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Science & Fuel

'IN spite of these advances, the overall efficiencies of use of fuel in industry and in domestic heating are even now far too low. *On the basis of existing knowledge*, and with no undue capital expenditure, the same amount of useful heat and power could be achieved with a saving over the country as a whole of several million tons of coal a year. Better still, for the same total fuel consumption, there could be greater industrial productivity and improved conditions of comfort.' This extract from the opening paragraphs of the 1953 Report of the Fuel Research Board (see p. 131) rings a bell that is familiar indeed, a point we have sought to emphasise by italicising one particularly salient phrase.

We are still backward in the application of past and present scientific knowledge, and it seems to be in the simpler and larger-scale fields of production that this form of inefficiency is most prominent. Really old knowledge is not applied to within even 50 per cent of its potential profitability. For coal and coal-derived fuels, used in every factory and dwelling in the country, well-established methods of efficient combustion and heat transmission are utilised to an even lesser extent.

In the sharpest contrast, complex and specialised processes such as the production of synthetic fibres or the microbiological manufacture of chemicals exploit all the opportunities of scientific betterment. Psychologically, the paradox is explained readily enough. Science and research are given full recognition by those who operate processes which owe their existence to science, but for processes which can be carried on empirically there is a much smaller appreciation of scientific possibilities. For a trading nation whose raw material resources are far from abundant, there could hardly be a more costly error of judgment. Yet from time to time earnest correspondents to newspapers call fearfully for a halt to the further application of science! The truth is that there has long been far too little application in the most obvious and most widely rewarding fields.

'Fuel Research, 1953' (1954, 62 pp., HMSO, 2s. 6d.) gives ample evidence to show that the scientific knowledge is there for the taking. It is perhaps debatable whether the best means of distributing this knowledge has yet been developed. When the government's annual economic survey is published, it is accompanied by a shorter and cheaper popularised version, and it is that more easily digested version which secures the lion's share of press attention. Would the same double-barrel system of reportage enlarge the reception range for DSIR annual reports on such major national subjects as fuel research? It may be true enough that the National Fuel Efficiency Service, formerly the progeny of the Ministry of Fuel and Power, but now more directly the responsibility of the nationalised coal, electricity, and gas industries, exists for such purposes as education and information, but any additional means of bridging this persistent gap between knowledge and practice seems worth consideration. These are not days of peaceful leisure and to be sure of a hearing even the worthiest of drums must be beaten all too frequently.

As to new knowledge in the making, the Report shows that steady advances in the pilot-scale development of the Fischer-Tropsch process are being achieved. With fluidised catalyst technique a 15 days' run produced 50 to 60 gallons of oil and other products per day, including waxes, and this represented a 92 per cent conversion of the synthesis

gas mixture. Radio-tracer labelled carbon monoxide is now being used in a further research approach to the problems of synthetic gas conversion. The pyrites residues from flash roasting for sulphuric acid production have been examined for suitability as a useful blending substance for coal in coke manufacture. These residues are too finely divided for use in smelting furnaces, but if up to 7 per cent additions are made to coking coals they lead to increased size and greater strength for metallurgical coke. Thus a new problem for sulphuric acid manufacturers may be converted into a small benefit for users of smelting cokes.

The effect of chlorine in coals upon the formation of deposits on the furnace sides of boiler transmission surfaces has been studied as an anticipation of problems likely to arise when more use of high-chlorine coals has to be made. Such deposits are 'bonded' by calcium chloride, which has an inconveniently low melting point for presence in a fuel combustion chamber; it seems probable that the calcium chloride first deposits in a fused form and is then converted into sulphate, a chemical change which intensifies the force of adhesion. There is a critical S:Cl ratio for fuels and if this exceeds 2 there is a much smaller production of calcium chloride. Sulphur recovery from flue gases has been given intensified attention, particularly the ammonia-scrubbing process for power station flue gas streams. The addition of a small amount of ferrous sulphate to act as an oxidation catalyst in the liquor (converting ammonium sulphite into the sulphate) has been found to reduce ammonia losses greatly and without any impairment of scrubbing efficiency.

It would appear, however, that more investigations in search of a suitable oxidising catalyst are needed, for in larger-scale operation the catalyst must succeed in spite of aeration difficulties; the use of manganese as a catalyst together with added aeration seems more promising. The 'know-how' of the ammonia scrubbing process is being accumulated, but more research, especially fundamental research, is needed. How much sulphur we shall eventually win from furnace stacks and how much danger will thus be taken out of the polluted airs of cities cannot be estimated today, but these probable boons of future generations are being created by the current work of the Fuel Research Station.

Indeed, the air pollution scare—if scare may pass as a somewhat inadequate word—of London's 1952 smog can now be seen in retrospect as a great stimulant to progress not only in pollution reduction but also in fuel burning efficiency. 'It is mainly as the result of the inefficient use of fuels that the air of the thickly populated areas is so heavily polluted, especially at times of persistent fog . . . . Smoke . . . is always accompanied by unburnt, invisible gases, and the loss of heat in these . . . is ordinarily much greater than the loss represented by the unburnt particles of carbon in the smoke . . .'

The smoke eliminator doors designed and developed at the Fuel Research Station for use on shell-type hand-stoked boilers are being manufactured by several firms today; thousands of boilers of this kind are in daily industrial operation but so far only hundreds have been fitted with the new doors. Their universal adoption would greatly reduce the total emission of smoke and at the same time save something approaching 1,000,000 tons of coal per annum! Is this sufficiently known in industry? Does it need to be forced into more attention and action by some incentive scheme? When the price of coal rises, a somewhat frequent event of our times, there is invariably a prompt and critical reaction expressed by industrial organisations and associations. Is it unduly cynical to suggest that there might well be as keen and rapid a reaction to the availability of modern devices which save fuel and reduce smoke nuisance?

If as a nation of householders and manufacturers we have taken both fuel and its efficient usage for granted for far too long, we are at least reminded each year by the Report of the Fuel Research Board and Station that scientific efforts in these directions are not in any way neglected. The way is there, but the will, in a national sense, seems to be sadly lacking.

Notes & Comments

Natural & Artificial

THE synthetic insecticide, allethrin, now being produced in the US on an industrial scale (see *Ind. Eng. Chem.*, 1954, **46**, 414), is not a synthetic pyrethrin, but only a chemical relative of the pyrethrin family. Natural pyrethrum contains four actively insecticidal substances, cinerins I and II and pyrethrins I and II; allethrin is the closest molecular arrangement chemists have so far been able to assemble, being the allyl homologue of cinerin I, with an allyl side-chain in place of the 2-butenyl group of the natural substance. There are, moreover, stereochemical differences. Synthetic allethrin is a mixture of eight optically active isomers, and each of these exhibits characteristic insecticidal properties. It is claimed that allethrin is essentially equal to pyrethrum in effectiveness if both substances are used without a synergist; but where a synergist, commonly piperonyl butoxide is used, allethrin is only half as effective as pyrethrum against flies and only a quarter as effective against cockroaches. And even these verdicts must be classed as rough judgments.

Strength in Isolation

IN the latest annual report from Rothamsted (for 1953) the isolation and separation of the four pyrethrum constituents is announced. This has been achieved by displacement chromatographic methods. Large quantities have not been extracted; indeed, from first attempts to scale up the processes, only 100 mg. of cinerin I and 300 mg. of pyrethin I have so far been obtained. But enough of all four substances has been obtained to measure their respective toxicities to test insects, and the following table of comparison seems particularly interesting:

Cinerin I	10,000
Pyrethrin I	2,000
Cinerin II	400
Pyrethrin II	769
Allethrin	80

The insecticidal power of pyrethrum products obviously depends mainly upon the amounts of cinerin I and pyrethrin I present, and this factor of variation helps to reduce the huge difference in basic potency between these natural and synthetic relatives. But allethrin as a man-made insect poison is a feeble imitation of Nature's Cinerin I, and it is hardly over critical to wonder whether the large-scale adaptation of the laboratory synthesis has not been premature; it is a complex multi-stage synthesis involving 18 major reactions. One sentence from the US papers is illuminating: 'Though faced with a multitude of unsolved problems, manufacturers today express overwhelming confidence in the future of allethrin.' Now that cinerin I has been isolated, there could well be a new and rapid advance in our chemical knowledge of the pyrethrum constituents. Will confidence in allethrin remain overwhelming if the synthesis of cinerin I or even of pyrethrin I draws nearer to reality?

British Chemicals in Canada

A RECENT note in *Canadian Chemical Processing* (1954, **38**, [5], 6 & 12), shows that British interests in Canada's chemical industry are actively expanding. This follows a general industrial investment trend made possible only in the last two or three years by some relaxation of financial controls. The major ventures listed are the $20,000,000 terylene plant of Imperial Industries of Canada Ltd. (which is, of course, an I.C.I. subsidiary); a $500,000 extension to the soap plant of Lever Bros. of Toronto, a Unilever subsidiary; a new transparent cellulose film plant by ICF of Canada Ltd., an associated company with Courtaulds and British Cellophane; a $1,000,000 plastics factory being built by Yardley of London (Canada) Ltd., in Toronto; a new plant in Ontario for the catalytic hydrogenation of phenol and cresylic acid built by Howard and Sons (Canada) Ltd., subsidiary of the well-known British firm of the same name; and the purchases of established paint and gypsum products

works by British Paints (Canada) Ltd., and British Plaster Board Ltd., respectively.

A Matter of Capital Interest

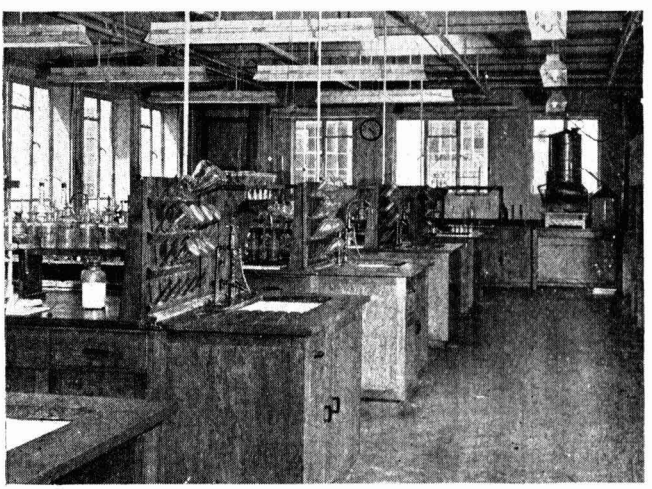
THESE injections of British capital into Canadian expansion cannot be compared with the huge flow of US capital which still dominates the financial picture, but at any rate the trend is now positive. Between 1948 and 1952 British invesment in Canada increased by about $200,000,000. Even this has not been enough to prevent the British share of foreign-owned capital in Canada from showing a proportionate fall over the same period. However, preliminary figures for 1953 show that new British investment rose to about two or three times the 1952 rate. There is little doubt that this enlivened interest in the Atlantic Dominion is welcomed by Canadians. Overall comparison with the pre-war position is naturally unfavourable; in 1939 our total investment was just under $2,500,000,000 and wartime sales brought this figure down to about $1,750,000,000 with principal falls in government securities and public utilities. But actual investment in Canada's manufacturing industry rose between 1939 and 1951, a pre-war investment of $250,000,000 being almost doubled. This is a stimulating contrast with the general story of recession. Pre-war British investment in manufacturing was only 11 per cent of the total British interest in Canada; by now the percentage must be at least 30, and it is rising at an accelerated rate. There is plenty of reason to regard this as an improvement.

SCI Annual Meeting

SOME 500 chemists and executives from Great Britain, the Commonwealth, the USA and other countries have attended the 73rd annual meeting of the Society of Chemical Industry which was held in Liverpool this week. The programme included an address by the president, Sir William G. Ogg, lectures by leading chemists representing some of the principal industries of Merseyside, and an address by Lord Cherwell, who received the Society's Messel medal. Dr. Alexander Fleck, chairman of Imperial Chemical Industries Ltd., was the principal guest at the annual dinner.

Visits were paid to factories in Liverpool, Birkenhead, Bromborough, Ellesmere Port, Ruabon, Shotton, St. Helens, Warrington, Widnes, and Winsford and one party travelled by air to Anglesey.

Two exhibitions were also arranged, one being devoted to laboratory safety equipment and the other comprising a display of transparencies painted by a local artist depicting, in the form of a fantasy, the hundred years of the chemical industry in Widnes.



