making this accumulated interest liable to the excess profits levy.

'Accordingly, in agreement with the President of the Board of Trade, any corporate body that is a claimant under the scheme will be given an option and it may now elect by letter addressed to the Board of Trade Insurance and Companies Department, not later than 31 August, to have its compensation made payable with accrued interest on 1 January, 1954, instead of 1 October, 1953.

'Where that election is made, no part of the accrued interest will be included in computing profits for excess profits levy purposes, whether the corporate body makes up its annual accounts to 31 December or to another date.'

New Research Institute

ESTABLISHMENT of the Mathieson-Squibb Institute of Chemical Research and Engineering was announced recently by Thomas S. Nichols, president, Mathieson Chemical Corporation. The president of the newly created institute will be Dr. Carl F. Prutton. The new organisation will consolidate Mathieson's rapidly expanding chemical research and engineering functions.

As an initial step the Institute acquired at auction a 350-acre tract of land, together with a number of excellent buildings near Shawan, Maryland. Plans are being made to use the land and farm buildings as a highly developed experimental farm where the company's varied agricultural chemical products such as plant foods, insecticides and animal nutritional supplements will be further developed and tested.

It is estimated that it will take about two years to complete the appropriate changes and additions which are to be made to the buildings and grounds to accommodate the Institute's activities.

Fire Prevention & Cure

A Year's Work at the Fire Research Station

ESTIMATES of the cost of losses due to fire in Great Britain are normally set at about £24,000,000 per annum; any investigations which can lead to a decrease in this figure are obviously of great national importance, and 'Fire Research 1952' describes some of the work on this problem carried out by the Fire Research Station, Boreham Wood, during the past year.

Further experiments on vaporising liquid extinguishers (see THE CHEMICAL AGE, **78**, 599) have been performed, relative effectiveness being defined in terms of 'peak value' (the minimum percentage of the agent which will prevent ignition with any mixture of the combustible vapour—coalgas or *n*-hexane—and air). The peak values of extinguishers decreased in the order: trifluorotrichloroethane, carbon tetrachloride, methyl bromide, chlorobromomethane, trifluorobromomethane, difluorodibromomethane, tetrafluorodibromoethane.

An apparatus was constructed which enabled the contents of a commercial fire extinguisher to be liberated in such a way as to eliminate the personal factor and to be directed systematically on to a petrol fire burning in a steel tray. Both trifluorobromomethane and methyl bromide were markedly superior to the other agents tested; trifluorobromomethane was somewhat more effective than methyl bromide, whether the comparison was based on the weight of compound, volume or time of extinction.

Decomposition Products Study

A study was made of the decomposition products obtained by burning coal gas at a small tubular burner, concentric with which was a tube carrying a mixture of air and the vapour of the extinguishing agent. The principal components, depending on the agent introduced, were HCl, HBr, or HF. Small amounts of free chlorine or bromine occurred, and in some instances traces of carbonyl chloride or carbonyl bromide, but no free fluorine.

Even with small additions of extinguisher, concentrations of hydrogen halide were higher than the generally accepted safe limits. With trifluorobromomethane between 73.5 and 100 per cent of the bromine introduced appeared as a mixture of hydrogen bromide and bromine, but only about one-third of the fluorine was found as HF; with chlorobromomethane, free bromine was found but no free chlorine.

Dangerous Substances

At the request of the Home Office, an analysis was made of fires involving dangerous substances. In 1948, fire brigades were called to 77 fires involving substances listed in the Petroleum (Inflammable Liquids and Other Dangerous Substances) Order 1947; they were also called to 88 fires involving substances not listed in this Order, but which gave rise to similar hazards. Lighter fuel was responsible for 49 fires, 38 of them in private houses and seven in shops: in 17 incidents the fuel was being used to light or assist the burning of fires or boilers. Twenty-four fires involving iron sulphide and oxide were connected with industrial operations; seven were attributable to methyl chloride, and eight to adhesive solutions for rubber floor coverings.

The conclusion drawn is that the majority of these fires were caused by carelessness or ignorance. For example, 30 fires involved ether and methylated spirit, and in every case the material was handled carelessly, spilt, or stored in the vicinity of naked flames.

A number of industrial dusts have been studied, both in smouldering experiments, and in investigations of explosions. Those which ignite and propagate flames readily, the source of heat required for ignition being small, include synthetic resins, aluminium flake, cellulose acetate, leather pigments, sulphonamide, sulphadiazine, blown zinc powder, and diazo compounds.

Extensive tests on the efficiencies of foam are in progress, and experiments have been begun again on the base injection of foam into petrol storage tanks on fire. Work on surface application showed that at high rates of application there is little difference in merit between foams produced from a wide range of compounds; the experiments also showed that below certain rates of application, hydrolysed protein foams were superior to others.

In view of concern in certain quarters

about the possible danger of production of phosgene during the combustion of plastics such as polyvinyl chloride or chlorinated methacrylate resins, experiments were carried out with various plastics at temperatures ranging from 300° to 1,000°. The principal products of combustion were CO, CO_2, and HCl; traces of phosgene were found in one or two instances, but the amounts were relatively insignificant in comparison with the other toxic gases.

These and many other important investigations are described in ' Fire Research 1952,' published by HMSO, price 3s.

Tin Research Institute

Development of New Alloys

THE report of the Tin Research Institute for 1952 illustrates the varied nature of the research projects undertaken during the year, and summarises the advances which have been made.

The development of the new tin-nickel alloy plating into an acceptable industrial process has presented some difficulties, since the plating solution is hot and actively corrosive, and must be quite free from suspended solids. A suitable filter has now been produced, however, and proved entirely satisfactory. The coating is hard and highly resistant to tarnish, and has a warmer and more attractive lustre than chromium.

The tin-zinc alloy plating for steel has been found to have wide applications, and it is estimated that plants throughout the world now total a capacity of some 50,000 gal. A new bearing alloy of aluminium containing up to 30 per cent of tin has been shown to be satisfactory in operation, but the problem of binding to a rigid steel backing has not yet been solved.

The manufacture of organotin compounds for use in the plastics industry has been started in England and is being contemplated by some manufacturers on the Continent. New methods of preparation have been developed by research workers at the University of Utrecht, and it is hoped that these will help to reduce production costs. Some information on the fungicidal properties of certain organotin compounds has also been obtained.

The report records that the various groups of tin producers have agreed to increase their financial contributions to the Institute by 50 per cent, in order to strengthen the staff and increase the free technical services to industry.

The report may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex, or from any of the Institute's overseas offices.

International Rubber Diploma

THE first example of a British professional examination being accepted as the basis for the award of an international diploma is announced by the Institution of the Rubber Industry. Far-reaching proposals, it states, were agreed at a meeting of the international education committee in Paris regarding the establishment of an international diploma for rubber technicians.

Preliminary negotiations had already resulted in the acceptance of an equal technical level of education in all collaborating countries on a standard comparable with that of the Licentiateship of the Institution of the Rubber Industry in London. It has now been decided that a mutually recognised international diploma, to be awarded on passing the examination set and assessed by the board of the British Institution, shall be available to candidates in participating countries.

General agreement has been reached on the requirements in preliminary and professional education and the scheme will come into operation forthwith in Norway, Sweden, Denmark, Holland, France Belgium, Western Germany, Switzerland, Italy, and the United Kingdom.

New Metals Factory

THE foundation stone of the new factory for the Telegraph and Construction Company, Ltd., at the satellite town of Crawley, was laid recently by Lord Colgrain, chairman of the company. The new factory, which will be devoted to the manufacture of Telcon metals (magnetic materials, electrical resistance alloys and special metals for the electronics industry and scientific instrument makers) will be completed in about a year, and will be in full operation before the end of 1954. It involves the complete removal of the company's Metals Division from Telcon Works, Greenwich, and about 350 people will eventually be employed in the new factory. Sir Thomas Bennett, chairman of the Crawley Development Coroporation, was guest of honour at a luncheon which followed the ceremony.

The Analysis of Cobalt

Part I—Qualitative

TOGETHER with a number of other metals, cobalt has assumed a greater importance during recent years, mainly as a result of the extensive researches into its applications during the last war. Apart from its many industrial uses, cobalt has been shown to be an essential trace element in animal nutrition. Consequently, there is a growing need for a collected account of some of the more important of the recent developments in the analysis of cobalt, and this review is an attempt to fulfil that need.

Detection with Organic Reagents

The first organic reagent for the detection of cobalt was 1-nitroso-2-naphthol. In 1885, Ilinski and von Knorre[1] observed that 1-nitroso-2-naphthol formed a brick-red precipitate with solutions of cobalt salts. Since then, numerous papers have been published describing the use of this reagent for the detection and determination of cobalt in many materials.

Although the use of 1-nitroso-2-naphthol is considered by some workers to be unattractive because of its colour (somewhat similar to the colour of the complex it forms with cobalt), there have been several recent papers describing its further applications. Thus Duval and Goff[2] have detected cobalt in urine (after intramuscular injection of cobalt chloride or pentamminochlorocobaltous chloride solutions) by the use of a solution of 1-nitroso-2-naphthol in acetic acid. The reagent will not detect cobalt complexes in urine but boiling with sulphuric acid or, preferably, electrolysing the urine will liberate the cobalt from the complex. As little as 0.05 μg. of cobalt can be detected in this way.

Dubsky and Langer[3] in a comprehensive review of organic reagents gave details of the precipitation of both divalent and trivalent cobalt with 1-nitroso-2-naphthol and 2-nitroso-1-naphthol and listed evidence for the existence of nitrosonaphthols in tautomeric forms.

Nukatu[4] used a solution of 1-nitroso-2-naphthol in ethyl alcohol as reagent for the detection of cobalt in neutral and acid solutions. Iron, nickel, manganese and copper did not interfere under the conditions employed.

For the rapid detection of cobalt in steels Adamovich[5] described the following test:—Dissolve the steel shavings in hydrochloric acid (1 : 1) or place on the surface of the sample several drops of a mixture of nitric and sulphuric acids, transfer the solution to a watch glass and heat to boiling. Place a drop of the solution on a filter paper, moisten with 10 per cent sodium pyrophosphate solution; when the spot is decolourised add 1 drop of 1 per cent solution of 1-nitroso-2-naphthol in acetone. A red spot is obtained if cobalt is present.