The newly completed chemical laboratory in the Analytical Block at Bordesley Hall

Looking at Cast Iron Research

BCIRA's Open Days

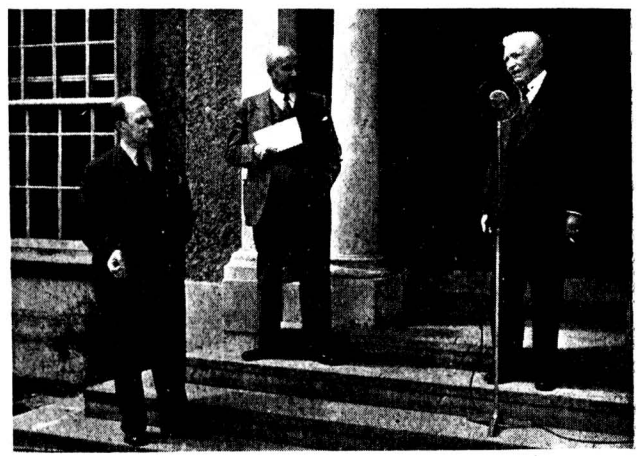
SINCE the last Open Days of the British Cast Iron Research Association, in July, 1952, a new analytical block housing spectrographic and chemical laboratories has been completed and equipped, and visitors to the Open Days at Bordesley Hall last week were able to see examples of the work now being carried out in these laboratories.

The most interesting piece of apparatus in the new building is a direct reading spectrograph embodying the quantometer principle, for use in production control. This particular model is American, but a similar instrument now being manufactured in this country was described recently in 'Instruments of the Year' (THE CHEMICAL AGE, 1954, **70**, 1456). Characteristic spectrum lines from a spark or arc discharge are focused separately each on a separate photomultiplier cell, which records the intensity of the particular line.

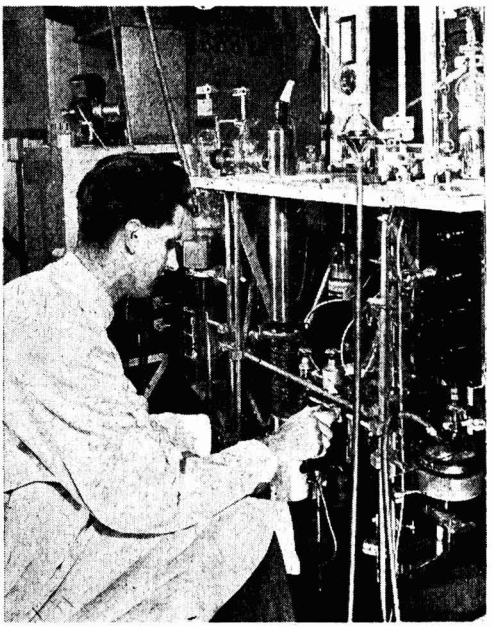
The output from the cells is used to charge a series of capacitors; when that associated with a standard reference line has been charged to a predetermined value, the arc or spark is switched off, and the rest of the capacitors are then connected in turn to a meter and recorder which indicates their respective charges and hence, by calibration, the actual analysis.

The instrument at BCIRA is accurate to within 3 per cent. and is at present calibrated to record the quantities of 10 alloying elements in steel within two minutes. These

Recording analytical results on the quantometer of the direct reading spectrograph



The Director, Dr. J. G. Pearce, Sir Frederick Scopes, President, and Mr. J. J. Sheehan, Chairman of Council, welcome visitors to BCIRA at the Open Day on 7 July



Determination of the gas content of cast iron by the vacuum fusion technique

elements and their range of concentrations are as follows: silicon, 0.1-4.0 per cent; magnesium, 0.01-0.25; manganese, 0.1-1.0; nickel, 0.2-3.0; chromium, 0.1-2.0; molybdenum, 0.2-2.0; copper, 0.1-2.0; aluminium, 0.1-1.0; titanium, 0.04-0.4; vanadium, 0.04-0.4.

Other spectrographic equipment includes a Hilger quartz prism spectrograph and a 2 metre diffraction grating spectrograph. A special room houses the microphotometer, the spectrum projector and the spectrum comparator.

Work carried out in the chemical laboratory includes determination of cerium in nodular irons; determination of lead by polarographic analysis; determination of phosphorus in cast iron; and determination of vanadium, using a potentiometric method. A particularly interesting development is the use of radio-frequency heating in the combustion determination of carbon; this has the advantages of rapid and very localised heating.

In one of the research laboratories, experimental work on the mechanism of blister formation during the enamelling of iron castings is being carried out. The technique involves the heating of cast iron specimens in a stream of pure argon and measuring the carbon monoxide evolved from the specimen by means of an infra-red analyser. Specimens are heated to 760° in a current of argon at 400 cc. per min., and the analyser is adjusted to give a full-scale deflection for 0.04 per cent CO. Normal concentration of CO is about 0.004.

Other determinations of oxygen, hydrogen and nitrogen in cast iron are carried out in the vacuum fusion apparatus in the Gases Laboratory. Essentially, this is a high vacuum system containing a graphite crucible heated by high frequency. Gases evolved are collected in a series of Topfler bulbs.

Recently, success has been attained in the direct determination of hydrogen in the vacuum fusion apparatus by its diffusion through a heated membrane of palladium, measurement being made of the pressure difference. Quantities of hydrogen of the order of 0.005 ppm. have been detected by this means.

Among many other interesting pieces of work demonstrated on the Open Days were: the application of thermal analysis data to the study of the solidification sequences in cast iron; the many testing procedures to which moulding sands are subjected, including estimation of gases evolved, volatile matter, pitch and coal dust; the effect of silicon on the tensile, impact and fatigue properties of ferritic nodular iron; and the means of direct addition of magnesium to molten cast iron.

The experimental melting shop, which is not yet equipped, houses some of the experimental work by the Foundry Atmospheres Team on the ventilation of foundry knockout systems, an investigation of considerable importance in dust control and in the prevention of atmospheric pollution.

Coke Output Downward Trend

Production of coke in the United States in April, as reported to the US Bureau of Mines by coke-producing companies, totalled 4,693,562 net tons. This continued the downward trend in coke output, with merchant plants operating at only 60 per cent of capacity, and plants associated with the iron and steel industry at 72.7 per cent. Producers' stocks of coke increased 5 per cent during April, and on 1 May were equivalent to 18.4 days' production at the current rate.

Chromium from Chromite

One of the Major South African Minerals

CHROMITE is the only ore mineral of chromium and consists theoretically of $FeO.Cr_2O_3$, the chromic oxide (Cr_2O_3) content being 68 per cent. Impurities are almost invariably present, however, and commercial ores marketed as chromite seldom contain more than 50 per cent Cr_2O_3 and usually less. In 1951, world production amounted to about 2,700,000 long tons of marketable ore, compared with little more than 1,000,000 tons in 1938.

The industrial uses of chromite fall broadly into three main categories—metallurgical, refractory and chemical—each of which demands a particular grade of ore. The lines of demarcation between these fields of usage are not always clearly defined, however, and the three grades in which chromium is marketed are interchangeable to some extent.

Metallurgical chrome, principally in the form of ferro-alloys, is used in the manufacture of various types of special steels. It is an essential ingredient of all stainless steels and of other high temperature alloys used in the production of jet aircraft and gas turbines. The grade normally specified for metallurgical purposes contains at least 48 per cent of Cr_2O_3 and has a Cr : Fe ratio of not less than 2.8 : 1. Sulphur should not exceed 0.5 and phosphorus 0.2 per cent. About half the world's output of chromium is used for metallurgical purposes.

Useful Furnace Lining

Chromite is itself a neutral refractory, which is highly resistant to both acid and basic slag. It is therefore used as a furnace lining for areas intermediate between the basic hearth and the acid. Refractory grade chromite contains 63 per cent of combined chromic acid and alumina, with 57 per cent a common minimum. Typical ores contain about 34 per cent of chromic oxide. The iron and silica contents should be low. Refractory applications account for about 35 per cent of the total chromite production.

The balance, equivalent to about 15 per cent of world supplies, is used by the chemical and allied industries for the production of numerous chromium compounds. Chromite is the primary material for the manufacture of dichromates of sodium and potassium, which have many direct applications in industry, besides being raw material for the production of other compounds largely used in electroplating, tanning, dyeing, ceramics, glass-making, and the manufacture of pigments. Chromium salts are also used for bleaching oils and fats; in the purification of wood vinegar; in the production of safety matches, antiseptics and certain aniline dyes; in photography; in various printing processes; in photolithography and photozincography, and in the dichromate battery.

Chromium Plating

Chromium plating is an electrolytic process, the electrolyte consisting essentially of a solution of chromium trioxide containing a small quantity of sulphuric acid. Two types of chromium plating are in common use, namely, a very light deposit for decorative or anti-tarnish purposes, and a heavier coating which is applied to give resistance to wear and corrosion. Electrodeposited hard chromium incorporating, oil-retaining pores is being increasingly used for reducing wear on engine cylinder liners, piston rings, rolls, etc.

Substantial quantities of chromium salts are used in the tanning of light leathers. Chrome tanning is carried out in a matter of hours, as compared with days for vegetable tanning. It is reported to produce a sole leather with exceptional wearing qualities, but rather deficient in water-resisting qualities. In the one-bath process, the tanning liquor is made from chrome alum, from sodium or potassium dichromate, or from a technical by-product resulting from a chemical process in which chromic acid has been used as an oxidising agent. In the two-bath method the prepared hides are soaked in an acidified solution of sodium dichromate and are then immersed in a solution of sodium thiosulphate, which reduces the dichromate to basic chromic sulphate.

In the dyeing of woollen materials various soluble salts of chromium are used both as mordants and for their colouring properties. In the pigment industry various yellows are

made from lead chromate according to the method of manufacture. Basic chromate of lead produces chrome red; zinc chromate gives the yellow pigment known as zinc chrome or zinc yellow; while various green pigments are produced from mixtures of Prussian blue and lead chromate or zinc chromate. Guignet's green, which consists of hydrated chromium oxide, is a brilliant green pigment of great stability and permanence, but rather lacking in covering power. Hexavalent chromium compounds containing zinc, cadmium or barium are valuable as corrosion inhibiting agents in paints.

Colouring Ceramics

Chromium compounds are also extensively used in the ceramic industries as colouring agents, the chief materials employed for this purpose being chromite itself, potassium dichromate, lead chromate and chromic oxide. Chromite used in this industry must be of special composition; it is ground extremely fine and air-floated to pass a 300-mesh sieve. The compound is usually converted into a 'stain' by mixing it with a flux of suitable composition and calcining the mixture at high temperature. In the glass industry various shades of green are obtained from the addition of 2 to 6 per cent of air-floated chromite to the batch.

Chrome compounds are also used in the printing of wallpapers, in calico printing, and in the production of printing inks. Chromic oxide, specially prepared and used under specified conditions, is claimed to be an efficient catalyst in the manufacture of sulphuric acid by the contact process.

The Union of South Africa is the largest supplier of chemical grade chrome and also produces refractory grade. The known deposits in the Transvaal are estimated to exceed 1,000,000,000 tons, if all minor seams are taken into account, and are probably the most extensive in the world. The United States has become almost entirely dependent on these deposits for supplies of chemical grade chrome. Last year South Africa exported 579,315 short tons of chrome ore with a f.o.b. value of £2,692,019, the average Cr_2O_3 content being 44.96 per cent. Shipments to the United States accounted for 417,614 tons, the balance being exported mainly to Canada (55,088 tons), the United Kingdom (41,792 tons) and Germany (40,611 tons).

South Africa's most important deposits of chromite are situated in the central Transvaal, where two main belts occur. The Eastern or Lydenburg belt is from 1½ to 3 miles wide and extends for about 70 miles, while the Rustenburg belt is about 100 miles long. In some sectors up to 15 different seams, varying in thickness from less than an inch to over 6 ft., have been encountered, most of them being persistent and regular over distances ranging from hundreds of yards to more than a mile. The average Cr_2O_3 content of the largest seams varies from 36 to 45 per cent.

Apart from the recovery of a certain amount of ore by surface stripping along the outcrops in the initial stages of opening up a prospect, the chromite is recovered by mining at shallow depth. It does not consist purely of the oxides of chromium and iron, but also contains appreciable quantities of combined magnesia and alumina. The grade of ore is therefore due largely to the nature of the mineral and cannot be greatly improved by concentrating methods.

For industrial purposes the chromite is classified as friable or hard, lumpy. An ore is said to be friable when it is in the form of loose grains or 'sand' or in fragments which readily disintegrate into such a condition. Though very tough, friable ore pulverises in mining and handling and crumbles in surface stockpiles. The hard, lumpy variety is in the form of coherent pieces which do not break or pulverise upon handling or exposure to the atmosphere. For the requirements of the chemical industry a friable ore is preferred, the hard, lumpy variety being used mainly for refractory purposes.

The following are some typical analyses of Transvaal chromite:

	Concentrates %	Friable Ore %	Hard, Lumpy Ore %
Cr_2O_3	53.33	47.05	43.38
FeO	19.24	23.80	25.62
SiO_2	1.04	3.16	1.70
Al_2O_3	14.70	16.18	18.65
MgO	12.18	9.58	10.66
CaO	—	0.91	0.10

The grades produced consist of a relatively small tonnage containing over 48 per cent Cr_2O_3, a large tonnage of + 44 to 48 per cent Cr_2O_3, and a slightly lower tonnage of — 44 per cent Cr_2O_3. By washing and concentration, using cone-classifiers, the chromic oxide content can be raised about 2 per cent above the run-of-mine material by removing some of the silicate gangue. Concentrates containing up to 54 per cent chromic oxide

are available for export. Because of its high iron content Transvaal ore is not normally suitable for the production of ferrochrome.

Chemical manufacturers vary considerably in their specifications for chromite, but as a general rule they prefer a high-grade ore, from which it is often possible to recover 95 per cent of the chromium present, whereas an ore carrying only 40 per cent Cr_2O_3 might yield as little as 35 per cent of its chromium content. Iron presents no problem to users of chemical grade, but a high alumina content is undesirable. The US National Stockpile Specification P-65, dated 1 June, 1949, for the purchase of chemical grade chromite, requires the mineral to contain not less than 44 per cent Cr_2O_3 and not over 5 per cent SiO_2. On the other hand, some United States users specify a minimum percentage of 48 for chromic oxide, with silica not exceeding 8 per cent, low sulphur, and a chromium: iron ratio of about 1.6: 1.

Beneficiation Doubtful

Owing to the improving supply position the demand for – 44 per cent Cr_2O_3 is falling off. In order to market the lower grades it might therefore be necessary to consider the introduction of washing and concentration on a more extensive scale. It is believed that some attention has also been given to the possibility of supplying a certain tonnage of metallurgical ore by the beneficiation of chemical grade. Beneficiation is not often practised with chrome ores, however, because, although it may raise the Cr_2O_3 content, it seldom improves the ratio of Cr to Fe. Apart from technical considerations, producers would have to consider very carefully whether the cost of additional processing was likely to be repaid by an enhanced price. Furthermore, many of the chromite mines are essentially small-scale propositions. Although several large companies are operating in the Transvaal fields, the bulk of the output is from small, scattered producers with limited resources for the installation and operation of additional treatment processes.

The regularity of the seams, coupled with their comparative shallowness, enables the Transvaal deposits to be cheaply mined, but because of their situation costs of transport form a large proportion of the c.i.f. cost to the consuming country. Most mines are from 2 to 14 miles from rail and in a few cases ore has to be transported by road for 30 miles or more. The construction and maintenance of roads have done much to place the industry on a sound competitive basis, but many producers are still cut off from railhead during heavy rains, while the absence of mechanical handling equipment is a further handicap. Lourenço Marques in Portuguese East Africa is the nearest port. The distance by rail to the coast from the Eastern belt is 355 miles and from the Western belt between 397 and 487 miles. Fortunately, the more distant deposits are able to mine a higher grade of ore, which more than offsets the higher railway rate. Operations at the South African chrome mines were seriously disorganised for a number of years by coal crises of seasonal recurrence, which made it necessary for trucks booked for chrome to be reallocated to coal, but the rolling stock position on the South African Railways is now improving.

Skilled labour also presents difficult problems. The law provides that all mining operations must be under the charge of a certificated miner, but qualified men are often reluctant to live in the wilds, particularly if they are married men with children, for whom schools must be found.

In spite of all obstacles production has steadily been expanded, apart from a severe setback during the depression years of the late ' 20's and early ' 30's. In 1938 the annual output was 174,000 long tons. By 1947 it had risen to 367,000 tons, and in the last six years it has again been more than doubled, a production of 798,567 tons being recorded for 1953.

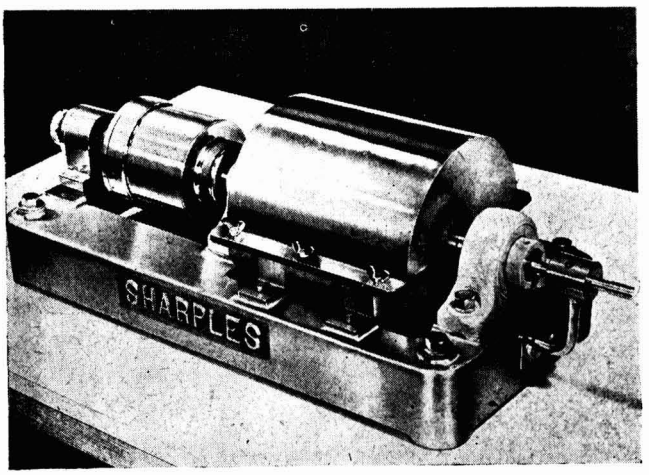
Future Assured

American industrialists and metallurgists, who recently investigated the Transvaal's chrome ore resources, expressed the opinion that a great future awaits this industry. According to *Resources for Freedom* — the report submitted by the Paley Committee to the President of the United States — the peacetime demand for chrome is expected to double by 1975. Although known reserves are believed to be adequate for the projected free world consumption, the final availability will depend on the extent to which serious obstacles to investment and development can be surmounted. Loans by the International Bank are helping to overcome the existing shortages. The long-term supply outlook for the British chemical industry can therefore be regarded as reasonably well assured.

New Pilot Plant Super-D-Canter

Apparatus for Testing & Development

THE Sharples P-14 Super-D-Canter, well known in industry for the recovery of solids from slurries, can operate at a feed rate of 300-2,500 gal. per hr. In applying the machine to new applications, however, difficulties were encountered since with this type of centrifuge the standard laboratory simulation tests are not very satisfactory, and a full scale test had frequently to be carried out on the P-14 machine, using quantities of up to 1,000 gallons of feed for the test. This was expensive, and in the case of new processes frequently impossible since only small quantities of the materials might be available for test at the time when a decision had to be reached on the separation equipment.



A general view of the new model separator

To overcome this difficulty Sharples have produced a new pilot plant Super-D-Canter known as the Model P-4. This machine has an average feed capacity of 1 gpm. and a maximum feed rate of up to 2½ gpm., and in consequence test work can now be carried out on as little as 5 gal. of slurry. From these tests authoritative predictions can be made regarding the capacity and performance that will be achieved by the full-size machine.

Apart from the application of the P-4 machine to testing the separation characteristics of slurries for scaling up to full size plant, it can also be used for small scale production work, for pilot plant operation, and as a general laboratory tool, in laboratories where slurries have frequently to be separated as part of routine analysis procedure, or as part of a research programme.

The actual capacity of the P-4 Super-D-Canter varies, of course, with the particle size distribution of the solids, the nature of the liquid, and the degree of separation required, but typical capacities are:—

Slurry containing 5 per cent solids by volume—feed rate 2½ gpm. Slurry containing 20 per cent solids by volume—feed rate 1 gpm.

The apparatus is fabricated in stainless steel and consists of: a conical bowl, rotated about a horizontal axis, in which the slurry is subjected to centrifugal force; a screw conveyor, rotated about the same axis as the bowl but at a lower rpm. to move the sedimented solids to one end of the bowl for discharge from ports; and a casing which collects the discharge of solids from one end and liquid from the other end, and diverts them in separate streams.

Provision is made to feed the slurry into the bowl through an axial feed tube. Centrifugal force separates liquid from the slurry, and this liquid overflows through apertures in what is called the plate dam. The relative motion between the conveyor and the bowl advances the separated solids to the opposite end, and the solids are delivered into the casing.

Oil in Sicily

Natural, Asphaltic and Refined

ON 29 October, 1953, the Italian Assessor for Industry and Commerce communicated to the Sicilian Regional Assembly that engineers of the American International Fuel and Petroleum Company had discovered a petroliferous horizon at a depth of 2,112 metres while drilling their first well near Ragusa.

Exploitation of the first two wells was to begin this month; each is expected to give about 100 metric tons of crude oil per day, and every fourth month a new well will add its contribution.

If three more wells are bored during the next year, at least 500 metric tons of crude oil per day will be available, equivalent to about 200,000 metric tons per year. The prospect is promising and particularly significant inasmuch as the first samples of the extracted oil have a good aromatic fragrance, a relatively low specific gravity (about 19° API) and, above all, a minimum sulphur content.

Ragusa has long been well known for the local asphaltic rocks, with an oil content of 7-8 per cent; owing to the limited oil content it would have been necessary to quarry and treat at least 12-14 metric tons of rock in order to obtain 1 metric ton of crude oil.

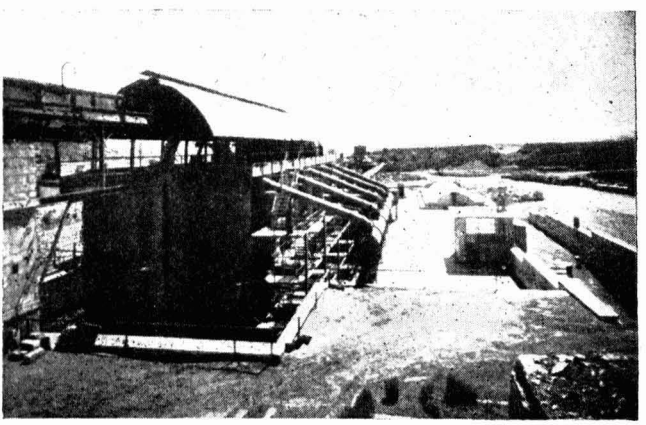
Recently, however, the Calce e Cementi di Segni, encouraged by the Regional Government, purchased the local installations and completed in one year an important factory, making the working of the Sicilian asphaltic rocks profitable at last.

The mineral, a normal limestone impregnated with asphaltic oil of relatively deep origin, is carried to a series of big breakers which reduce it to the size required for the extraction of oil in De Bartolomeis furnaces; 20-25 per cent of the oil originally contained in the rock is burnt here and 60-70 per cent extracted, with a residual 10 per cent left in the rock as fixed carbon.

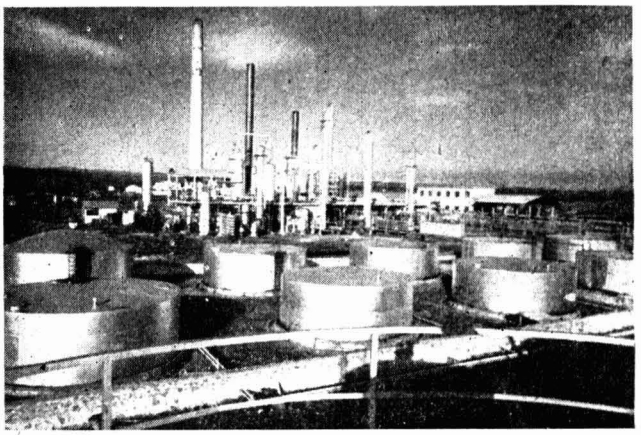
The crude oil obtained in this manner is mixed with commercial naphtha and utilised for feeding the thermal installations of the factory. About 10 per cent of the produced crude oil (300-350 metric tons per month) is at present transformed into oxidised bitumen of considerable importance for road-surfacing; an installation which will extend this treatment to all the extracted oil is being completed.

The De Bartolomeis furnaces give a crude oil for established use and an already broken and hot exhausted limestone, containing about 1 per cent of fixed carbon, which is sent to the cement factory. Use of the already broken asphaltic rock results in a reduction of the energy required for grinding the primary material: an ordinary 400 kW ball mill, which usually treats about 15 metric tons of primary material per hour, can grind 20-25 metric tons per hour when employed with this rock. A second advantage is that using an already dehydrated product saves heat.

It is obviously impossible to appreciate precisely the advantages to be gained, but the consumption of thermal energy amounts in this installation to about 1,100 thermal



De Bartolomeis furnaces for extraction of oil from the asphaltic rocks of Ragusa



Storage tanks, topping plant No. 1, and cracking plant in the Augusta refinery

units per metric ton of clinker, as against 1,600 in the usual cement factories.

Apart from the deposits of oil and asphaltic rock, Sicily also possesses the Rasiom-owned refinery of Augusta, with a total potential output of 2,200,000 metric tons. Only the first topping plant is of entirely American construction, while the remainder was almost totally planned and built by Italian technicians.

The refinery is composed of the following parts:

(1) Topping plant No. 1—A two-stage plant with a predistillation tower, of entirely American construction; the productive capacity of this plant amounts to 1,400 metric tons per day.

(2) Topping plant No. 2—A two-stage plant designed by Rasiom and built by Italian industry, with tower for the redistillation of gasolines. The productive capacity of this plant amounts to 3,000 metric tons per day.

(3) Topping plant No. 3—A one-stage plant of new construction built by Rasiom; its productive capacity amounts to 500 metric tons per day.

(4) Thermal cracking plant—A Dubbs selective thermal cracking plant with two furnaces and recirculation of a heavy distillate, based on modern technical principles and built in 1949 according to a design of Universal Oil Products of Chicago. It is combined with topping plant No. 1, from which it receives directly the reduced hot crude oil. The potential output of this plant amounts to 650 metric tons per day.

(5) Vacuum plant—A one-stage plant with three lateral products and recirculation of two lateral refluxes, a flux of gas oil for washing purposes and a flux of gas oil for recycle to the furnaces; it is designed for the production of bitumen and three fractions of lubricants, and is combined with topping plant No. 3 from which it receives the reduced hot crude oil; the capacity of the vacuum plant amounts to 350 metric tons per day.

(6) Thermal reforming plant—Comprises also a section for the treatment with earths, a section for the absorption of light gases and a section for the stabilisation of gasoline; the capacity of the plant amounts to 450 metric tons per day.