Lung, Cardini and Fukman[6] claimed that 2-nitroso-1-naphthol gave a more sensitive test for cobalt that 1-nitroso-2-naphthol. Their procedure was as follows:—Add three drops of reagent (0.1 per cent solution of 2-nitroso-1-naphthol in ethyl alcohol) to 1 ml. of neutral sample solution. A brown-red precipitate indicates cobalt. If small amounts of cobalt are present, allow the mixture to stand for 30 minutes, then add 0.5-1 ml. of benzene and 2-5 drops of 5N sulphuric acid. Shake vigorously to extract the cobalt complex. The benzene layer is coloured light-red when 3-4 μg. of cobalt are present. To eliminate the excess of reagent make the aqueous layer alkaline and shake thoroughly. The benzene layer becomes brighter red. The reagent is very stable and will detect as little as 0.03 μg. of cobalt in 1 ml. of solution.

Sensitive Detection

The compound 2-nitroso-1-naphthol-4-sulphonic acid, prepared by the action of nitrous acid on 1-naphthol-4-sulphonic acid, gives a red colour with trivalent cobalt at *p*H 7-8. Sarver[7] showed that it was possible to detect one part of cobalt in 20 million parts of solution using this reagent. The interference from ferric ions could be masked by addition of an alkali fluoride.

1-Nitro-2-naphthol has been claimed to give a precipitate with cobalt. Mayer and Prodinger[8] found, however, that the method normally used for the preparation of the reagent always resulted in the formation of 1-nitroso-2-naphthol and that the perfectly

pure nitro compound would not precipitate cobalt.

Another naphthol compound which has been used for the detection of cobalt is 2,4-dinitro-1-naphthol, which in pyridine solution is reported[9] to give crystal rosettes of a slightly orange colour. The reaction is sensitive to 0.05 μg. of cobalt at a limiting concentration of 1 in 10,000.

Isatin-2-oxime has proved useful as a colorimetric reagent for the detection of cobalt. Sykova[10] recommended a 1 per cent solution of isatin-2-oxime in ethyl alcohol for the detection of cobalt in the lower valency state. A brown precipitate was obtained in buffered acetate solutions. A spot test technique was devised by Hovorka and Divis[11] using the same reagent. They impregnated filter paper with 2-isatoxime alone or in the presence of sodium acetate. A green colour was obtained due to the formation of complex cobaltous salt which was soluble in excess of alkali and ammonia, yielding a dark green solution, stable towards cyanides. Although anions such as chloride, bromide, cyanide, thiocyanate and thiosulphate interfered, they could be removed by treatment of the test solution with silver nitrate.

Isatin-2-semicarbazone has been used as an alternative to the oxine. The reagent of Hovorka and Holzbecher[12] contained 10 gm. of isatin-2-semicarbazone and 2 gm. of sodium hydroxide dissolved in one litre of 35 per cent ethyl alcohol and gave a yellow brown precipitate with cobaltous ions.

Spectrophotometric Examination

During a spectrophotometric examination of certain metal derivatives of 8-hydroxyquinoline Moeller[13] showed that a solution of the cobalt derivative in chloroform absorbed maximally at 420 mμ. It was proved that when a *p*H of 6.8 or greater was used chloroform solutions containing as little as 20 mg. per litre of cobalt showed little or no deviation from Beer's Law.

Martini[14] obtained maximum sensitivity (0.1 μg.) in the quinoline test by evaporating the test solution to dryness and adding a drop of paraffin oil and a small amount of quinoline. A study of the precipitate formed was made by Dubsky[15] who found that the formula is not exactly that which would be expected from a study of complexes in general.

The use of dithizone as a microchemical reagent for cobalt was described in detail by Beaumont.[16] He applied this reagent to quantitative analysis and the method will be discussed at length in a later article.

Dimethylglyoxime

One of the more common organic reagents for the detection of cobalt is dimethylglyoxime, which is useful for the detection of the element in Group IV of the group analysis. The reaction of cobalt with dimethylglyoxime and a sulphide or polysulphide can be made considerably more sensitive by converting the element to the trivalent state. The method described by Nilssen and Paulsen[17] is as follows: —The cobalt solution is treated with ammonia and dimethylglyoxime (which may be added solid), filtered if necessary, then treated with a few drops of hydrogen peroxide and heated to boiling. A solution of sodium polysulphide is prepared by boiling sodium sulphide with 3-5 molecules of sulphur. Two drops of this are added to the cobalt solution. A clear blue colour indicates the presence of cobalt. With this very small concentration of cobalt the colour of the polysulphide may cause the colour obtained to be greenish. In the presence of copper, filtration of the solution is recommended. None of the common ions interferes and the sensitivity is at least one in 5,000,000.

Another variation of this method was suggested by Dwyer.[18] He carried out a preliminary removal of any copper and iron which might be present by adding dilute potassium permanganate solution to 5-10 ml. of the hot acid cobalt solution until a slight pink colour remained. This was then decolorised with a few drops of sulphurous acid. 5-10 drops being added in excess.

Five-ten drops of potassium thiocyanate solution were added and boiling was continued until any red ferric thiocyanate colour was discharged and any copper present was precipitated as copper thiocyanate. A small amount of 0.5 per cent methylene blue solution was added, followed by an excess of 1 per cent sodium sulphite solution in 2N potassium cyanide. In the presence of cobalt the blue colour disappeared but this re-appeared on standing in the air or on shaking.

Cobalt could be confirmed in the filtrate from the dimethylglyoxime precipitation by acidifying the filtrate, boiling with two drops

of sulphurous acid reagent and a little methylene blue and making alkaline with ammonia. Decolorisation and then return of the colour indicated the presence of cobalt. Other methods for the detection of cobalt using dimethylglyoxime are based on one or other of the two described.

Keuning and Dubsky[19] suggested the use of phenanthrenequinone monoxime as a reagent for divalent cobalt. A 0.02N solution of phenanthrenequinone monoxime in 50 ml. of ethyl alcohol gave a red precipitate with cobaltous ions. The precipitate was insoluble in 80 per cent acetic acid and in concentrated ammonia solution. This method is not often encountered in general chemical analysis due to the expensive nature of the reagent.

Cuisu[20] prepared and studied the cobalt, nickel, ferrous and ferric salts of phenanthrenequinone monoximes and dioximes. The monoximes were found to be capable of detecting as little as 0.000094 gm. of cobalt per ml. of solution. Other lesser known reagents examined by Cuisu were diacetyl- and benzil-phenylhydrazone. The disadvantage of these reagents is that they are generally more sensitive to other elements. It is possible to detect 0.000048 gm. of ferrous iron using the same reagents.

Dipicrylaminates

Sheintsis[21] showed that, contrary to the claims of earlier workers, cobaltous ions gave dipicrylaminates which are insoluble in dimethyl ether and leave the oxide behind when heated in a crucible. These workers had reported that the precipitate was actually dipicrylamine itself instead of the metal salt, and stated that the colour obtained, as with other metal dipicrylaminates, was yellow. Sheintsis showed that the colours of the precipitates varied from yellow and brownish yellow to reddish brown. While the reagent is suitable for a confirmatory test on pure solutions it is not considered sufficiently selective to be used in other analyses.

The work of Naito and Mitio[22] has led to the following method for the qualitative determination of cobalt:— 28 gm. of phenylhydrazine when boiled with 10 gm. of thiourea in an oil bath at 130°-40° gave 6 gm. phenylthiosemicarbazide ($C_6H_5NHNHCS.NH_2$, mp. 200°). After boiling in 400 ml. of absolute alcohol for 12 hours a further 25 gm. could be extracted. Cobalt ions in sodium hydroxide gave a green colour and in ammonium hydroxide a green precipitate. In either instance as little as 9.8×10^{-7} gm. could be detected.

Pentamethylene dithiocarbamic acid in alkaline solution is known to form a salt with pyridine of the composition $(CH_2)_5 NCS_2H.C_5H_{11}N$, mp. 138°C. The salts of cyclohexyldithiocarbamic acid and phenylethyldithiocarbamic acid were also investigated by the same workers. They found that in each instance the trivalent cobalt salts were labile while the bivalent ones were stable.

Also examined were salts related to carbamic acid such as those of *s*-dicarbamidothiourea. It was found that an indigo-coloured precipitate could be obtained from 1 μg. of cobalt ion in 50 ml. of water. This colour was readily visible in a Lovibond Nessleriser and at a concentration of 4 μg. a detectable precipitate was formed. A comprehensive study of this reaction has been made.[24]

Cyclohexylethylamine dithiocarbamate was shown by Herrman-Gurfinkel[25] to give a characteristic precipitate with cobalt. Although the reaction is not very selective it could be used as a sensitive tests for cobalt.

The sodium, potassium and ammonium salts of 8-isonitramino methone semicarbazone and oxide give highly coloured precipitates with cobalt which are readily soluble in ethyl alcohol but insoluble in distilled water and ether. The salts are sufficiently coloured to be used as tests for cobalt. Brambilla[26] suggested that the reaction must be due to an isonitramino group present in both reagents.

A very sensitive test put forward by Vogelsang[27] in 1946 involves the use of *bis*-carbomethoxysemicarbazide. On adding alkali, as little as one part cobalt in 4×10^6 parts of water can be detected by the brown-yellow colour formed.

Testing Distilled Water

Kuznetsov[28] found a very useful reagent for the rapid testing of distilled water or the estimation of the efficiency of washing procedures, etc. The reagent, 4,4′-*bis*(2-hydroxy-1-naphthylazo)-2,2′-stilbenedisulphonic acid, was prepared by stirring 7.5-8.0 gm. of disodium diaminostilbenesulphonate in 50 ml. of distilled water and treating with 7.5 ml. of 4N sodium nitrite and 25 ml. of concentrated hydrochloric acid. This was allowed to

stand for one hour and then the brown suspension was poured into a filtered solution of 3.5 gm. of 2-naphthol in 30 ml. of ethyl alcohol and 60 ml. of 80 per cent sodium hydroxide solution.

The black precipitate formed was filtered off after two hours, and washed with distilled water and ethyl alcohol. The reagent was recrystallised from distilled water, suspended in water and re-converted to the free acid by adding hydrochloric acid. It was then washed with dilute hydrochloric acid and air-dried. The pyridine and triethanolamine salts were used in aqueous solution and the test solutions were either neutral or slightly alkaline. The colours of the salt solutions were pink and that of the cobalt suspension was raspberry.

A spot paper test for cobalt was devised recently by Khivopistev[29]. The acid-test solution, containing cobalt and thiocyanate, was treated with diantipyrylmethane. A slightly soluble blue complex was formed, probably having the formula $(C_{23}H_{24}O_2N_4)_2H_2[Co(CNS)_4]$. When Khivopistsev applied the method to a drop test on a filter paper he dissolved the reagent in 2N hydrochloric acid containing 10 per cent ammonium thiocyanate.

Sensitivity Lowered by Zinc

The test was efficient in that it was not interfered with by chromium, nickel, iron, manganese, aluminium, zinc, barium, strontium, calcium, magnesium, potassium, sodium or ammonium ions. Pretreatment of the sample with sodium thiosulphate in acid solution and precipitation of other possible interfering ions, e.g., sulphides, made the test generally useful. It must be noted, however, that large quantities of zinc lowered the sensitivity by the formation of a colourless zinc complex.

The following year the same worker examined a similar compound as a reagent.[30] He found that in neutral or nearly neutral solutions cobalt ions reacted with pyramidone (Pyr) and thiocyanate ions, yielding the blue $Co(Pyr)_2(CNS)_2$ complex. When the *p*H of the solution was between 3-4 only $(Pyr)_2H_2[Co(CNS)_4]$ existed and this compound, at *p*H above 6, was transformed completely into $Co(Pyr)_2(CNS)_2$. Since the acidic complexes of zinc and cobalt are isomorphous, this fact was used to improve the sensitivity of the cobalt test. The most satisfactory results were obtained using as reagent a 4 per cent ammonium thiocyanate solution containing 1-6 gm. of pyramidone and 16 ml. of 2N hydrochloric acid. The test was sensitive to 0.4 μg. of cobalt ion when 2 per cent zinc sulphate heptahydrate solution was used as the auxilliary reagent.

Brighter Blue Colour

Alkali and alkaline earths did not interfere nor did the cations of the ammonium sulphide group with the exception of ferric iron. Chromium and nickel did not interfere, except when present in very large amounts; even then their colour moved to the spot boundary and so caused no serious interference. Ferric salts were removed by reduction to the ferrous state, masking with fluorides having proved ineffective. The brighter blue colour obtained using this reagent was far more distinct than that obtained using the unsubstituted reagent.

Spectrophotometric studies by Shome[31] showed that the cobaltisonitroso-dimethyldihydroresorcinol (isonitrosodimedon) complex in 50 per cent ethyl alcohol could be used to detect as little as 0.05 ppm of cobalt. Even traces of cupric ions and cyanide ions had to be avoided, but apart from those very few other ions interfered.

(To be continued)

REFERENCES.

1 *Ber.*, **18**, 699 (1885).
2 *Compt. rend.*, **204**, 817 (1936).
3 *Chem. Obzor.*, **12**, 27 (1937).
4 *J. Chem. Soc., Japan*, **65**, 10 (1944).
5 *Trudy. Inst. Khim. Khar'kov. Gosudarst Univ.*, **5**, 273 (1940).
6 *Anles. asoc. quim. argentina*, **31**, 122 (1943).
7 *Ind. Eng. Chem.*, Anal. Ed., **10**, 378 (1938).
8 *Z. Anal. Chem.*, **117**, 334 (1939).
9 *Pub. inst. investigaciones microquim., Univ. nacl. litoral* (Argentina), **2**, 269-7 (1939).
10 *Collection Czech. Chem. Commun.*, **10**, 83 (1938).
11 *Ibid.*, **15**, 589 (1950).
12 *Ibid.*, **14**, 186 (1949).
13 *Ind. Eng. Chem.*, Anal. Ed., **15**, 346 (1943).
14 *Pub. inst. investigaciones microquim., Univ. nacl. litoral*, **4**, 69 (1940).
15 *Mikrochemie*, Festschr. von Hans Moliasch, (1936).
16 *Metallurgia*, **29**, 217 (1944).
17 *Tids. Kjemi Berguesen*, **20**, 52 (1940).
18 *Australian Chem. Inst. J. and Pro.*, **3**, 277 (1936).
19 *Chem. Obzor.*, **15**, 18 (1940).
20 *Gazz. chim. ital.*, **66**, 591 (1936).
21 *Zavodskaya Lab.*, **8**, 1198 (1939); *Chem. Zentr.*, 1 2434 (1942).
22 *J. pharm. Soc., Japan.*, **56**, 807 (1936).
23 *Chem. Obzor.*, **15**, 81 (1940).
24 *J. Chem. Soc.*, 1358 (1937).
25 *Bull. Soc. Chim. Belg.*, **48**, 94 (1939).
26 *Ann. Chim. applicata*, **29**, 513 (1939).
27 *Rec. trav. chim.*, **65**, 789 (1946).
28 *Zavodskaya Lab.*, **14**, 545 (1948).
29 *Doklady Akad. Nauk U.S.S.R.*, **73**, 1193 (1950).
30 *Zhur. Obshchei. Chim.*, **21**, 481 (1951).
31 *Anal. Chim. Acta*, **3**, 679 (1949).

A New Cracking Process

Encouraging Results in Preliminary Experiments

IN *Comptes Redus*, **236** (17), 1659-1661 (1953), A. Pacault and G. Sauret describe a method of molecular cracking, e.g. of cellulose and pinewood, in which the temperature of the whole system does not exceed 100°. The material is subjected periodically to the action of small arcs which raise the temperature at those points momentarily very high. Cooling is very rapid and the products of reaction are immediately quenched owing to the fact that the temperature of the system throughout is not higher than the b.p. of water.

Relatively simple apparatus is used. The material to be treated is disposed between a lower fixed electrode and an upper movable electrode, having a potential difference that can be varied from 0 to 250 V. The small arcs momentarily formed between the upper electrode and the material cause gases to be evolved which are at once in contact with a medium of relatively low temperature (less than 100°). They then pass into the still lower temperature of a refrigerant which condenses any water vapour, and after traversing a meter they are collected in a gasometer.

The two electrodes are placed inside an apparatus having three openings that permit (a) outflow of gas, (b) insertion of thermocouple, and (c) sweeping out of initial air content by a current of nitrogen. The arrangement is such that the gasometer produces a slight vacuum in the system which thus sucks in the gases as formed. The following results were obtained in cracking cellulose and pinewood.

	Authors' Results				Lebeau Results			
	Gas per cent	Carbon per cent	Water and Tar per cent	Vol. Gas 1 kg. of dry matter	Gas per cent	Carbon per cent	Water and Tar per cent	Vol. Gas 20 kg. of dry matter
(A) Cellulose	80.5	18.5	1.0	960	—	—	—	—
	81.0	17.5	1.5	1,030	—	—	—	—
	78.0	12.0	2.0	930	—	—	—	—
					16.3	27	66.6	169.5
(B) Pine	70.0	29.0	1.0	875	—	—	—	—
	64.0	35.0	1.0	900	—	—	—	—
	71.5	28.0	0.5	755	—	—	—	—
	72.0	28.0	—	790	—	—	—	—
					11.6	18	70.4	146.5

	Gas Composition		Gas Composition	
	A	B	A	B
CO_2	14	14.0	24.1	14.9
CO	33	32.5	29.2	30.9
H_2	46	46.5	36.4	42.0
CH_4	7	7.0	7.0	11.2

These results differ from those of pyrogenation. The amount of gas formed starting with the same weight of raw material or dry matter is much greater (about 4-5 times as much). Water and tar are practically absent. Composition of the gas is about the same.

The earlier work is thus confirmed quantitatively of Klason ('Holzverkohlung in Ullman Enzykl. Tech. Chem.,' 2nd edit., Berlin (1930), **6**, 171), and of Dupont (Paul Baud, 'Traité de chim. ind.,' **11**, 264), according to which the percentage contents of carbon, carbon monoxide, water and tar, fall when rate of pyrogenation increase. This new method should permit extension and control of the reaction mechanism, and determination of the first stages of pyrogenation; also the synthesis of products stable at a low temperature. Reaction is facilitated by momentary high temperatures, but the thermal decomposition of the products formed is avoided owing to the rapid cooling. The first results obtained in this way are encouraging.

Synthetic Wools

The 'greatest threat of economic chaos in the history of Australia' is presented by synthetic wools according to Mr. O. Falkiner, president of the New South Wales Sheep Breeders' Association. Australian wool growers, he said, had to fight 'the great synthetic companies' of Britain, USA and Italy. One company alone was spending £14,000,000 on research in synthetics.

Fluoridation of Water

Recommendations of UK Mission

ALTHOUGH in favour of adding small amounts of fluoride to piped water supplies to reduce dental decay, the United Kingdom Mission which last year went to the United States and Canada to study the effects of fluoridation recommend that before it is generally adopted in this country carefully controlled investigations in selected areas should first be undertaken. These would serve as 'study centres' and include periodic medical and dental examinations at all ages.

Satisfied with the evidence they found that fluoridation is proving a useful means of reducing the incidence of dental decay in North America, the Dental Mission think it reasonable to assume that it would also be useful in this country. But before the proposed fluoridation studies can be started it will be necessary, in their view, to ascertain the existing incidence of dental caries (decay) in children and adults; assess the amount of fluoride which should be added to the water (a content of about 1 p.p.m. is indicated); provide the necessary supplies of fluorides and equipment; and organise controls and safeguards both against dosage errors and for operating staff.

To meet the needs of people who have to depend on privately owned wells, boreholes and springs for their water, the Mission suggest that simple methods of adding fluorides to supplies of this kind should be investigated.

The Mission state that the mechanical addition of fluoride to a water supply at any desired level presents few difficulties. With a correctly designed plant and proper controls there is no danger of adding a toxic overdose.

That adequate control could be maintained was proved by the fact that no evidence of overdosage was detected in an examination of the records of the 19 water plants which were visited in the United States. These ranged in size from that serving a population of 735 and maintained by a local handy man, to one under the control of fully qualified staff which is supplying over 20,000,000 gallons of water daily.