(7) Liquid-gases plant—Comprises a section for the redistillation of gasolines, a section for the separation of light gases (butane, propane, etc.) and a section for the compression of light gases. The capacity of the plant for the separation of liquid gases amounts to 50 metric tons of compressed gases per day.

(8) Plant for the desulphurisation of the light topping gasolines on bauxite—The capacity of the plant amounts to 300 metric tons per day.

(9) Chemical refining plant—Includes two sections for doctor treatment, a section for hypochlorite treatment, a section for caustic washing of compressed gases, a section for the discontinuous acid treatment of petroleum, a section for the acid treatment of petroleum with four Alfa Laval centrifugal machines, and a series of centrifugal machines for the recovery of gasolines from the doctor solution.

(10) Ethylation plant—Comprises dosing devices of the Ethyl Corporation type and a system of pipes with ejectors and mixers.

Timber Extractives*

FROM the title of your Association your main interest is in the preservation of timber. This is a subject upon which I might have been more competent to address you some 20 years ago when I was the head of the chemistry department at the Forest Research Institute, Dehra Dun. In my laboratory we had to make numerous analyses of timbers which had been treated with various preservatives more particularly against the depredations of 'white ants.' While therefore your main interest is in timber preservation against the attacks of the climate, fungi and insects, I gather that you have some interest in minor timber constituents since not only may they prove of value as preservatives but also provide an economic outlet for your waste timbers. The former possibility does not seem unreasonable when we recollect the natural resistance of certain timbers, such as teak, to insect attack.

Cellulose & Lignin

The two main constituents of all timbers are cellulose and lignin. I do not propose to say anything about cellulose since its properties and its uses are too well known to require comment. I should, however, like to make a few brief remarks on the subject of lignin, a waste product available in very large amounts for which no large scale use has as yet been found. In seeking such a use an obvious first stage is the determination of its chemical structure. Owing to its properties and to its high molecular weight this is no easy problem. The long series of experiments, which have been carried out mainly in Sweden, Germany and the United States, have given us much information and it is now clear that all the lignins are not identical. They are closely related but they differ dependent upon their botanical origin.

While up to the present no large industrial use has been found for lignin it is used in Canada and in the United States as the raw material for the manufacture of the flavouring material, vanillin. In this country vanillin is made from eugenol, the main constituent of clove stem oil from Zanzibar. It would be in the nature of a major calamity for this island if the manufacture of vanillin from lignin was undertaken in this country since cloves provide the main source of revenue in Zanzibar, yet vanillin from lignin would be much cheaper.

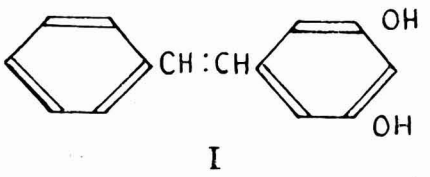
Recently a new possible use for lignin has been under investigation, namely the possibility of using it, either alone or in combination with carbon black, for the reinforcement of natural rubber. If these experiments should prove successful they would provide a valuable outlet for this waste product.

Little Attention to Minor Constituents

It is somewhat remarkable how comparatively little attention has in the past been paid by chemists to the minor constituents of timber. This does not apply to those containing dyestuffs, essential oils, tannins or alkaloids. Thus prior to the introduction of the synthetic dyes such woods as red sanders wood, *Pterocarpus santalinus,* or logwood, *Haemotoxylon camphechinum,* were sources of important dyes and the latter still finds a limited use. Timbers provide an extensive and valuable source of essential oils. Among these mention may be made of *Santalum album* yielding sandalwood oil, Bois de Rose from Brazil, cedar wood oil from *Juniperus Virginia* or *J. procera.* The most important, however, of all the essential oil industries is the so-called Naval Stores industry, which is based upon the oleo-resin obtained by tapping the *coniferae,* more especially the slash-pine, *Pinus caribaea,* in the United States and *P. maritima* in France. It is most unfortunate that we have not within the British Commonwealth, with the possible exception of British Honduras, any stands of these *coniferae.*

It is perhaps hardly necessary for me to remind you that the oleo-resin yields oil of turpentine and rosin (colophony). I fear that in far too many minds oil of turpentine is associated solely with its use in paints. This was once true but now it provides only a minor use having been largely replaced by white oil, a petroleum product. Its constituents, α- and β-pinenes, now find their main use in the fine chemical industry,

* An address by Sir John L. Simonsen to the Annual Convention of the British Wood Preserving Association at Cambridge on 23 June.



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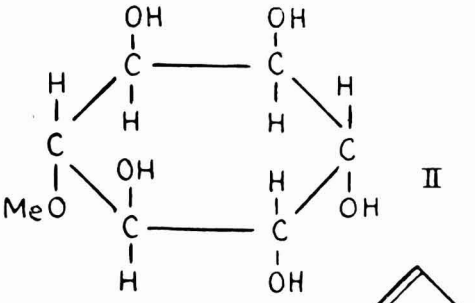

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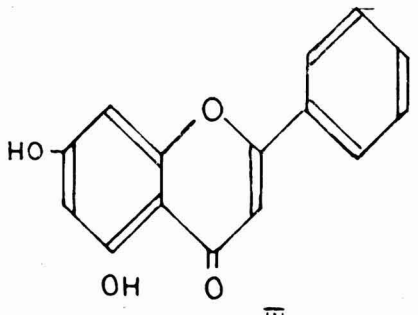

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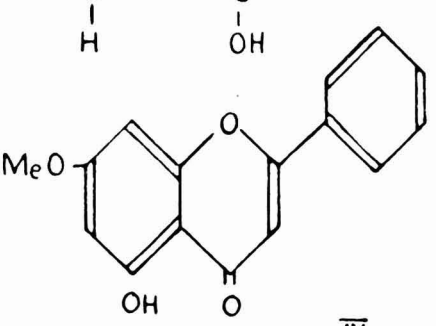


IV

being converted into camphor, α-terpineol and other products. Rosin has always been a valuable industrial product and its uses are being continually extended more particularly in the field of plastics. Rosin is also available in India and Pakistan from the oleo-resin of *Pinus longifolia* but unfortunately the turpentine has different constituents from the American and French oils and its use is largely confined to the paint industry.

Our knowledge of the chemistry of the tannins, obtained from the bark of trees, is still somewhat limited. The recent work of King and Bottomley on a product which has been obtained from *Acacia melanoxylon* suggests that this long outstanding problem may be nearing solution. The bark of trees is a source also of drugs and I need only mention cinchona bark which provides the valuable alkaloid quinine and its cogeners.

During recent years we have witnessed an increased interest in the minor constituents of timber. I think that these investigations are of importance not only from their scientific value but also because they may disclose the occurrence of substances of industrial value. If this should prove to be the case they would doubtless be obtained from the waste timber always available in constructional work and from the sawdust. Furthermore it is very possible that their investigation may throw some light on the many problems of timber preservation.

I come now to the main theme of this lecture, namely the recent work on the minor constituents of timber, and I propose to discuss the important work of Professor H. Erdtman in Sweden and Professor F. E. King, F.R.S., in the University of Nottingham. We have two main classes of timber, the soft- and hard-woods. As was to be anticipated from the forests of the country, the researches of Professor Erdtman of the Royal Institute of Technology, Stockholm, have been concerned with the former and he has studied in great detail the constituents of the *coniferae*. This class is divided into six orders, comprising seven families which are themselves sub-divided into more than 50 genera containing approximately 600 species. As you are aware they form the main source of supply of cellulose for the paper pulp industry although recently some hardwoods, such as *Eucalyptus regnans*, have been successfully pulped and there are French reports of the use of tropical hardwoods.

As Professor Erdtman has pointed out, the heartwood of the *coniferae* may be regarded as 'dead' wood and yet it is comparatively resistant to insect attack, whereas the sapwood is readily attacked. We are only too well aware that the *Lyctus* beetle, for example, attacks the sapwood first. Professor Erdtman's experiments

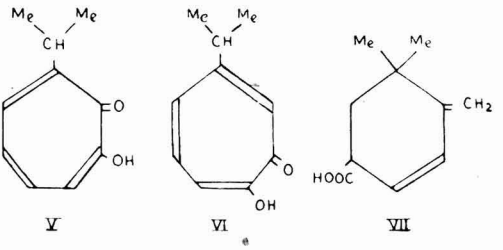
apparently originated in an attempt to explain why the wood of *Pinus sylvestris* afforded difficulties in the removal of the lignin in the production of pulp by the sulphite process. In due course he found that this was due to the presence in the wood of the substance pinosylvin (I). This constituent, its monomethyl ether or its dimethyl ether, was found to occur in the heartwood of many varieties of pine but they were absent from the sapwood.

In the 50 varieties which he has so far examined, with the exception of *P. pinaster,* one of these substances was present. The content is not large, *ca.* 1 per cent. He made the important observation that pinosylvin was toxic to both fungi and insects, the monomethyl ether less so and the dimethyl ether not toxic. He has therefore suggested that pinosylvin may be regarded as a natural timber preservative although this view has not received general acceptance.

Of Value to Taxonomists

In the course of his detailed study of the pines, Professor Erdtman has been led to consider whether the chemical constituents of the pines can be of value to taxonomists. He regards this as a very important aspect of his work. As you are doubtless aware, Baker and Smith in their classical memoir on the Australian *eucalypts* used their chemical constituents, in this case essential oils, for their botanical classification. This possibility is one which particularly interests me as some twenty years ago I ventured to suggest that this might also provide a method for the classification of the *Andropogons,* grasses which taxonomists have found great difficulty in identifying. The pines contain two main groups, haploxylon pines and diploxylon pines. Professor Erdtman has now found that these two groups can be readily distinguished by the constituents of the heartwoods. So far the present investigations have shown that all haploxylon pines contain the cyclic carbohydrate, pinitol (II), and certain flavones, such as chrysin (III) and tetrochrysins (IV), but pinosylvin was absent. None of these substances was found in the diploxylons which do, however, contain certain flavanones and they all contain pinosylvin.

The heartwood of *Thuja plicata,* the shavings from which have been used as an insect repellant, contains the interesting substances, α- and β-thujaplicin (V) and (VI), while from the heartwood of *Libocedrus*



formosana, which is resistant to white ants the acid, shonanic acid (VII), has been isolated.

The isolation of these natural timber preservatives and the determination of their structures would suggest the possibility of improving upon the preservatives now in use more especially when we recollect the very small amounts present in the wood. It is clear that further research in this field is desirable more especially since, while these substances do appear to have toxic properties so far as insects and fungi are concerned, there does not seem to be any evidence that they will protect the timber against climatic conditions.

Unlike the forests of the Scandinavian countries and those of the Western hemisphere the tropical forests consist almost entirely of hardwoods. Timber extraction from these forests is now being developed on an extensive scale and a large number of new tropical hardwoods are being imported into this country. It is therefore fortunate that Professor F. E. King and his colleagues in the University of Nottingham have commenced a comprehensive study of their constituents.

While the first experiments were made with resistant timbers, namely those which were known to be resistant to fungal and insect attack, these investigations have a much wider objective which may be summarised under the following heads:—

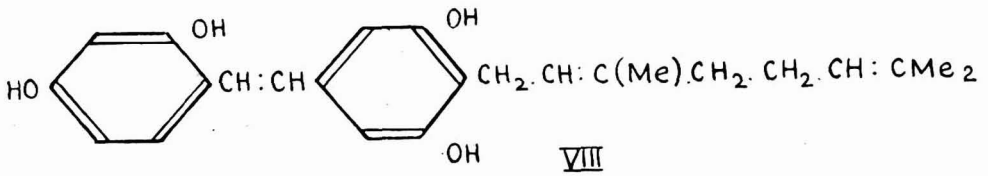
(i) Possible contributions to the taxonomic classification of the species.

(ii) The discovery of new materials or of improved sources of compounds for the fine chemical industry, particularly that section concerned with pharmaceuticals.

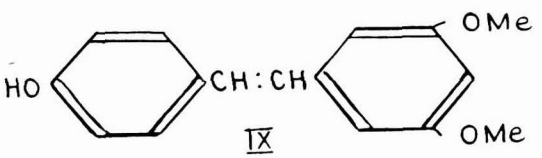
(iii) The elucidation of problems arising in the technical utilisation of wood.

(iv) The general stimulation of research in organic chemistry by the discovery of compounds of novel type.

Professor King's first experiments were concerned with the constituents of iroko



VIII



IX

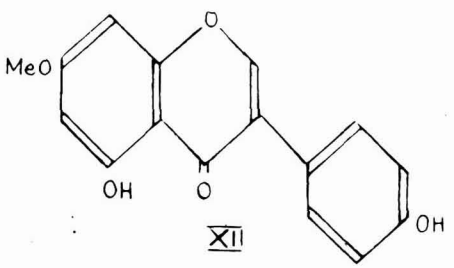
wood, the so-called West African teak, *Chlorophora excelsa*. It is not without interest to mention that his experiments were carried out with the residual timber from the making of the benches for a new laboratory. He found that the wood contained about 8 per cent of a substance, chlorophorin (VIII). You will observe that this, like pinosylvin, is a stilbene derivative. It is also closely related to pterostilbene (XI) which has been found by Späth and Schlager to occur in red sanders wood. This wood contains two other colourless constituents, pterocarpin (X) and homopterocarpin (XI).