'The Fluoridation of Domestic Water Supplies in North America as a means of controlling dental caries.' HMSO, 5s. 9 July 1953.

Largest 'Platformer'

Now in Operation in USA Refinery

A PLATFORMING unit which is claimed to be the largest in the world is now in operation at the Shell Petroleum Company's refinery at Houston, USA. A 'platformer' is so called because it uses a platinum catalyst to reform low-grade petrol into high-grade products.

This new plant has been designed to produce either petrol or benzene and toluene. Production is at present confined to benzene and toluene—16,000,000 gal. of benzene a year or 28,000,000 gal. of toluene a year—and no petrol manufacture is contemplated in the immediate future.

Designers & Licensers

The 'platforming' section of the new plant has been designed and licensed by Universal Oil Products Company, to produce either petrol or benzene and toluene. The prefractionation and extractive distillation sections were designed by Shell.

There are three phases to the refinery processing, the initial one being the feed preparation.

Light naphthas are distilled from East and West Texas crudes, then blended with a selected naphtha cut. The feed-stock mixture is charged to the platforming feed preparation unit and other similar units, and fractionated to provide narrow range feed stock containing nearly all of the C6 and C7 fractions.

Reformed into Aromatics

Feed stock is then charged from the fractionators to the platformer, where the catalyst which contains platinum, reforms components of the feed stock into aromatics. Reactor effluent is separated into a liquid and a gas stream. Part of the gas stream is vented to refinery fuel through an absorber to recover light hydrocarbons, including benzene. The rest is recycled to the process through a gas scrubber to remove hydrogen sulphide.

The third step in the process consists of depentanising the liquid stream and charging it to the aromatic-recovery unit, where the aromatic hydrocarbons are separated and purified.

Materials Conservation

Sources of Information

A CONSIDERABLE number of research organisations both in this country and abroad are concerned with problems of the conservation of scarce raw materials such as metals, fuels, chemicals and textiles, and it is not always easy for an inquirer to discover all the sources of information on the problem in which he is interested.

A list of sources on a wide range of subjects has now been collected by the Sub-committee for Co-operation in Scientific Research and Technical Development of the OEEC, covering work being done in Austria, France, Germany, Italy, the United Kingdom and Sweden.

The list consists of standard sheets, each devoted to a particular subject of research and giving the names and addresses of persons or organisations from which detailed information may be obtained, and the sheets may be consulted at, or borrowed from, the Technical Information and Documents Unit, DSIR, at Cunard House, 15 Regent Street, London, S.W.1.

The principal materials and techniques are:—*Building Materials*: Economy in the use of materials; protection from fungus and rust; sound insulation; contractors' equipment; wood construction techniques; concrete and plaster.

Cellulose: Improvements in cellulose chemistry; manufacture of cellulose from wood waste.

Corrosion: Prevention of corrosion of steel: studies of corrosion problems to save metals.

Fuels: Economy in domestic and industrial equipment; utilisation of low-grade coals; the use of natural gas, methane, low-grade liquid fuels, shale oils, etc.; coke conservation; gasification of solid fuels; hydro and thermal power plants; wind power for electrical generation; diesel engine operation on methane.

Glass: The use of glass fibre as a furnishing material.

Iron and Steel: Conservation of steel, cast iron, nodular iron, etc.; conservation of tungsten in high-speed steel; substitutes for stainless steel; the use of alloying elements in alloy steels; low alloy steels for gears, etc.; saving of steels by economical design of structures; the recovery of pickling acids; substitutes for galvanising.

Non-ferrous metals: Conservation of copper, zinc, tin, lead, tungsten, etc.; protective coatings for metals; production of high-purity metals and pigments; recovery of lead and manganese from scrap; substitution of aluminium for copper.

Ores: Utilisation of low-grade iron ores; ion-exchange methods of extraction; chlorination of ores.

Paper: Manufacture of paper and board from straw.

Plastics: Use of plastics for plumbing.

Rubber: Substitutes for electrical rubbers; conservation of rubber; home-produced carbon black.

Sulphur: Recovery from furnace gases; low-grade sources; sulphuric acid production; conservation of sulphuric acid; saving sulphuric acid in fertiliser manufacture; biological production of sulphur.

Leather: Tanning materials.

Textiles: Economy in the use of natural and synthetic fibres; substitutes for cotton, linen, wool, sisal, jute and silk; substitutes for wool in felt.

Wood: Conservation of wood; uses for wood waste; wood as a substitute for metals; the use of new woods in the chemical and printing industries.

USA Manufacturing Chemists

IN a progress report reviewing the year's activities at the annual meeting of the American Manufacturing Chemists' Association, the retiring president pointed to the interest in the Association's newly inaugurated mid-winter meetings, the growth in membership, and the intensive state and regional activity. Producers of 90 per cent of the nation's chemical production were now enrolled in MCA, he said.

The industry's main emphasis, however, was on the future and not the past. It had before it the opportunty of making an even greater contribution to national welfare and to sound industrial statesmanship. 'The change of administration in Washington has increased the challenge to our industry and to all industries,' he said. Recently the MCA had created a Tax Policy Committee to recommend sound constructive legislation to administrative officials and Congress.

Among noteworthy achievements of the year in public relations was the preparation of 'The Chemical Industry Facts Book.'

Canadian Chemicals

Production Figures Again Show Increase

CONTINUING the steady advances of recent years, Canada's production of chemicals and allied products in 1952 rose 3 per cent in value to a record of $806,200,000 from $776,489,000 in 1951. The gain brought the production value to more than double the 1944 wartime peak of $371,000,000.

Most concerns in the chemical and allied group showed moderate advances in output value in 1952, but substantial declines were reported for vegetable oils, primary plastics and heavy chemicals, and a smaller drop from adhesives. Production of vegetable oils fell 11.9 per cent in value to $53,033,000 from $60,202,000 in 1951; primary plastics, 11.4 per cent to $34,917,000 from $39,370,000; heavy chemicals, 2.9 per cent to $114,379,000 from $117,823,000; and adhesives, 3.4 per cent to $11,053,000 from $11,437,000.

Output of coal tar distillation rose to $12,490,000 ($12,077,000 in 1951); compressed gases to $15,923,00 ($15,378,000); fertilisers to $78,422,000 ($74,489,000); medicinals and pharmaceuticals to $90,546,000 ($89,249,000); paints and varnishes to $107,327,000 ($104,839,000); soaps and washing compounds to $78,577,000 ($73,719,000); toilet preparations to $25,291,000 ($22,535,000); inks to $10,919,000 ($10,583,000); polishes and dressings to $15,960,000 ($13,245,000); and miscellaneous chemical products to $151,363,000 ($131,543,000).

Both exports and imports of chemicals and allied products declined in 1952, exports dropping 5 per cent to $124,000,000 and imports about 2 per cent to $187,700,000. Production value was higher than in 1951 in all provinces except Manitoba and Saskatchewan.

Export Difficulties

DIFFICULTIES militating against the export of goods from this country were the subject of comment by Mr. P. L. Wright, chairman of the Bleachers' Association, Ltd., in a statement circulated with the annual report for the year ended 31 March.

The revival of demand experienced by the company in the latter half of the year was mainly due to increased sales in the home market, said Mr. Wright. Export business remained throughout at a low ebb. The import restrictions and controls imposed by so many of the markets which in more normal times took large quantities of bleached goods had proved a most formidable obstacle.

In the matter of exports, Mr. Wright continued, one obtained the impression that the Government did not attach the same importance to the textile industry as it did to certain other trades, and he thought there was increasing disquietude that the just claims of the industry had been so little met.

A further matter in that connection which gave rise to some anxiety was the effect on the future of their industry of the bilateral trade agreements which were now influencing a large volume of trade in several parts of the world. When nations who for long years had been traditional customers felt they must have recourse to barter as a mode of trading it would seem that this country would require to give some attention to its development, despite its undesirable features.

Rubber 'Bag' for Reservoir

ONE of two reservoirs belonging to the Sunderland and South Shields Water Company at Mill Hill, Easington, Durham, was found to have serious cracks as a result of subsidences due to coal workings. After considering all possible materials, and trying many of them, the Water Company decided that rubber, being specially elastic, offered the only hope of stopping the leaks.

The problem was explained to the Dunlop Rubber Company and although it was obvious that the usual technique for lining plant was not practicable for a water reservoir, a new idea for using rubber emerged from discussions with the Water Company's engineers.

This was tested out on a small representative section of the reservoir and also on the mixing chamber between the two reservoirs, with every success. As a result, Dunlop have now been asked to line one of the two main reservoirs. Nearly one ton of adhesive will be used to fix to the sides of the reservoir some 16,000 square yards of high quality rubber, mainly a quarter of an inch thick. The rubber 'bag,' which will hold 12,000,000 gallons of water, will weigh 100 tons.

METAL STATISTICS, 1953. Forty sixth annual edition. New York : American Metal Market. Pp. 872. $2.50.

This edition contains the same general assortment of statistical information on ferrous and non-ferrous metals, and miscellaneous economic subjects, as was supplied in previous issues.

Some improvement has been made in the compilation of world statistics on production and consumption of ferrous and non-ferrous metals. The improvement thus far observable, however, is only slight so that in most cases world totals are still largely based on estimates because of the continued lack of reliable data relating to the Iron Curtain countries.

The prices given are representative of wholesale selling prices. With few exceptions the prices of many items were still under Government control during the past year. However, the remainder of such controls came to an end officially on 12 February 1953, so that the prices recorded for this year will again reflect the ever-changing conditions under the law of supply and demand.

Statistics dealing with production and consumption are gathered from various authentic sources and particularly from the American Iron and Steel Institute, American Bureau of Metal Statistics, USA Bureau of Mines, Bureau of the Census, Copper Institute, American Zinc Institute, Lead Industries Association, and the International Tin Study Group. There is a useful directory on the metal trade in the USA.—F.N.

NON-AQUEOUS SOLVENTS. By L. Audrieth and J. Kleinberg. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. 1953. Pp. 284. 54s.

The average chemist may be a little puzzled by the suggestion in the preface to this book that chemists generally feel that there is something mysterious about reactions in non-aqueous solvents. Most organic syntheses are carried out in such solvents as anhydrous ethers, hydrocarbons, alcohols or ketones, and though no-one would consider carrying out a Friedel-Crafts reaction in water, few will be surprised to learn that the process takes place smoothly in liquid sulphur dioxide. The truth of the matter is that recent investigations have shown that many inorganic reactions, hitherto associated with aqueous media have been shown to occur in a number of other solvents of high dielectric constant.