It is known that muninga (*P. angolensis*) does not contain any of the above-mentioned substances, and its resistance to fungal attack may well be due to the occurrence in it of the three phenols, prunetin (XII), muningin (XIII) and angolensin (XIV).

Angolensin would appear to be the type of substance which might prove to be of economic value. On suitable treatment it could yield substances analogous to stilboestrol, while on fusion with alkali the methyl ether gives very high yields of *p*-ethylanisole and 4-methyl-β-resorcylic acid which are not readily available from other sources.

Professor King's investigations of other hardwoods have shown that they contain constituents which would provide materials for the preparation of a great variety of substances. Detailed discussion of these does not come within the scope of this address but I would venture to suggest that development on these lines may provide a use for the large quantities of waste woods which are available.

In the past research in this field has been far too limited. Is there not a prospect that if it received support a new chemical industry based upon wood waste products might not be developed?



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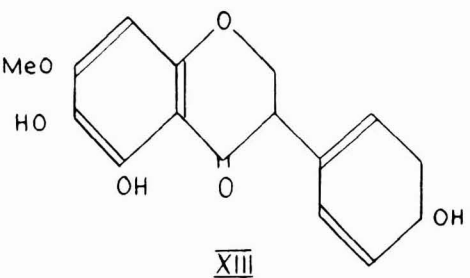

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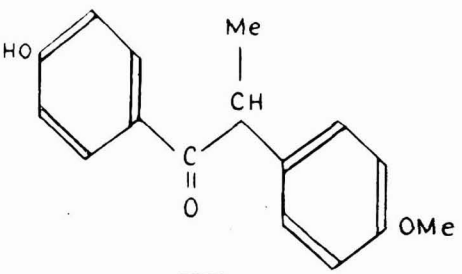

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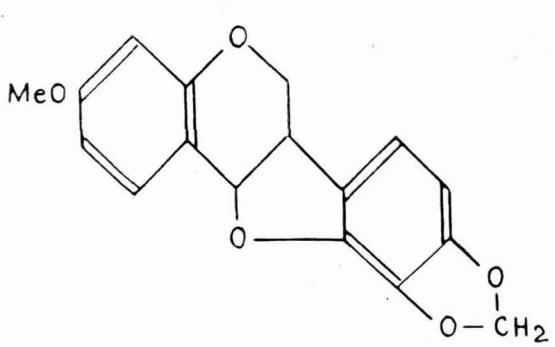

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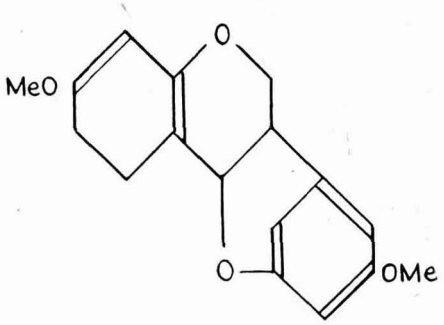


XI

Fuel Research 1953

Growing Public Interest in Fuel Efficiency

THE year 1953 was marked by increased public attention to one of the effects of the inefficient use of fuel, namely, the production of smoke and other substances causing air pollution with resulting damage to health and property. The Fuel Research Board report emphasises how closely much of the work of the Fuel Research organisation is linked to this aspect of fuel economy.

Details are given of progress during the year towards perfecting the method of washing flue gas with ammonia to remove sulphur compounds and recover ammonium sulphate and sulphur. It is shown how basic investigations of the vapour pressures of the ammonia-water-sulphur dioxide system have helped this work.

Improved equipment has been developed for recording the amount of smoke passing up domestic chimneys and a start has been made on a more intensive investigation than hitherto on the factors affecting production of smoke from open fires. At the same time work has been re-started on the manufacture of coke which will be easier to burn than present day coke, using typical gasworks equipment but modified conditions of carbonisation. Cokes which burn satisfactorily on an ordinary domestic grate have been produced in this way from a weakly-caking Nottinghamshire coal.

In addition to the positive measures for the reduction of atmospheric pollution, the co-operative survey of pollution throughout the country, which is organised by the Fuel Research Station and is reviewed in this Report, has been further developed. There are now about 1,400 measuring instruments in regular use throughout the country to provide basic data on which action to tackle the pollution problem must be foundd. The special surveys conducted by the Fuel Research Station deserve particular attention as they provide a means of ascertaining how the pollution at ground level in certain districts varies with the amount of polluting substances emitted from given industrial installations and with meteorological conditions.

Work is in progress on the utilisation of fine low-grade coal and coke both as boiler fuel and for gas production. On the gasification side, attention has been devoted mainly to the production of water-gas and producer gas from weakly-caking coal using the fluidised-solids technique. Originally much of the fuel was lost as dust and although alterations to the pilot plant have now reduced this loss considerably, further reduction is necessary. A comparison has been made between rates of gasification in this continuously operated plant and in a small intermittent laboratory-scale reactor; considerable progress has been made toward correlating the results obtained in the two ways. A slagging cyclone generator has been used with some success to gasify crushed coal using a blast enriched with oxygen.

When pyrites is roasted for the manufacture of sulphuric acid the residues of iron oxide are ordinarily mixed with iron ore,

and smelted in blast furnaces. It has now been found advantageous to use a type of burner at sulphuric acid works which requires finely divided pyrites and produces a residue unsuitable for smelting. At the suggestion of the National Sulphuric Acid Association Ltd., samples of these residues have been mixed with coking coal and carbonised in the intermittent vertical chambers at the Fuel Research Station to see whether a coke with a high iron content could be produced that would still be strong enough for use in blast furnaces. The results so far obtained are distinctly promising.

In investigations undertaken in co-operation with the Admiralty on the undesirable thickening of residual fuel oils during storage, a method for the artificial ageing of these oils has been developed. By subjecting a sample of freshly prepared oil, or of one that has been in store for a moderate time, to a cycle of heating, rapid cooling, and reheating, its flow properties can be made to simulate those that the oil acquires after storage in bulk for long periods. Differences in the internal structures of the artificially and the naturally aged oils are being investigated.

Oil & Chemical Synthesis

Investigations of synthesis of oils and chemicals have covered such widely different fields as, on the one hand, the purely chemical problems concerned with the development of suitable catalysts and the discovery of the best conditions to give the desired products, and on the other, the chemical engineering problems that have to be solved before the process can be satisfactorily operated on a large scale. These include the design of reaction vessels for the different methods of working—with a fixed bed of catalyst, a fluidised bed of powdered catalyst, and a suspension of powdered catalyst in a liquid medium—taking into account the large amount of heat evolved by the reaction.

In experiments with the large pilot plant using a water-cooled bed of fluidised iron catalyst, smooth operation has been achieved with a conversion of 92 per cent of the synthesis gas and a daily production of about 60 gallons of products, including condensable gas, liquid hydrocarbons, wax, alcohols and other compounds containing oxygen.

Tin Research in 1953

Work on New Bearing Alloys

WORK on a group of new bearing alloys which, it is stated, has made considerable progress during the year, is described in the annual report of the Tin Research Institute for 1953. Samples are now being supplied for engine and machine trials on a practicable scale. Solid bearings containing 30 per cent of tin alloyed with a strong aluminium matrix have been made in the laboratory for trials in Italian tram cars.

Another alloy containing 20 per cent of tin bonded to a duralumin backing has been in experimental use for six months on a number of automotive engines used in cars and trucks. A third alloy containing 15 per cent tin can be bonded to steel backing shells and bearings are now being prepared for trials by some of the largest manufacturers of automobiles.

A new white alloy of copper, manganese and tin, which takes a high polish and is suitable for rolling and stamping, may find applications in tableware and in the electrical industry.

The Report reveals that the Institute's tinplate researches have again been principally concerned with the study of the tin-iron alloy layer, since the solderability and the corrosion resistance of tinplate are closely linked with the amount of the alloy and its structure. Study of the evolution of hydrogen from corroding tinplate has been continued and some anomalies have been cleared up. In the field of hot-tinning the Institute's work has been largely confined to technical service, and 86 firms have been served during the year.

Researches on the trialkyltin and triaryltin compounds, says the report, are still mainly in the laboratory stage. With the collaboration of specialist laboratories in many countries they were assessing the value of these compounds as pesticides. Among the possible fields of application being explored were agriculture, textiles, wood preservatives and paints. Most of these applications demanded long-term service trials, some of which had been started during the year. For example, timbers treated with organotin compounds have been placed in the Dutch State Mines and in tin and lead mines in England.

Nylon Patents Licences

Reserved Judgment for B.N.S.

MR. Justice Danckwerts, in the Chancery Division on 10 July, gave judgment for plaintiffs in the action brought by British Nylon Spinners Ltd., of Pontypool, Monmouthshire, against Imperial Chemical Industries Ltd., claiming a declaration that they were entitled to exclusive licences in respect of patents vested in I.C.I. for the manufacture of nylon yarn within an area defined by an agreement of March, 1947. (For an interim report, see THE CHEMICAL AGE, 1954, **71**, 76).

The patents related to inventions which were originally the property of an American corporation called E.I. du Pont de Nemours, who assigned them to I.C.I. in 1946.

In 1939, I.C.I. had been granted an exclusive licence for certain Commonwealth territories.

British Nylon Spinners were incorporated by I.C.I. and Courtaulds in 1940 on a fifty-fifty basis and in that year I.C.I. agreed to grant British Nylon Spinners a sub-licence for a restricted area.

I.C.I. said they could not or should not be ordered to grant the exclusive licence to plaintiffs because, if they did so, they would be in breach of an order made by the court in the United States of America under the Sherman anti-trust legislation in that country.

The American Court ordered that the agreement of 1946 for the assignment of the patents from the du Pont company to I.C.I. should be cancelled and in substitution du Pont were to grant a licence to I.C.I.

Mr. Justice Danckwerts said I.C.I. had in fact no wish to break their contract with the plaintiffs but they were apprehensive that if they carried it out they would be guilty of a disregard of the order of the American court and be involved in penal proceedings in America. Plaintiffs and Courtaulds were not a party to the American proceedings and were in no way bound by the order made there. If he (his lordship) reached a different conclusion from that of the American judge it was not due to this unwillingness to co-operate but to the differences in the legal situation in the two countries. In the present action there was no issue of conspiracy. It was evident that the US judge was far from certain that the English courts would accept the validity of his order. The question was whether the American order provided a defence for I.C.I. in the present action for performance of a contract which had been admittedly made between the plaintiffs and defendants.

There was no evidence that the object of the contract was to do anything contrary to American law and no evidence that plaintiffs were party to or had knowledge of any conspiracy contrary to US law when the contract was entered into.

There was evidence that the American courts would not regard a judgment of the English courts enforcing the contract against the I.C.I. as in any way inappropriate; there did not appear, therefore, to be any difficulty in regard to comity between the two courts.

His lordship said that the I.C.I. were bound by English law to carry out their agreement and he would grant plaintiffs specific performance of the contract, with costs.

Automatic Control & Computing

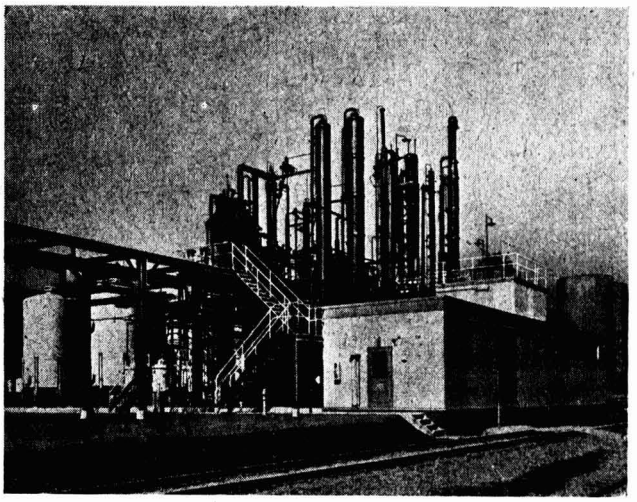
THE new Division at the National Physical Laboratory, which as already announced has been formed by the amalgamation of the Electronics and the Control Mechanisms Sections, is to be called the Control Mechanisms and Electronics Division. The field to be covered by the new division is the automatic control of industrial, administrative and experimental operations and the development of techniques and equipment for data processing and computation.

Modern research and development produces innumerable records of events made during tests. The interpretation of such records often takes weeks of skilled work. The new division is developing automatic or semi-automatic equipment to digest this data and produce it in the form of graphs or typescript ready for immediate use.

The officer in charge of the division is Mr. R. H. Tizard.

Oil Search in Malta

The d'Arcy Exploration Co. has been given permission to prospect for oil in Malta.



A NEW unit for the commercial production of high purity grades of ethyl and methyl acrylates has recently been completed at the West Virginia plant of Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. Production facilities of the new unit represent a substantial expansion of Carbide's previous capacity for the manufacture of these important polymer and copolymer intermediates. This unit can also be used for production of other esters of acrylic acid. Increased production of these acrylic products will afford a continuous large volume supply for manufacturers

Boiler Water Standards

THE British Standards Institution have just issued BS.2486 'The treatment of water for land boilers' which is a complementary volume to BS.1170 'Treatment of water for marine boilers' which has proved to be valuable and has been in widespread daily use since its publication in 1947.

The production of the present code for land boilers has proved to be considerably more complex due to the greater variety of boilers in use in land installations. The present document is particularly directed to the needs of operators of steam generating plant as used widely in industry and usually operated at a pressure not exceeding 250 psi.

The purpose of this standard is to show how impurities in the water affect boiler plant and to assist in the application of an economical method of treatment suitable to the individual supply.

The document is divided into parts dealing with water supplies and their treatment, feed water and boiler water and the care of boiler installations. Additionally, a glossary of terms used in water treatment is included as an appendix.

A further document has been published, namely, BS. 2455 'Methods of sampling and testing boiler water deposits.' It is confined to a description of methods suitable for the more general problems encountered, but does not cater for special cases except insofar as reference is made to the possibility of physical methods of analysis.

It is appreciated, however, that in such special cases elements other than those determined in this standard may be of interest, e.g., zinc, nickel, chromium, and that the ionic form of the copper and the iron may at times be of interest. It is also known that the quantity of sample recommended for analysis will not always be available, particularly in the case of small deposits of corrosion products in high pressure boilers, and that in such cases semi-micro or even micro technique may be needed.

The methods of chemical examination have been selected so as to require the minimum of time consistent with yielding results of an accuracy adequate for the purposes required. The following determinations are included: oil, loss on ignition, phosphate, carbonate, sulphate, chloride, sodium, silica, copper, iron, aluminium, calcium, magnesium and water soluble salts.

Copies of these standards may be obtained from the British Standards Institution, British Standards House, 2 Park Street, London, W.1. Price 6s. each.

The book, 'Oil in the Soviet Union,' by Heinrich Hassman and translated by Alfred M. Leeston, with foreword by E. DeGoyler, which was reviewed in THE CHEMICAL AGE of 3 July, page 43, is published by Oxford University Press and not Cambridge University Press as was indicated.

ORGANISCHE FALLUNGSMITTEL IN DER QUANTITATIVEN ANALYSE. By W. Prodinger. 3rd Edition. Ferdinand Enke, Stuttgart. 1954. Pp. xv + 232. DM. 34.

The second German edition of this book appeared in 1939, and was almost immediately translated into English. Now somewhat out of date, it was in its day a most valuable addition to the literature of analytical chemistry, and the new edition is to be welcomed. It may be that this, in its turn, will also undergo translation, but in the meantime we now have much additional information available in the German language, since the book has undergone a thorough revision.

The general pattern is more or less as previously. The general introduction has been considerably abbreviated, occupying only seven pages. This more concise section is warranted because workers in general ought nowadays to be sufficiently familiar in general terms with the field of organic analytical reagents. It is noteworthy, too, that the somewhat dubious classification of these reagents advocated in the previous edition has now been abandoned. The present treatment appears to the reviewer much more acceptable.

The special section deals in detail with the analytical uses of 32 important organic precipitants as against the 23 discussed in the previous edition. In other words, a number of important new reagents now make their appearance, the most notable of these being dipicrylamine, sodium tetraphenyl boron, N-benzoylphenylhydroxylamine, mandelic acid and *p*-bromomandelic acid, *p*-cresoxyacetic acid and tetraphenylarsonium chloride. The sections dealing with other reagents such as 8-hydroxyquinoline have been considerably enlarged, and neocupferron, dealt with in the 2nd English edition by the translator, is now included by the author. The most notable omission is dithizone, now excluded because of its slight use as a true precipitating reagent.

The treatment of each reagent is clear, comprehensive and detailed. Analytical chemists will find it most useful to have in collected form this practical account of the more versatile and valuable organic reagents. In particular, those chemists who have not ready access to a wide range of the literature should find here everything that is needful to enable them to make use of any of the precipitants.

It should, perhaps, be emphasised that although all the reagents included function primarily as precipitants, the book is not restricted to gravimetric procedures, titrimetric or photometric finishes to determinations being included where these have proved themselves serviceable. Many separations are described in addition to the individual determinations. The production of this new edition must be regarded as fully justified.
—CECIL L. WILSON.

POLYMER DEGRADATION MECHANISMS. National Bureau of Standards Circular 525. Government Printing Office, Washington. 1953. Pp. 280. $2.25.

Because of the wide use of polymeric materials their durability is of increasing importance. Knowledge of the mechanisms by which polymers degrade is needed in order to predict their expected life, to inhibit degradation and to devise methods of testing. A large amount of work has been carried out, during the past decade, on the mechanisms of polymer degradation and in this book, the proceedings of a symposium held by the National Bureau of Standards in 1951, much of the work is summarised. The book contains 17 papers on different aspects of polymer degradation, each paper being followed by a discussion.

The first paper, by Dr. H. H. G. Jellinek, is a critical review of theories of degradation of vinyl polymers with particular reference to polystyrene. A chain theory of degradation is presented and the thermal degradation of polystyrene considered in the

light of this and other theories. Degradation of vinyl polymers in the presence of oxidising agents and by ultrasonics are also considered. A paper by Dr. R. Simha on the mechanisms and kinetics of thermal and photo-degradation also suggests a chain process, accounting for the parallelism between monomer yield, rate of decomposition and rate of change of molecular weight of polymer. The theory is used to interpret the degradation of polyethylene and polymethyl methacrylate. P. R. Cowley and Professor H. W. Melville contribute a paper on the photo-degradation of polymethyl methacrylate. Degradation to monomer is induced by radiation of wave length 2537 A at much lower temperatures than those used in studies of thermal degradation. The kinetics of the process have been studied and lifetimes of radicals estimated.

Four papers deal with the degradation of polyvinyl chloride. Thermal degradation appears to be primarily a dehydrochlorination reaction, autocatalytic with respect to HCl in the presence of oxygen and light. Cross linking and chain breaking may also occur. Exposure to ultra-violet light renders the polymer more susceptible to thermal degradation. Other papers deal with the hydrolysis of polyvinyl chloride and polyvinylidene chloride by water, the alkaline degradation of polyacrylonitrile and the oxygen absorption of olefins with structures similar to that of the synthetic rubber GR-S, and include information of industrial importance. Thus, the thermal oxidation of polythene is found to be an autocatalytic free radical chain mechanism subject to inhibition by antioxidants. Photo-oxidation is rapid and antioxidants are of little effect although the effect of light can be reduced by incorporation of opaque pigments.

A paper on the stabilisation of cellulose esters deals with degradation in cellulose ester—plasticiser systems. The plasticiser may, in thermal degradation, be more easily oxidised than the cellulose ester producing peroxides which induce polymer degradation. This may be inhibited by antioxidants. Severe but non-oxidative breakdown may occur if the plasticiser contains ferric salts but this can be reduced by suitable chelating agents. In photo-degradation oxygen plays a part but antioxidants are only effective if combined with an additive to filter out ultra-violet light. A review of the oxidative breakdown of ethyl cellulose suggests a peroxide catalysed chain mechanism, initiated at end groups and propagated by reaction on ethoxyl groups along the chain. Oxidation is catalysed by free radicals and exposure to ultra-violet light and inhibited by organic chain breakers.

The remaining papers are concerned with experimental studies of the degradation of polystyrene, polyethylene, copolymers and polyamides. These are of particular interest for the experimental methods used. Mass spectrometry is used in three cases as a means of analysing the products of degradation, and the degradation of polyamides has been studied by a wide range of physical methods.

The discussions following each paper are not the least interesting part of the book and in many cases are useful in relating laboratory studies and industrial conditions. Thus, while polyacrylonitrile in solution is rapidly degraded by alkali, the discussion points out that, in the solid form, polyacrylonitrile is among the more inert polymers in that respect. Most papers are well documented with references and the book provides an up-to-date and very useful survey of an important aspect of polymer chemistry. Both research and industrial polymer chemists will find much of interest.—W.R.M.

CHEMISTRY FOR OUR TIMES. By E. C. Weaver and L. S. Foster. 2nd Edition. McGraw Hill Book Co. Inc., London. 1954. Pp. 666. 30s.

The factors which determine the quality of the production of a scientific book always seem difficult to identify. Here we have an introductory primer which is bound more handsomely and printed on better paper than the majority of textbooks published recently, and yet, despite its size, at a price well below the average. One answer to the problem may be that it is a teaching book, intended to be sold in considerable numbers and to withstand the thumbing of generations of students. Whatever the reasons, its high standards are to be admired.

The text is divided into 10 'units,' each unit further subdivided into chapters (40 in all). A unit corresponds to some general aspect of chemistry such as carbon compounds, rocks, and minerals, or the heavy chemical industry. The 10 units do not constitute any course familiar in this country, but may best be described as an introduc-

tion to applied chemistry, suitable, in conjunction with similar expositions in companion sciences, for a general science course for sixth forms. In fact the book goes a considerable way beyond this in its attempt to give the student a picture of present day chemistry in relation to the community in which it is applied. The first unit introduces the subject in a style which from the speed of its cutting appears to derive from the film script, but this style is abandoned in favour of a more sober recording of facts in the later sections. The chemistry of air, hydrogen, and water is described in the second unit under the heading of 'Our Environment' together with the properties of gases. Formulae and equations are explained by analogy with modern business procedure and the reader is then rather unexpectedly introduced to electrochemistry and colloids. A brief survey of minerals and crystal structure follows in 'The Chemistry of the Earth's Crust.'

The unit dealing with the heavy chemical industry contains a short history of the periodic classification, and the subject of corrosion is introduced at the end of the unit upon metals. Organic chemistry occupies a further five chapters and the final two units consist of heterogeneous collections under the titles of 'Human Needs' and 'New Directions in Chemistry.' The first of these discusses such diverse topics as fibres, food, detergents and rocket fuels, while the second has chapters on radioactivity, photochemistry and the less familiar elements.

Some 15 film-strips are available from the publishers and may be used if desired to amplify the text, although it must be pointed out that they are not an integral part of the book which is itself copiously illustrated. The diagrams are very well drawn and where possible, as in the case of laboratory apparatus, they are perspective drawings rather than flat outlines. An appendix contains in addition to useful tables of constants a number of review questions: specific questions appear at the end of each chapter. There is a very complete glossary of terms and phrases. The book is not entirely free from fault; the writing is a little 'isolationist' in character, although this is probably unintentional. As an example, in the chapter dealing with the synthesis of nitric acid from the air, a process is mentioned in which air is passed over zirconia at 2,500° . . . 'a discovery made in our times at the University of Wisconsin.' No mention is made of the now obsolete Birkeland-Eyde process which operated under similar conditions using the electric arc. Similarly, in the description of sulphuric acid manufacture, the merits of the contact and lead chamber processes are discussed without reference to the root from anhydrite, which can now be considered as competitive. These are on the whole, however, minor faults in a serious attempt to convey to the student and to the layman the present position of chemistry.—J.R.M.

THE REVOLUTION OF PHYSICS. By Louis de Broglie. Routledge & Kegan Ltd., London. 1954. Pp. 310. 18s.

The author of this work has had a most distinguished career in the study of theoretical physics and at the early age of 37 was awarded the Nobel Prize in Physics. As he states in the introductory chapter, many potential readers will no doubt be discouraged by the sight of the mysterious word 'quanta.' These doubts have no doubt arisen in the past largely because so much of the quantum theory has been shrouded in rather formidable and complex mathematical expressions. The purpose of this book is to dispel these misgivings and to introduce the reader in a non-mathematical fashion to the quantum theory and wave mechanics.

The story begins with a general statement of the basic principles of classical physics and mechanics, and of the opinions on the nature of atoms and corpuscles held before the advent of the quantum theory. The theory of relativity is next discussed in simple terms since relativity and quanta are considered to be the two pillars of contemporary theoretical physics. The author then considers the difficulties that were found in interpreting the experimental and theoretical studies of black body radiation and that later led Planck to lay the foundations of the quantum theory. After a discussion of the ideas developed by Bohr on the structure of atoms and the limitations of these ideas in certain directions, the origins and fundamental ideas of wave mechanics and quantum mechanics are explained in a simple but detailed manner.

The book is reasonably priced and can be well recommended to physicists and chemists who do not find themselves able to derive much benefit from a study of other more advanced and mathematical treatises on the quantum theory.—G.S.E.

• HOME •

Paraffin Wax Prices

Increases in some of the ex store/works prices of paraffin wax and scale, operative from 5 July, are announced by Shell-Mex & B.P. Ltd. The new prices of category 'A' Scotch waxes are: ex-store, London, Liverpool and Manchester, minimum one ton lots, £78 10s. (grade, melting point 110/115° F.) to £81 10s. (125/130° F.); ex works, Pumpherston, £76 (100/105° F.) to £79 (125/130° F.). Category 'B,' other qualities, minimum one ton lots, £82 10s. (125/130° F.) to £100 12s. 6d. (150/170° F.); smaller quantities, from £83 5s. to £101 7s. 6d., according to melting point. Scale, minimum one ton lots, £71 7s. 6d.; smaller quantities £72 2s. 6d.