The application of these new techniques has aroused considerable interest, and early this year a symposium upon titration in non-aqueous media was published. It is the combining of these two types of information which will suggest that some 'mysterious principle' is involved, since separately the facts are quite explicable. The book itself is written in a very systematic manner, the first chapter introducing the reader to the essential physical properties of a solvent, giving a classification of the better known solvents and examining the types of reaction which can occur in non-aqueous solvents.

The exact interpretation which can be placed upon such phenomena as the properties of guanidine in water and in liquid ammonia is questionable. In aqueous solution guanidine is a strong base and forms salts with acids, in liquid ammonia it behaves as an acid and forms metallic salts which are themselves incapable of existence in the presence of water. The current theories which attempt to explain this type of problem are described in a non-critical fashion in the second chapter.

By far the most widely used non-aqueous solvent has been liquid ammonia and it is therefore fitting that no less than four separate chapters are devoted to it. In spite of this, however, the authors have not found space to review the extensive amount of organic chemistry which has been carried out in liquid ammonia, except in outline. In view of the small size of the book this is unfortunate and limits its overall usefulness.

The following chapter is concerned with

other nitrogen-containing compounds such as amines, nitriles, hydrazine and hydroxylamines. Much of the work reviewed here is of a qualitative nature and in tables of solubilities there is little distinction drawn between such potentially reactive solutes as mercuric chloride and alkali metal halides. Despite the extremely poisonous nature of hydrogen cyanide there is a surprisingly large amount of information about its solvent properties, and this may also be said of hydrogen fluoride which is described later on in the book. There are also sections upon acid and acid chloride solvents among which selenium oxychloride is one of the lesser known media in which to carry out acid base reactions.

One of the most interesting sections is, however, the final discussion of reactions at high temperatures. Although it may appear that reactions of oxides met with in metallurgy and ceramic chemistry have little in common with neutralisations in liquids at room temperature, nevertheless the authors have shown that the same theory applies to both these types of systems. This is a fruitful analogy, and in addition to providing the solution to familiar problems of systems at high temperatures, may well promote new lines of investigation guided by these conceptions.—J.R.M.

THE INSTRUMENT MANUAL. Second edition. United Trade Press Ltd., London. 1953. Pp. 628 + 105. £4 4s.

This is a volume which it is a pleasure to recommend unreservedly; a volume which already, in its first edition, has had a deserved success, and which, revised and enlarged, should prove even more popular.

The form of the book is excellent. Each of the 25 chapters begins with a comprehensive list of contents, followed by a brief introduction and a section on symbols or definitions required. After this a wide range of instruments is discussed, with both theoretical and practical considerations, and details of their installation, and the chapter ends with a bibliography of BSI specifications text books and articles in chronological order, and what appears to be a complete buyers' guide to every sort of instrument, whether or not it has been described in the text.

At the end of the book are sections on organisations and publications interested in instruments, an alphabetical list of manufacturers, a guide to accessories and components, an index which includes BS specifications, and a set of data sheets contributed by the leading manufacturers.

In this edition the sections on patents and general trends have been abandoned, and in their place new sections including aeronautical, navigational, meteorological, surveying and nucleonic instruments, measurement and control of conductivity, telemetering, and measurement of viscosity, have been added. Five chapters have been completely rewritten, and the remainder extensively revised.

This is a book of value and interest to any user of instruments, and its publication, coincident with the second British Instrument Industries Exhibition, is an important occasion.—B.I.

Preventing River Pollution

THE problem of preventing river pollution by trade waste is commented upon by Mr. G. H. Whigham, chairman of British Celanese Limited, in a statement circulated with the report and accounts for the nine months ended 28 March.

Mr. Whigham says much work has been devoted to the problem of complying with the Court Order made against the company last year in a river pollution action. As the Court was told, it was never anticipated that the period of two years for which the injunction was suspended would be sufficient to enable the company or the co-defendants to provide a remedy against the complaints. However, much research work has been done and a good deal of progress has been made.

Cooling units are in course of construction and when they come into operation early next year should remove the complaint of overheating the river. The company has also been able to reduce their trade waste pollution figure by about 35 per cent. Further research is necessary before the best methods of treating the waste can be established. Their consultants have advised them, however, that the most efficient method of dealing with it is most probably by treatment in combination with domestic sewage. Negotiations have therefore been continued with a view to arranging for the waste to be treated at the Derby Corporation's sewage works.

HOME

British Visqueen Ltd.

Construction has started at Stevenage, Hertfordshire, of the headquarters and factory of British Visqueen Ltd., the company formed jointly by Imperial Chemical Industries and the Visking Corporation of Chicago, to manufacture polythene film in Britain.

Viscose Rayon Staple Costs Less

The price of the viscose rayon staple sold by Courtaulds Limited under the name of 'Fibro' has been reduced by 3s. to 2s. per lb., and prices of the same material in dyed forms have also been reduced. Courtaulds produce a major part of British rayon staple, present production running at the rate of about 200,000,000 lb. a year.

'Atomic' Fertiliser

Radio-active phosphorus produced at Harwell is being used as a fertiliser in South Africa, according to statements made by Dr. J. Van Gardern and Dr. C. F. J. Der Walt at a scientific congress in Bulawayo last week. After being flown out from England, the phosphorus is turned into radio-active superphosphate at a plant at Modderfontein, near Johannesburg.

Drug Research

Although agreeing that the National Health Service drug bill is too big, the July issue of *The Practitioner* says it would be 'a major tragedy for the nation if the great pharmaceutical houses of the country had to curtail their research programmes because of financial stringency or if they were nationalised.'

Effect of Detergents on Skin

Questioned in the House of Commons as to the alleged harmful effects of detergents on the skin, the Secretary of State for Scotland, Mr. Henderson Stewart, replied that the chief medical officer of the Department of Health had advised that while it was suggested that the use of detergents had caused isolated cases of dermatitis, neither the Department, the Ministry of Health, the Minister of Labour nor the Ministry of National Insurance had any positive records to show that dermatitis or eczema was being caused by detergents.

Exemptions from KID

The following have been exempted from Key Industry Duty for the period 9 July-18 August:—*n*-amyl alcohol of a purity not less than 98 per cent, 1-naphthol, pentaerythritol, potassium cyanate and sodium methoxide. The relevant order—made by the Treasury—is the Safeguarding of Industries (Exemption) (No. 5) Order, 1053.

Tinplate Works Close

Since the beginning of the year, ten tinplate works in West Wales have been closed almost completely and five are now in process of being closed. This was stated at a meeting of the West Wales district committee of the Welsh Board of Industry.

Aluminium Freed From Control

UK fabricators are now free to import aluminium privately and the price of Canadian virgin aluminium in ingot form has been reduced by £11 to £150 a ton. The British Aluminium Company has announced price reductions as follows: pure aluminium and medium strength alloys in all rolled forms, also all extruded products, by 1d. per lb.; heat-treatable strong alloys in all rolled forms, also paste, by ½d. per lb.

River Pollution Alleged

The alleged pollution of the River Dee estuary by a steelworks effluent containing cyanide, which was stated to have killed large numbers of salmon, was the subject of an action mentioned in the High Court last week. The hearing of the action—which was brought by the owners of fishing rights against John Summers & Co., Ltd., Hawarden Bridge Steelworks, Shotton—was postponed until 20 October. It was contended on behalf of the defendants, that the effluent from their works no longer contained cyanide.

A Coal Warning

In a written Parliamentary reply, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, said it was essential that industrial consumers should continue to take all the coal that was offered them. He had previously stated that industrial and total distributed stocks of coal at the end of May were less than last year by about 1,000,000 tons and 2,000,000 tons respectively.

• OVERSEAS •

Canadian Nickel Deposits

Large nickel deposits are reported to have been discovered 53 miles north-west of Kenora, Ontario. Geologists have described them as 'the most fantastic we have ever witnessed.'

Metal Controls Eased

From Washington it is reported that the National Production Authority of the USA has removed allocation controls over molybdenum, columbium-tantalum and cobalt, also inventory and reporting controls over the metals stated, together with chromium. The only metal over which full controls remain is nickel.

USA Rayon Output

After increasing steadily from the low level to which it fell in February, production of rayon and acetate in the USA rose to more than 8,000,000 lb. in May, according to the latest available figures. Yarn production accounted for 800,000 lb. of this total, the remainder being accounted for by the output of staple-tow.

Chilean Copper Production

According to a message from Santiago, the Kennecott Copper Company has decided to cut copper production at El Teniente by 30 per cent, because of an accumulation of unsold stocks. Total Chilean copper production for the first six months of 1953 was 189,342 metric tons, compared with 178,867 metric tons for the same period last year.

Algerian Iron Ore

A rich iron ore deposit has been discovered in Algeria by the geologists of the Mining Exploration Office. The deposit, situated near Tindouf, has reserves of an estimated 600,000,000 tons with an iron content of 60 to 75 per cent. Experts believe open-cast mining will be possible as the deposit is close to the surface.

Norwegian Steel Plant

The Norwegian Government recently discussed the cost of the steel plant which a Government company is building at Mo i Rana in North Norway. After a number of Opposition speakers had strongly criticised the project, it was agreed by a majority vote to make another £5,500,000 available to finance the plant, the estimated cost of which is £23,000,000.

Italy to Produce Carotene

What is claimed to be the first factory in Europe for the production of β-carotene by extraction from carrots is being built at Latina, in Italy. β-Carotene provides a readily available source of vitamin A for human metabolism, and it is suggested that it may be more valuable than the synthetic vitamin. Utilisation of by-products should promote other local industries and agricultural developments.

Japanese Rayon in India

A three-man mission is to be sent to India by Japan to examine urgently the prospects of increasing rayon sales to that country, which is now buying largely from European countries, particularly Italy. Exports of rayon to India from Italy have been built up on a highly successful co-operative system of bulk buying, which has brought the ruling price to 59 yen less than the Japanese quotation.

Old Iron Protects New

The Building Science Institute of Hungary has adopted the cathode method of protecting the cast iron tunnel of the new Budapest underground railway from corrosion. Pieces of old iron are inserted in the surrounding earth and an electric current is passed between them and the tunnel walls.

Argentina-USSR Trade Agreement

Under the terms of the first trade treaty recently signed by Argentina and the USSR, the latter will send drugs, oil-drilling equipment, processed steel, etc., to Argentina, while Argentine exports will include linseed oil, wool, hides, etc. Under a second Argentine trade agreement, with Western Germany, the latter will receive cereals, wool, etc., in exchange for chemical products, iron, steel, etc.

USA Chemical Industries Exposition

The Exposition of Chemical Industries, held in New York almost continuously since 1915, will move to Commercial Museum and Convention Hall, Philadelphia, for its 24th biennial run, 30 November-5 December. There will be a substantial increase in exhibit area. Many former exhibitors are planning expanded layouts. Nearly 100 new exhibitors have already engaged space.

• PERSONAL •

MR. GEORGE KING, senior research worker, Albright & Wilson Limited, who was appointed a Member of the Most Excellent Order of the British Empire in the Prime Minister's List of the Coronation Honours (see our issue of 6 June), joined the firm from Birmingham University. He was part-author with Ernest I. Lewis of 'The Making of a Chemical.' He is well known for his pioneer work on silicon organic compounds—the silicon esters—and has spent over thirty years working on silicon tetrachloride. From 1922-1931 he was the secretary of the Birmingham Section of the Society of Chemical Industry; chairman from 1940-1942, and a member of the Council of the Royal Institute of Chemistry for two periods. He has also been associated with electrolytic developments in the industry; researches on baking powder and much research during the wars. Mr. King joined the research staff of Albright & Wilson in 1914.

G. King, MBE

MR. CARL A. SETTERSTROM was last week appointed general manager of the Textile Fibres Division of Carbide and Carbon Chemicals Company, it was announced in New York. Mr. Setterstrom had been sales manager of the Textile Fibres Division, the principal product of which is 'Dynel,' and, before this, product manager of Carbide's Fine Chemicals Division. Mr. Setterstrom is chairman-elect of the Division of Chemical Marketing and Economics of the American Chemical Society and is a national councillor of the American Chemical Society and a director of the New York Section. He is a Fellow of the American Institute of Chemists, and a member of the American Association for The Advancement of Science, Society of Chemical Industry, American Association for Textile Technology, and the American Association of Textile Chemists and Colourists.

MR. R. G. STEVENS, B.Sc., is relinquishing his position as sales research and development officer to Hardman & Holden Limited, Manchester, in order to take up post-graduate study at the Institute of Business Administration of Toronto University.

Two new appointments were announced by the Anglo-Iranian Oil Company last week. MR. A. W. G. TRANTOR has been appointed general manager of Aden Refinery, and MR. A. PATRICKSON has been appointed works manager of Kent Oil Refinery.

Mr. Trantor, who took up his appointment on 17 June, was previously works manager at Anglo-Iranian's 4,000,000 tons a year Kent refinery on the Isle of Grain. Aged 45, he was formerly chief engineer at Abadan. He was educated at Robert Gordon's College, Aberdeen, and at Aberdeen University. He joined Anglo-Iranian in 1935.

A. W. G. Trantor

A. Patrickson

Mr. Patrickson was born at Newcastle-on-Tyne and is 49 years old. He was educated at Swansea Grammar School and joined the firm's Llandarcy Refinery in 1922. Seven years later he was transferred to Abadan and held a number of posts in the process department of which he became general superintendent in 1950. In 1952 he was appointed process superintendent at the Kent refinery.

MR. E. D. E. ANDREWES, a director of Tube Investments Limited and until recently managing director of the company's export

organisation, TI (Export) Limited, has been appointed joint managing director of Accles & Pollock Limited, of Oldbury, which is a member of the TI group.

Appointment of DR. HENRY H. STORCH as chief of the Synthetic Liquid Fuels Branch of the Bureau of Mines, USA Department of the Interior, was announced recently. Dr. Storch has been with the Bureau of Mines since 1928, and during most of his service he has directed research on gas reactions and on the chemistry of coal hydrogenation. He has been chief of the Fuels Technology Division of the Bureau's Region VIII at Pittsburgh, Pa., since March, 1951.

In the mid-1930's Dr. Storch directed construction and operation of a pilot plant at Pittsburgh, Pa., where gasoline was first produced from coal in the United States. From 1944 until March, 1951, he was chief of the Research and Development Branch of the Bureau's former Office of Synthetic Liquid Fuels at Pittsburgh and Bruceton, Pa. From 1924 to 1926 Dr. Stroch was chief chemist for the West End Chemical Company, directing research on recovery of potash and borax from brines of Searles Lake, Calif. From then until he joined the Bureau in 1928, he was performing research for the Roessler and Hasslacher Chemical Company, Perth Amboy, N.J., on catalysts for use in synthesising methanol from water gas.

At a ceremony on 3 July, the University of Durham conferred honorary degrees of D.Sc. upon DR. ALEXANDER FLECK, chairman-elect of I.C.I., and MR. R. W. L. GAWN, superintendent of the Admiralty Experiment Works at Haslar; and of M.Sc. upon MR. E. G. CLARK, secretary of the Institution of Civil Engineers.

Metropolitan-Vickers Electrical Co., Ltd., announces that DR. WILLIS JACKSON, D.Sc., D.Phil. F.R.S., was appointed Director of Research and Education on 1 July and has also joined the board of the company. Dr. Jackson's appointment releases DR. DANNATT for an extension of his present duties as assistant managing director. Dr. Jackson has been Professor of Electrical Engineering at the Imperial College of Science and Technology, University of London, since 1946.

MR. J. R. BARKLA has received the congratulations of many friends on completing 60 years' service with J. W. Towers & Company, Ltd., Widnes. He joined the late Mr. J. W. Towers ten years after the foundation of the company and has seen its development until it now has three branches and several hundred employees.

MR. C. G. HAYMAN, chairman of the Association of British Chemical Manufacturers, and SIR HENRY J. ROSS, chairman of the Distillers Company, Ltd., were among contributors of articles included in 'A Survey of the British Economy,' issued to commemorate the 20,000th issue of *The Financial Times*.

Obituary

DR. FRANK L. SEYMOUR-JONES, Welsh-born research director for the Borden Company, USA, has died in a New York hospital, aged 57. Born in Wrexham, he studied at Wrekin College and the University of Leeds. After the 1914-18 war he gained the M.Sc. degree at Leeds and Ph.D. in chemistry at Columbia University.

MR. PERCY NAPIER MCGILL SODEN, C.B.E., president of P. N. Soden & Company, Montreal chemical manufacturers and during World War II deputy director of Civil Defence for the Province of Quebec, died recently in a Montreal hospital in his 61st year. Mr. Soden was born in Swansea, Wales, in 1893, was educated in Dublin and came to Montreal in 1908.

Prominent in the chemical industry, Mr. Soden formed P. N. Soden & Company in 1925, and was continuously president up to the time of his death.

During World War I he served overseas with the Canadian Army. He held the position of Deputy Director of Civil Defence for Quebec, from 1942 to 1945, when he resigned. He was awarded the O.B.E. for his service during the war.

The death occurred on 4 July of DR. E. G. RAWLINSON, who was for many years dean and director of the laboratories at the Royal Institute of Public Health and Hygiene. He was born in Yorkshire in 1877, and qualified at the University of Toronto in 1900. He then returned to England, where, among other posts, he held those of honorary pathologist at the East Surrey County Hospital.

Publications & Announcements

THREE years have passed since Aero Research Limited, Duxford, Cambridge, pioneered in Great Britain the 'Aerolite' system for the bulk delivery of synthetic resin glues, which is unique in that it is operated by the company's own road tankers supplying direct to storage tanks which the company has installed on behalf of customers. Full details of the system are given in the company's 'Aero Research Technical Notes' for June (Bulletin No. 126), which points out that the influence of bulk storage installations on factory cleanliness has been commented upon by many consumers and this fact has a pronounced effect upon general efficiency. A further advantage inherent in the system is that glue is used in the order in which it is delivered.

* * *

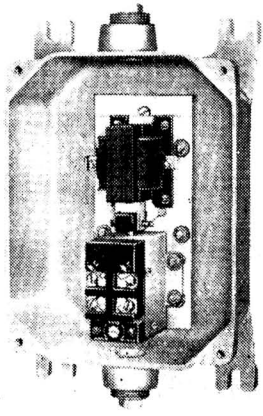
LIST 115 issued by the Doran Instrument Company, Limited, Stroud, Gloucestershire, describes the company's Portable DC Potentiometer E. 4246. This instrument is similar to the company's Precision General Purpose DC Potentiometer (Cat. No. E. 4247). The reflecting galvanometer of the latter is replaced by a pointer type, thus providing a smaller and more portable piece of test equipment. Three ranges are incorporated, covering EMF measurements from 10 microvolts per division on the lowest range to a maximum reading of 1.8 volts on the highest range. In addition to its usefulness for general laboratory purposes, it is claimed, it will be found especially suitable for *p*H, electrometric titrations and accurate temperature measurements by means of thermo-couples.

* * *

INCREASING complexity of modern chemical plant emphasises the need for process control instrumentation while in many other industries such as atomic energy, coal, fuel, oil production and water, the achievements and potentialities of instruments and automatic controls are being more and more appreciated. A step in helping to disseminate knowledge of this important subject is the production by the British Industrial Measuring and Control Apparatus Manufacturers' Association of its first handbook, well timed to appear during the British Industries' Exhibition at Olympia, London. The book lists the 27 members of the association alphabetically and under the various types of instruments produced. There is a forward by W. G. Ardley, the founder and past-president and a brief survey of the development of instrumentation with some excellent illustrations. It is estimated that to keep pace with the growing demand for all types of industrial instruments the labour force of the industry has doubled since 1938, while in the same period the value of its output has multiplied by five.