Food Advisory Committee's Abolition

Following the abolition of food rationing, the Food Rationing (Special Diets) Advisory Committee of the Medical Research Council has been dissolved. This body was set up in 1940 by the Medical Research Council at the request of the Ministry of Food, the Ministry of Health and the Department of Health for Scotland, to advise from time to time on the question whether it was necessary on medical grounds to modify or supplement rations in the case of invalids or other persons on special diets.

Mutual Marketing Arrangements

Arrangements for mutual marketing of the Foxboro d/p cell and the Kent oxygen analyser in the United Kingdom are announced by George Kent Ltd. and Foxboro-Yoxall Ltd. Foxboro selling of the Kent oxygen analyser may later be expanded to the United States.

Science and Small Trades

New methods of introducing scientific knowledge and practice into the smaller industries are to be investigated shortly by the Scottish Council (Development and Industry). A team of experts are to undertake a series of visits to a selected cross-section of Scottish firms.

Dunlop Donations

Dunlop have sent donations of £25 to the Air League of the British Empire and to the Conference of the International Law Association in Edinburgh next month; and one of £50 to the Royal Empire Society.

Thermometer Standard

The British Standard for incubator, water bath and oven thermometers for laboratory use (BS. 619) was first published in 1935 and has now been revised and brought into line with other recent British Standards for thermometers. Four mercury-in-glass solid-stem thermometers are specified with ranges 20° to 60°, 30° to 75°, 65° to 125° and 115° to 180°. The thermometers are designed to enable the scales to be read to about ± 0.1°, and the usual details are given for material, dimensions, constructional details, graduation, figuring and permissible errors. Copies of this British Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 2s. 6d.

Chinese Merchants Visit

Eleven trade delegates from China paid a two-day visit to Manchester recently to inspect a textile machinery works, a chemical works and a factory making food-handling plant. The party later left for a 24-hour visit to Birmingham. In April a letter inquiring about trade possibilities was sent to the Chinese Government on behalf of the Federation of British Industries, the China Association and the London Chamber of Commerce. Early in May the Chinese asked for a visit to be arranged for them, and expressed particular interest in such products as building materials, pre-fabricated building units, pharmaceutical and chemical products, textile raw materials and those chemical and scientific instruments not subject to embargo.

Fumes Near Sea Front

A notice of motion calling for an investigation into the possible effect of fumes, alleged to come from chemical works near the seafront, was submitted at Aberdeen Town Council on 5 July. The question arose following a complaint that a belt of trees planted on the Queen's Links to screen industrial premises had died.

Power Board's Peat Scheme

A start has been made with the preliminary work on the North of Scotland Hydro-Electric Board's peat utilisation scheme at Altnabreac estimated to cost about £500,000.

• OVERSEAS •

Drilling Rights in Alberta

The Alberta Government has received more than $1,500,000 in its first sale of 'drilling reservations' of petroleum and natural gas rights on six tracts in central and southern Alberta.

Argentine Import Licences

Chemicals, refractory materials, abrasives and glass are among the goods for which the Argentine Central Bank have granted import licences to the value of 73,000,000 pesos, from the UK, Denmark, France, Sweden, Japan, Austria, Italy, Switzerland and Finland.

Oil Refinery for Puerto Rico

An aggregate of $24,500,000 is to be used by the Commonwealth Oil Refining Company for the construction and initial operating requirements of a modern oil refinery on Guayanilla Bay, Puerto Rico, which is expected to refine a minimum of 21,770 barrels daily of crude oil.

US Cadmium Expansion

Most significant development in cadmium in the United States last year was the expansion in many segments of the industry. A Bureau of Mines report states that records were established in total supply, production, imports of metal, consumption and stocks.

New FOA Allocations for Israel

The Foreign Operations Administration has announced authorisations for Israel covering $820,000 worth of commodities. This figure includes $36,000 worth of chemicals and chemical preparations, $40,000 worth of industrial chemicals, $600,000 worth of nylon, cotton yarn and cotton fabrics, and $13,000 worth of construction and mining equipment.

Du Pont Research Centre in Canada

Disclosing its first major programme, the recently introduced Du Pont Company of Canada states that a large new research centre is to be built on a 25-acre site next door to its nylon-spinning plant at Kingston, Ontario. This year Du Pont will start construction of the first building of the centre at a cost of $1,500,000. Over the next ten years or so it is envisaged that another four units will be built.

US Sulphur Production in April

The United States domestic sulphur industry produced 445,168 long tons of native sulphur and 31,000 tons of recovered sulphur (of a purity of 97 per cent or greater) during April, according to reports of producers to the US Bureau of Mines. Producers' stocks of native sulphur decreased and at the end of April stood at 3,190,438 tons.

MCA Membership Now 151

Two more firms, both from the Chicago area, have joined the Manufacturing Chemists' Association. Admission of these companies brings MCA's total membership to 151, of which 148 are American and three are Canadian firms. The MCA represents more than 90 per cent of the United States chemical industry.

8,000 Tons Salt Deposit

Something like 8,000 tons of salt are deposited over an area of about 90 acres in five concentrating ponds at the Dominion Salt Company's undertaking at Lake Grassmere, New Zealand, a few miles from Blenheim in the South Island, where unusually favourable conditions for evaporation over the past few months have made possible an unexpected harvest this season.

Phosphates in Israel

Within three years, a calcinated phosphates industry, capable of producing 600,000 tons a year, will be set up in the Negev, Israel, Dr. Dov Joseph, Minister of Development declared at the recently held convention of the Manufacturers' Association.

US Narcotics Laboratory

For some years the possibility has been considered of setting up a United Nations laboratory to replace the laboratory facilities which have been made available to the Secretariat chemists by the United States authorities. The Commission has now proposed that the Council recommend to the General Assembly that a UN laboratory be established to enable the Secretary-General to implement the research programme, and more particularly to develop methods to determine the geographical origin of seized opium.

• PERSONAL •

As a move to expand the application by British industry of the results of research from the National Physical Laboratory, Sir Edward Bullard, the director, has appointed MR. E. I. BRIMELOW and MR. A. J. GARRATT as liaison officers to work with industry. Mr. Brimelow is a metallurgical engineer, and an honours graduate of Liverpool University. After two years in industry as a metallurgist and research and development manager he joined in 1949 the chief scientific adviser's division of the Ministry of Works where he remained until transferred to the Building Research Station in 1950. He has also served on various technical committees of the British Standards Institution and on advisory committees of the Ministry of Supply. Mr. Garratt is a physicist and an honours graduate of London University. He was in the Civil Service from 1940 to 1951, first with the Ministry of Supply Armament Research Establishment and later with the Festival of Britain Office as staff physicist.

SIR WILLIAM OGG is to continue as president of the Society of Chemical Industry for a further year. He is director of Rothamsted Experimental Station, Harpenden, Herts, and consultant director of the Commonwealth Bureau of Soil Science.

MR. GEORGE HEYWOOD has relinquished the chairmanship of the United Indigo and Chemical Company, Manchester, and has retired from the directorate. MR. JAMES BRUNDRET has been appointed chairman.

New president of the Society of Dyers and Colourists is MR. FRED SMITH, chairman of William Smith & Co. Ltd., of Cliffe Dyeworks, Bruntcliffe, near Leeds. Mr. Smith, who succeeds the late Mr. F. L. Goodall, has served the society for over 40 years. From 1939 he was chairman of the West Riding section of the society for seven years and vice-president of the society for ten years.

MR. M. LANGSTRETH, who has been general manager of the Dunlop Cotton Mills since 1948 and has had 40 years' service with the company, has, on account of ill health, expressed the wish to have his responsibilities lightened and will retire next year.

MR. J. WRIGHT, director and general manager of the Dunlop Rim and Wheel Co. Ltd., Coventry, has been appointed a director of the Dunlop Rubber Co. Ltd. For the present he will continue his executive duties from Coventry.

The Court of the Salters' Company has elected MR. G. HETHERINGTON to be a Salters' fellow for the year 1954-55 and has extended the fellowship held by MR. P. P. MANNING for a second year. The following have been elected Salters' scholars for 1954-55: MR. C. P. BROWN (Nottingham University), MR. M. MCLEMAN (Imperial College, London), MR. A. D. SHIPMAN (Bristol University), MR. H. SPOEL (Oxford University), and MR. W. L. WILKINSON (Cambridge University). Mr. Manning held a Salters' fellowship during 1953-54, while carrying out research work in the chemistry department, Leeds University, on chemical kinetics of cyclic monomers forming linear polymers, and theoretical studies on the polymerisation of olefines. Mr. Hetherington, who held a Salters' scholarship during 1953-54, has been working in the chemistry department at King's College, Newcastle-upon-Tyne, on the chemistry of nitrosyl fluoride.

Durham University last week announced the appointments of DR. J. BADDILEY as professor of organic chemistry, and MR. G. R. MARTIN as reader in radio-chemistry. Dr. Baddiley, who is aged 36, is on the staff of the Lister Institute of Preventive Medicine, and will take up his new post in the Newcastle Division of the University at the beginning of next year. In 1947 he was awarded the Meldola Medal by the Royal Institute of Chemistry and last year was awarded the Corday-Morgan Medal and prize by the Chemical Society. Mr. Martin, who is aged 34, is lecturer in radio-chemistry at the University. His new appointment in the Durham Division is from 1 October. He was research assistant at Durham to atom scientist Dr. F. A. Paneth, former professor of chemistry at the University, and in 1942 he went to the Cavendish Laboratory, Cambridge, where he worked on problems related to the military applications of nuclear energy.

MR. F. C. BAGNALL, managing director of British Nylon Spinners Ltd., and MR. ALBERT HEALEY, director of Dunlop Co. Ltd., are among members of a committee which has been set up by the Government to hold an independent inquiry into the organisation and efficiency of the nationalised electricity supply industry of England and Wales and make recommendations.

Jenolite Ltd. have appointed MR. J. S. ARMSTRONG to be marine representative for their technical department at 13-15 Rathbone Street, London, W.1. Mr. Armstrong, who was for eleven years a chief officer in the Merchant Navy, will be specifically engaged as a consultant to the industry on all matters relating to marine corrosion and its cure.

The Ramsay Memorial Fellowships Trustees have made the following awards of new fellowships in chemistry for 1954-55: MR. J. R. ANDERSON, a British fellowship at the University of Cambridge; MR. G. A. SIM, a Glasgow fellowship; DR. J. A. DAVIES, a Canadian fellowship at the University of Leeds; MONSIEUR GEORGES MORALLI, a French fellowship at King's College, Newcastle-upon-Tyne; DR. CASIANO ALFONSO, a Spanish fellowship at the University of Birmingham; DR. HANS JUCKER, a Swiss fellowship at King's College, London; DR. O. R. RODIG, a United States fellowship at the University of Manchester. The trustees have renewed the following fellowships for the same year: MR. G. T. ROGERS (British fellowship) at the University of Cambridge; DR. K. SAITO (Japanese fellowship), University College, London; MR. W. G. HANGER (New Zealand fellowship), the University of Cambridge; MR. SANTOS AMER (Spanish fellowship) the University of Cambridge; MR. R. H. DOREMUS (United States fellowship), the University of Cambridge.

Appointment of DR. AUGUSTUS B. KINZEL as director of research, Union Carbide and Carbon Corporation, effective 1 July, has been announced by DR. GEORGE O. CURME, JR., vice-president (research). In his new capacity Dr. Kinzel will be responsible for the administration and co-ordination of the research activities of all divisions of Union Carbide. He has been actively engaged in research work with Union Carbide and Carbon Corporation since 1926.

MR. R. H. BINGHAM has resigned from the board of Huntington, Heberlein & Co. Ltd. with effect from 30 June after 44 years' service with the company. Joining in 1910, he was appointed a director in 1919 and had been in charge of the sintering and furnace section of the business since 1926. MR. S. ROBSON and MR. R. B. SHARP have joined the board with effect from 1 July.

MR. FREDDIE CHARNOCK, first assistant to Dunlop's divisional manager for Africa and the Middle East, is retiring after 40 years with the company.

MR. W. G. COWAN, of J. H. Carruthers & Co. Ltd., 27 Hamilton Street, Glasgow, has been appointed a member of the Glasgow and West District Committee of the Scottish Gas Consultative Council.

MR. A. HASLAM WOOD, of Barnsley, has been appointed chairman of the East Midlands Gas Consultative Council. Mr. Haslem Wood is chairman and managing director of Wood Bros. Glass Company Ltd., Barnsley, and is well known in the glass manufacturing industry.

Wills

MR. FRED WILKINSON, chairman and managing director of J. B. Wilkinson (Chemicals) Ltd., left £37,560.