* * *

IN the field of process control there are many applications for the Pneumatic Time-Delay Relay (Type 500) manufactured by Electro Methods Limited, Caxton Way, Stevenage, Herts, and shown to the public for the first time at the British Instrument Industries Exhibition at Olympia. This instrument is a single-pole change-over switch in which 'make' or 'break' timing can be set to operate over the range of 1/6 sec. to 180 sec. It comprises a compact pneumatic system and a robust solenoid and is mounted in a fully tropicalised case of cast aluminium. Coils are available for standard voltages, 50-60 c/s; they are fully impregnated and baked, and will operate at voltages 10 per cent above or below nominal figures. The manufacturers will soon be able to offer very prompt delivery.



Pneumatic time-delay relay

New Licensing Proposals

USA Firms Offer Co-operation

FOURTEEN new licensing proposals for the foreign manufacture of USA products have been announced by the Mutual Security Agency Mission to the USA. This is the ninth compilation of specific licensing proposals made by USA manufacturers and put out under the licensing programme begun by the Marshall Plan organisation and continued by MSA.

USA manufacturers are reached by MSA through some 700 field counsellors, composed of representatives of trade associations, banks and the USA Department of Commerce. In the UK representatives of the following are acting as field counsellors: the Associated British Chamber of Commerce, the FBI, Scottish Council (Development and Industry) and the Ministry of Commerce, Northern Ireland.

Latest proposals include the following:—

The Inland Rubber International Corporation, Mansfield, Ohio, offers licences to manufacturers in GB, Germany, Italy and France, to manufacture tyres and tubes in moulds supplied by USA firms, to supplement USA production in supplying the present export market. European manufacturers would be paid in local currency.

The Renee Thornton Cosmetics Incorporated, New York, offers capital, equipment, services, patents, processes and techniques for manufacture of its line of cosmetics in France, Italy, Austria, Germany, Turkey and Greece.

The Plastone Company, Incorporated, Chicago, seeks licence to manufacture sanitary chemicals, industrial chemicals such as fireproof compounds, water repellants and rust removers, also toilet preparations, soaps, cosmetics, beauty preparations, etc.

Viscosity of Water

New NBS Value Adopted by BSI

THE British Standards Institution has announced that the value of 0.01002 poise for the absolute viscosity of water at 21.00° C. has now been adopted. This new value has recently been obtained by the National Bureau of Standards, using improved means (see 'The Absolute Viscosity of Water at 20°C.", by J. F. Swindells, J. R. Coe and T. B. Godfrey, N.B.S., R.P., 2279; *Bull.*, **48**, January, 1952) and replaces the hitherto adopted value of 0.01005 poise.

The new value has been adopted in collaboration with the National Physical Laboratory and the Institute of Petroleum and coincides with its adoption in the USA by the National Bureau of Standards and the American Society for Testing Materials.

Results of viscosity measurements made in accordance with B.S.188, 'Method for the Determination of Viscosity in Absolute (c.g.s.) Units,' are now assumed to be based on the new value, i.e., 1.002 centipoises (1.0038 centistokes), and an amendment to Appendix C of B.S.188 has now been published (reference P.D.1655) on the basis of the new value. This revised Appendix C gives a table of values for the kinematic and dynamic viscosities of water from 10° to 60°C. at 10°C. intervals.

The Institution, in collaboration with the Institute of Petroleum, is revising B.S. 188, consequent upon the decision to use water at 20°C. as the sole calibrating liquid, instead of using 40 per cent and 60 per cent sucrose solutions of known relative viscosity. The use of water for all calibrations has been made feasible by employing the master or secondary viscometer for calibration purposes. The publication of the revised Appendix C of B.S.188 is therefore only in the nature of a stop-gap until the revised standard is issued. Copies of this Amendment (P.D.1655) can be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1.

Dyers' Exhibition

THE Rayon Dyers' Exhibition held at the Manchester College of Technology recently illustrated some of the problems which the dyer and finisher has to overcome and brought to notice some of the newer finishes.

By fabric illustration and with the aid of diagrams, photographs and laboratory equipment, visitors were shown the unattractive loom-state fabric and its step-by-step transformation by the dyer and finisher into fabrics of great beauty, wide variety and outstanding fitness for purpose. Laboratory equipment on view included instruments and equipment for the quantitative determination of colour, for colour matching, assessing fastness to light or to washing, and for calculating fastness to rubbing.

Law & Company News

New Registrations

Sulphonate Sales Ltd.

Private company. (520,563.) Capital £100. Manufacturers of, agents for and dealers in cleaning materials of all kinds, soaps, abrasives, powders, detergents, etc. Directors: F. Lucas, Mrs. L. M. Lucas. Reg. office: Railway Approach (Down Side), Beckenham Junction Station, Kent.

Kenrick Manufacturing Co. (Birmingham) Ltd.

Private company. (520,943.) Capital £2,000. Manufacturers of and dealers in detergents, washing, cleaning and scouring powders, etc. Directors: K. D. Lucas, G. T. Walker. Reg. office: 95a Baker Street, Sparkhill, Birmingham, 11.

New Forest Pine Products Ltd.

Private company. (520,896.) Capital £3,000. Manufacturing research, dispensing and analytical chemists and druggists, etc. Directors: Joan C. L. Branch, M. W. E. Mear. Reg. office: 124 Old Christchurch Road, Bournemouth.

Brymod Products Ltd.

Private company. (520,986.) Capital £100. Producers, developers, manufacturers and merchants of preservatives for finishing metal and other goods to prevent rust, corrosion, rot or other deterioration or for rendering all kinds of substances fireproof. Directors: H. M. Rowe, S. T. Roberts. Reg. office: Winstanley Works, Long Lane, Orford, Warrington.

Purmat (Drugs) Ltd.

Private company. (521,026.) Capital £100. Chemists, druggists, manufacturers of and dealers in chemicals, drugs, etc. Directors: H. G. Blank, H. L. Goodman. Reg. office: 10 Coleman Street, E.C.2.

Carina (London) Ltd.

Private company. (521,066). Capital £100. Manufacturing, wholesale and retail chemists and druggists, drysalters, oil and colourman, etc. Directors: F. Weller, C. V. Cave, D. J. Fielding. Reg. office: Clive House, Portsmouth Road, Esher, Surrey.

Scandinavian Timber Ltd.

Private company. (521,108.) Capital £10,000. Directors: C. E. Gamborg, Mary Gamborg. Reg. office: 23 Blomfield Street, E.C.2.

J. S. R. Maunder Ltd.

Private company. (521,135.) Capital £100. Control, destruction and extermination of all pests, diseases, fungoid growths, etc. Directors: H. E. Morrish, J. S. R. Maunder. Reg. office: 27-8 Finsbury Square, E.C.

Polycell Products Ltd.

Private company. (521,214.) Capital £2,000. Manufacturers and merchants of all kinds of paints, and all types of materials and chemical substances used in the making of paints, colours, varnishes, etc. Directors: N. Shand Kydd, R. Shand Kydd. Reg. office: 199 Piccadilly, W.1.

D'Arcy-Evans & Partners Ltd.

Private company. (521,248.) Capital £100. Petroleum technologists, research and consulting chemists and technical advisers in connection with the use of petroleum products for fuel and lubricating purposes, etc. Subscribers: A. H. Murrell, W. G. W. Hilliard. First directors are to be appointed by the subscribers. Solicitors: Hill Dickinson & Co., 3/6 Bury Court, St. Mary Axe, E.C.3.

D. Davies (Handsworth) Ltd.

Private company. (521,250.) Capital £3,000. Retail and manufacturing, pharmaceutical and general chemists and druggists, manufacturers, distillers and refiners of glycerine, etc. Directors: Joan C. Triston, Barbara R. Lashford. Reg. office: 179 Rookery Road, Handsworth, Birmingham.

P. T. Tugwell Ltd.

Private company. (521,360.) Capital £2,000. Manufacturing, pharmaceutical and wholesale and retail chemists and druggists, opticians, etc. Directors: Mrs. J. R. Tugwell, H. G. Tugwell, Mrs. N. M. Musson, P. D. Tugwell. Reg. office: 402 Lymington Road, Highcliffe on Sea, Hants.

Increases of Capital

The following increases of capital have been been announced: R. A. CRIPPS & SON, LTD., from £5,000 to £10,000; BRITISH RATIN CO., LTD., from £5,000 to £50,000.

Company News

British Industrial Plastics Ltd.

For the year to 30 September, an interim ordinary dividend of 7½ per cent has been declared by the directors of British Industrial Plastics Limited. For the previous year a single payment of 12½ per cent was made as a final dividend.

Johnson Matthey & Co. Ltd.

Group net profit amounting to £638,825 for the year ended 31 March last, compared with £580,429 for the previous year, after allowing £550,054 for tax (£782,244), is reported by Johnson Matthey & Company, Limited. The final ordinary dividend is 12 per cent, less tax, making 15 per cent for the year, this being the same as for the previous year.

Coalite & Chemical Products Ltd.

When considered in relation to the general recession in the chemical and plastics industries the demand for the chemical products of Coalite and Chemical Products Limited has been well maintained, according to the chairman, Commander Colin Buist, in a statement issued with the annual report for the year ended 31 March last. He added that competition in certain directions had increased both as regards price and quality, particularly in overseas markets, but the company retained the leadership, both home and abroad, in knowledge relating to the liquids and chemicals obtained when coal was carbonised at low temperatures. After deducting certain sums retained in the accounts of the subsidiaries, the net profit of the parent company was £145,495. A final dividend of 5 per cent (less tax) made a total of 8 per cent for the year.

Whessoe Ltd.

The year ended 31 March last was a record one for Whessoe Ltd., according to the chairman, Mr. H. G. Judd. In the course of a statement circulated in connection with the annual meeting on 22 July, he said that since the beginning of the modern petroleum industry at the end of last century, Whessoe had been one of the foremost builders of large iron storage tanks and now also held a leading place in the fabrication of steel plate vessels of all descriptions, including large stainless steel autoclaves for the chemical industry.

British Glues & Chemicals Ltd.

An ordinary final dividend of 12½ per cent, making 15 per cent for the eleven months ended March last, which is the same as for the preceding year, is announced by British Glues & Chemicals Limited. There will be a participating dividend of 2 per cent on the 8 per cent Cumulative Preference stock for the same period. Before taxation, the group profit for the eleven months totalled £243,424, including £25,000 for provisions, as compared with £821,618 for the preceding year, including £56,926 relating to previous years.

Market Reports

LONDON.—Although there has been some seasonal slackening in interest the demand for most of the routine industrial chemicals has remained fairly steady, and deliveries against contracts have been good. The fertiliser market remains steady with consumers covering their future requirements. The price position generally is unchanged. The coal tar products market continues to be without feature and no improvement can yet be reported in export business.

MANCHESTER.—Due allowance being made for holiday interruptions of deliveries and also of the placing of new business, fairly steady trading conditions have been experienced on the Manchester chemical market during the past week. Compared with what the position was a few months ago, there has been a noticeable improvement in the cotton, rayon and other textile trades, which are absorbing relatively good quantities of a wide range of chemicals. A fair demand is also reported from most other leading consuming outlets. Prices generally continue on a reasonably steady basis. In the tar products market benzol and most of the other light distillates are meeting with a steady inquiry.

GLASGOW.—The majority report rather slow trading during the course of the week and with the tendency being towards lower prices buyers are not anxious to place definite business for forward delivery. On the whole the prospects look quite favourable and it is encouraging to note that the uplift experienced by the textile trade is being fairly well maintained.

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.

CHEMICAL ENGINEERS are required at various levels in the design and development department of a well known chemical manufacturing company in South Lancashire. Starting salary will depend upon qualifications and experience but will not be less than £600 per annum. The company encourages effort and enterprise and promotions are strictly by merit and ability. Write, stating age, qualifications and experience to **BOX No. C.A. 3229, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

CHIEF CHEMIST required for **INDUSTRIAL LABORATORY IN WEST LONDON AREA.** Analytical work on Factory raw materials. Knowledge of beer and soft drink analysis or glues, binding materials and varnishes an advantage. Good conditions in well equipped Laboratory. Superannuation and other welfare facilities. Write stating age, full particulars of qualifications and salary required to **BOX No. C.A. 3232, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FOR SALE

MORTON, SON AND WARD LIMITED
offer
MIXERS

"**MORWARD**" Trough **POWDER MIXERS** made to requirements up to 3 tons.

One Stainless Steel Trough **MIXER** by **CHALMERS.** Electrically driven. 2 cwt. capacity.

One Stainless Steel Lined Trough **MIXER** by **GARDNER.** 3 cwt. capacity.

WE SPECIALISE IN MIXING VESSELS OF ALL SHAPES AND SIZES TO REQUIREMENTS

JACKETED PANS

One New 200g. **STAINLESS STEEL,** Open-top **JACKETED PAN.**

100g., 150g. and 200g. New **JACKETED PANS,** a welded, on three legs.

Any can be fitted with mixing gear to requirements.

HYDRO EXTRACTORS

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

PUMPS

Large selection of **MONO** and other **PUMPS,** 2 in. to 6 in., new and second-hand.

INQUIRIES INVITED.

MORTON, SON AND WARD LIMITED,
WALK MILL,
DOBCROSS, NR. OLDHAM,
LANCS.
'Phone: Saddleworth 437.

FOR SALE

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.

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

FIVE new **FURNACE RETORTS,** 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.

FIVE Dish-ended **NAPHTHA TANKS,** 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.** Stainless Steel **FILTER TANK,** 3 ft. 6 in. diam.

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, $\frac{7}{8}$ 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, COLEFORD, GLOS.

600

PROCESS PLANT

TWO 72 in. **HYDRO EXTRACTORS** by Thomas Broadbent. 72 in. galvanised basket, 20 in. deep, $\frac{1}{4}$ in. perfs. Motorised 400/3/50.

7 **FILTER PRESSES,** plate and frame type, each with 51 frames forming cakes 29 in. sq. by 2 in. Individual plate discharge. Plates have ribbed surface.

ROTARY VACUUM FILTER by Davey Paxman. Drum 33 in. by 36 in. dia., with stepped perfs. F. and l. pulley drive through spur and worm gear.

Unused Johnson Wooden Plate and Frame **FILTER PRESS CARCASE,** with hydraulic closing gear. Frame size 61 in. by 49 in. Cake size 48 in. by 38 in. by $2\frac{13}{16}$ in. thick. Suitable for 27 chambers with cap. 80 sq. ft. With rubber lined filtrate trough.

2 Recessed Plate type **FILTER PRESSES** by Manlove Alliott, with 54 plates 36 in. sq. by 1 in. thick. Hand op. closing gear.

LABELLING M/C by Rawsons, for pint or 16 oz. size flat or square. Cap. 24-30 per min. Numbering device. Motorised 400/3/50. Unit mounted on rubber tyred wheels.

Carton filling, packing, wrapping and labelling machine by **SOCIETE INDUSTRIELLE SUISSE,** adjustable for cartons from 73 mm. sq. by 38 mm. to 65.6 mm. sq. by 38 mm. Motorised 400/3/50. Complete with label attachments and heat sealing device. Conveyor feed approx. 55 per min.

De-airing type **PUG MILL** by Bonnot. Primary chamber 4 in. diam. secondary worm extruder 3 in. diam. — 3 in. discharge with $7\frac{1}{2}$ in. by 9 in. opening. Of Aluminium constr., with S. Steel shaft and worms. Motorised 220/440/3/50.

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

FOR SALE

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

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

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

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

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

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

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

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

1—Johnson **FILTER PRESS,** 42 cast-iron plates, 32 in. square, centre feed.

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

1—Johnson **FILTER PRESS,** 46 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.

1—24 in. and 1—30 in. **HYDRO EXTRACTOR,** self-balancing, swan-neck type, self-emptying bottom, belt driven.

1—30 in. and 2—36 in. Ditto with enclosed motors, 400 volts, 3-phase, 50 cycles.

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

5—sets A.A. **CRUSHING ROLLS** for linseed, 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.

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

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

" U "-shaped Horizontal **MIXER,** 7 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven, end outlet, square horizontal centre shaft with cast radial type mixing arms, last used for linoleum paste.

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

No. 1 and No. 3 Size **MIRACLE MILLS** with fans and cyclones.

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

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

1—4½ Christy & Norris **DISINTEGRATOR** with 60 h.p. A.C. motor and starter.

RICHARD SIZER, LTD.,
ENGINEERS,
HULL.
Telephone : 31743.

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 " MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS : " HILL-JONES, BOCHURCH LONDON." TELEPHONE 3285 EAST.**

IT is impossible not to like the **JENCON'S ALL-GLASS PRECISION BEARING LABORATORY STIRRER.** Inexpensive too. **JENCON'S, ACTON, LONDON,** for leaflet.

ROTATING PAN MIXER by **ARTOFEX.** Two **PANS,** 47 in. diam. by 22 in. deep ; 2-sack capacity. Human arm type blades. Fast and loose pulley drive. £100 ex-works.

One Ditto by **T. COLLINS, BRISTOL.** Two **PANS,** 47 in. diam. by 24 in. deep ; 2-sack capacity, with automatic feed. Chain drive to 5 h.p. motor. £85 ex-works.

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

TWO M.S. HIGH PRESSURE AUTOCLAVES 4 ft. I.D. by 18 ft. 6 in. long over domed ends. Riveted construction, fabricated from 1⅛ in. thick plate, 625 lb. per sq. in. working pressure.

M.S. HORIZONTAL " U " TROUGH MIXER 3 ft. by 1 ft. 9 in. at top by 2 ft. deep at centre. Fin type agitating gear belt driven through helical gearing from f. and l. pulleys. Arranged for hand tilting.

WERNER TYPE MIXER having G.M. trough 13 in. by 12 in. by 12 in. and double " Z " G.M. agitators belt driven through spur gearing from f. and l. pulleys. Hand tilting.

GARDNER M.S. POWDER MIXERS, sizes D. and E. Belt driven.

STEAM JACKETED COPPER BOILING PANS, 30 galls. capacity. Arranged for hand tilting. Jacket working pressure 40 lb. p.s.i.

STEAM JACKETED COPPER BOILING and **EVAPORATING PANS,** 50 and 100 galls. capacity. Open top. Jacket working pressure 40 lb. per sq. in.

KESTNER HORIZONTAL TUBULAR EVAPORATOR, having six turns 1¼ in. bore copper tube, complete with copper reception pot.

TWIN PORCELAIN PEBBLE MILL, 12 in. by 12 in. Belt driven.

Belt driven **DISINTEGRATORS** by **HARRISON CARTER.** Size 00 and 2½.

STEAM JACKETED M.S. VACUUM DRYING OVEN, 3 ft. I.D. by 7 ft. long internally fitted 5-bank steam heating coil supporting 15 aluminium trays in five tiers of three. Rear end dished ; domed door secured by eight swivel clamps. Jacket and coil working pressure 20 lb. per sq. in.

DITTO 3 ft. I.D. by 5 ft. long internally having 10 **STAINLESS STEEL** trays in five tiers of two. Quick release C.I. door with handwheel operated spider locking device. Jacket and coil working pressure 20 lb. per sq. in.

PROCESS & CHEMICAL ENGINEERING CO., LTD.,
6/8, NORTHUMBERLAND PARK,
TOTTENHAM,
LONDON, N.17
Phone : **TOT**tenham 2436 (3 lines).

SERVICING

CRUSHING, GRINDING, MIXING and DRYING for the trade.
THE CRACK PULVERISING MILLS, LTD.,
Plantation House,
Mincing Lane,
London, E.C.2.

SERVICING

PULVERISING of every description of chemical and other materials for the trade with improved mills, wharfage, and storage facilities. **THOS. HILL-JONES, LTD., "INVICTA" MILLS, 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

WANTED

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.

WORKING NOTICES

THE Proprietor of British Patent No. 621480, entitled **VITREOUS COMPOSITIONS OF MATTER, AND METHODS OF MAKING THE SAME,** offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG, 14, EAST JACKSON BOULEVARD, CHICAGO 4, ILLINOIS, U.S.A.**

THE Proprietor of the Patent No. 682869 for **ANTI-RUST OR ANTI-OXIDE COMPOSITIONS** desires to secure commercial exploitation by Licence or otherwise in the United Kingdom. Replies to **HASELTINE LAKE & CO., 28, SOUTHAMPTON BUILDINGS, CHANCERY LANE, LONDON, W.C.2.**

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.

INDEX TO ADVERTISERS IN THIS ISSUE

Printed in Great Britain by THE PRESS AT COOMBELANDS Ltd Addlestone and published by Benn Bros