Obituary

DR. JOHN THEODORE HEWITT, who was killed in a road accident at Reading on 9 July, was 82. A Fellow of Queen Mary College, London, he worked during the first world war for the Ministry of Munitions, and was later awarded the O.B.E.

Chemical Pulp Import Licences

No assurances had been given to Courtaulds Ltd. that they would be granted import licences for the extra amount of chemical pulp that would be required following their building of a new rayon staple fibre unit on the Humber to produce 100,000,000 lb. weight annually, Mr. D. Heathcoat Amery, Minister of State, told the Commons last week at question time. He had no doubt, however, he said, that any application would be considered as sympathetically as our balance of payments position at the time permitted.

Publications & Announcements

APRIL issue has just been published of Philips Technical Review, which deals with technical problems relating to the products, processes and investigations of the Philips Industries. Articles published in the issue include 'A Cold Cathode Gas-Discharge Tube as a Switching Element in Automatic Telephony,' by J. Domburg and W. Six; 'Radio-Controlled Models' by A. H. Bruinsma; and 'Lattice Imperfections and Plastic Deformation in Metals; Behaviour of Lattice Imperfections During Deformation' by H. G. van Bueren.

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INTERESTING facts behind the story of Benjamin R. Vickers and Sons Ltd., manufacturers of technical oils for wool, silk, cotton and rayon, of 5 Grosvenor Road, Hyde Park, Leeds, are revealed in an attractive booklet with the title of 'This Family Business,' produced to commemorate the firm's 125th year of operations. The business began on 1 May, 1828, when Benjamin Randall Vickers, grandfather of W. Farrar Vickers, the present managing director and author of the booklet, established himself as an agent in oils and soaps. On 24 May, 1830, he made his first transaction on his own account—a transaction in olive oil. The story unfolds the early problems of the founders, the enterprise shown in the general development and a realisation of Divine guidance in all that was undertaken. The booklet is illustrated with photographs and painting reproductions of personalities associated with the firm, while there is also an interesting facsimile reproduction of the first handwritten record of the company. At the end there is a family tree which shows the relationship of many of the people in the story.

* * *

THE ninth annual report of the British Welding Research Association announces that as a result of a special grant from Mutual Security Aid funds, the Association has been able to purchase in the US a Sciaky 3-phase spot welding machine and a Baldwin-Tate-Emery 400,000 lb. universal testing machine, additional equipment which will appreciably augment the facilities available at the research station at Abington. During the year, says the report, thirty-four research reports were issued to members—an increase of nearly 50 per cent on the previous best figure—and arrangements have been made for publication of some of the results of the researches in the new monthly *British Welding Journal* which is being sent to all members. This year, for the first time, the Association's income exceeded £100,000; membership now includes 320 organisations, many of them group members, and the mailing list for research reports and other publicatons was well past the 1,000 mark.

* * *

GERMANY is steadily increasing its share in world trade at a much greater rate than the United Kingdom. If the present volume of investment and savings in Germany is maintained it is almost certain that in the immediate future German industrial expansion will continue faster than that of the UK. Consequently, Germany will have a greater opportunity of reducing the market prices of its products. These and other points in the complex question of international trading are examined in 'Competition From Germany,' a new pamphlet published by Political and Economic Planning, of 16 Queen Anne's Gate, London, S.W.1. It is pointed out that the success of British goods in the North American market shows that once an effort is made to adapt goods to suit a particular market, and then to sell them there, Britain can be as successful as its competitors.

* * *

DETAILS of their range of products comprising wool grease and wool grease derivatives for technical and industrial purposes are described in a new leaflet issued by Croda Ltd., of Snaith, Goole, Yorks.

* * *

'LAUNDRIES and Laundry Requisites 1954,' published by Anglo-Scottish Press Ltd., provides a mine of information for those engaged in this industry. The first part of the publication is designed to be a buyers' guide for the launderer, dyer and cleaner, supplying as it does, the names, addresses and telephone numbers of a large number of firms under the type of products and services they provide. In the second part is given a directory of laundries broken down under counties and towns. The directory sells at 7s. 6d.

ACTIVITIES carried on at the Anglo-Iranian Oil Company's main research centre at Sunbury-on-Thames, Middlesex, are described in a new illustrated booklet, 'Research at Sunbury,' which has been produced by the company. From its earliest days this enterprise has been keenly aware of the importance of research, and the buildings at Sunbury, which cover 19 acres and employ over 600 men and women, are equipped to investigate every kind of problem relating to petroleum, ranging from the testing of oil-heated chicken brooders and the breeding of flies for the evaluation of insecticides, to the development of new processes and refinery units by elaborate pilot plant tests. Copies of 'Research at Sunbury' are obtainable from the General Department, Anglo-Iranian Oil Co. Ltd., Britannic House, Finsbury Circus, London, E.C.2.

* * *

ARISING from complaints from members in connection with advertisements inserted in localised media such as guide books, catalogues, programmes, shopping and entertainment guides, the Advertising Association have issued a pamphlet designed to assist advertisers and advertising agents in placing contracts so as to avoid being caught by unscrupulous publishers.

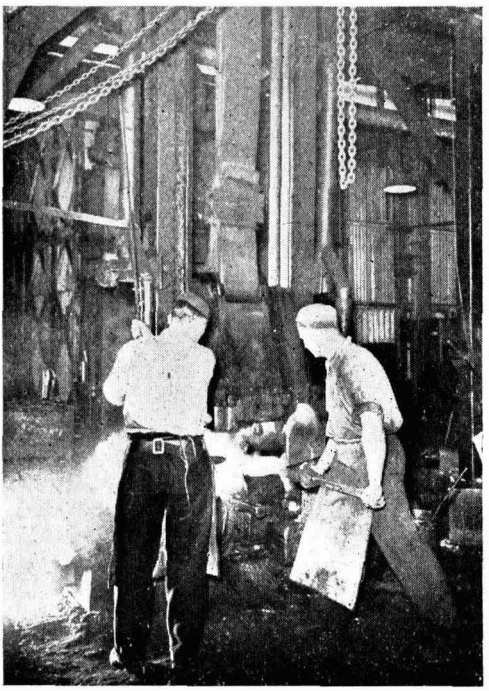
* * *

A HANDY little volume, 'What Every Engineer Should Know About Rubber' by W. J. S. Naunton, consultant on rubber and plastics to the Admiralty, has been published by the Rubber Development Board, of Market Buildings, Mark Lane, London, E.C.3, at 3s. 6d. In the course of preparing material for the book the author, who was formerly in charge of the rubber laboratories of the Imperial Chemical Industries Ltd., made many contacts with engineers which have enabled him to view the subject from the point of view of the engineer who wants to incorporate rubber in his designs. Over half the book is devoted to the specific engineering uses of rubber, while the remainder covers the sources, properties, manufacture and testing of rubber. A chapter on manufacture has been included to enable the engineer to take an intelligent interest in the material.

* * *

JUNE issue of the Bulletin of the British Whiting Research Laboratories has been published by the Research Council of the British Whiting Federation.

DROP stamp belting made from nylon is now being widely used in drop forges in this country. In some it has almost completely superseded hair belts and it seems that it will be only a matter of time before it is adopted universally.



In drop forges where it is being used extensively it has been found that operating efficiency has increased, that costs have come down and that the loss of valuable production time has been considerably reduced. One belt, for example, which was fitted to a 4-cwt. stamp was still in use after four years. It was calculated that during that time it had made a total of 14,400,000 lifts and had raised a total weight of 2,800,000 tons.

Normally a nylon belt can be expected to last about three times as long as a hair belt. As the nylon belt is frequently smaller than the hair belt it replaces it is difficult to make any accurate comparison of the initial cost, although on average nylon is probably slightly more expensive. But this is more than offset by the much longer life of the nylon belt. In addition, production is increased and wasted time is reduced because the belts do not have to be replaced so frequently.

Law & Company News

Commercial Intelligence

Mortgages & Charges

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

BUGGES INSECTICIDES LTD. (formerly INSECTICIDES LTD.). Sittingbourne. 3 June, debenture to Barclays Bank Ltd. securing all moneys due or to become due to the bank; general charge. *Nil. 12 August, 1953.

W. M. DELF (LIVERPOOL) LTD., soap manufacturers, etc. 9 June, £3,000 mortgage, to W. M. Delf, Birkenhead; charged on Delca Works, 130/132 Rice Lane, Liverpool. *Nil. 5 June, 1953.

Satisfactions

CHANCE BROTHERS LTD., Smethwick, glass manufacturers. Satisfaction, 2 June, of charge registered 29 September, 1952, to the extent of £1,450 (24 Baronald Drive, Kelvindale, Glasgow, having been released from the charge).

JENCONS (SCIENTIFIC) LTD., London, E.C., laboratory furnishers, etc. 8 June, of debenture registered 5 August, 1948.

Increases of Capital

The following increases of capital have been announced: EDWARD CHARLES & CO. LTD., from £10,000 to £44,000; L. DENNIS & CO. LTD., from £45,000 to £95,000; MURGATROYD'S SALT & CHEMICAL CO. LTD., from £150,00 to £1,197,000; HELLE VAN DER BRACHT LTD., from £2,500 to £10,000; ROBINSON BROTHERS LTD, from £250,000 to £350,000.

New Registrations

Hughes & Hughes Ltd.

Private company. (535,258.) Capital £12,500. To acquire the business of chemical and colour merchants and consultants carried on by Hughes & Hughes Ltd. (in voluntary liquidation), etc. The first directors are to be appointed by the subscribers.

Hughes & Hughes (Consultants) Ltd.

Private company. (535,259.) Capital £100. To acquire the business of consultants to the chemical, colour, mineral, metal and allied trades, being part of the business previously carried on by Hughes & Hughes Ltd. (in voluntary liquidation), etc. Particulars are similar to Hughes and Hughes Ltd. (q.v.).

Smith & Thorpe (Chemists) Ltd.

Private company. (535,336.) Capital £10,000. Consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors. John M. Smith and Basil C. Thorpe. Reg. office: 127 Killinghall Road, Bradford.

Jones-Clarke Ltd.

Private company. (535,230.) Capital £100. Manufacturing, research, dispensing and analytical chemists and druggists, etc. The first directors are to be appointed by the subscribers. Reg. office: 32 Shaftesbury Avenue, London, W.1.

Roderick Smith Ltd.

Private company. (30,064.) Capital £3,000. Manufacturers, exporters and importers of and dealers in medicines, drugs and proprietary articles of all kinds, etc. Directors: R. Smith, Mrs. C. A. Matheson, J. Macdonald. Reg. office: 50 Point Street, Stornoway.

Drodor-X Hygiene Services (Southern) Ltd.

Private company. (534,134.) Capital £1,000. Sellers of hygiene or other fumigating and disinfecting products, etc. Directors: Robert A. Chandler, Frank L. Coventry, Edward B. Monkhouse, James H. Chandler and Wm. P. Sweeney. Reg. office: 309 Corporation Road, Birkenhead.

Mayhew, Baker & Co. Ltd.

Private company. (534,107.) Capital £100. Manufacturers of and dealers in salt, soda, solvents, soaps, detergents, etc. The first directors are not named. Solicitors: Clifford-Turner & Co., 11 Old Jewry, E.C.2.

Praignex Developments Ltd.

Private company. (534,064.) Capital £500. Invention, research, inquiry, development and production of chemical disinfectants, deodorisers, toilet, hygienic and other goods, etc. The first directors are not named. Solicitors: Stanley Attenborough & Co., 30 Clarges Street, London, W.1.

Cookson Produce and Chemical Company (Fertilisers) Ltd.

Private company. (534,191.) Capital £10,000. Merchants, importers and exporters of, wholesale and dealers in and manufacturers of fertilisers and manures of all kinds, etc. The first directors are to be appointed by the subscribers. Solicitors: C. G. Metson & Co., 58 Mark Lane, E.C.3.

Geddes Laboratories Ltd.

Private company. (534,316.) Capital £1,000. To acquire the business of a manufacturer of pharmaceutical substances carried on by John Geddes, at 380 Norwood Road, West Norwood, S.E. Directors: John Geddes and Mrs. Doris E. Geddes.

Labways Ltd.

Private company. (30,092.) Capital £10,000. Analytical, research and advisory chemists, etc. Subscribers: Kenneth R. Grimston and John K. Finlayson, 15 Hill Street, Edinburgh. First directors are to be appointed by the subscribers.

Kingswood (Chemists) Ltd.

Private company. (534,379.) Capital £1,000. Chemists, manufacturers of and dealers in chemicals, bleaching powders and liquids, gases, drugs, medicines, etc. Directors: Charles V. McManus and Ronald M. Betts. Solicitors: Wilberforce Jackson & Co., Crowdon.

Aliamaid Products Ltd.

Private company. (534,003.) Capital £500. Manufacturers, importers and exporters of, agents for wholesale and retail dealers in proprietary medicines, emulsions, drugs, chemicals, etc. Directors: Harvey D. Martin and Alice M. Jones. Registered office: 1 Museum Place, Cardiff.

Szego Technical Services Ltd.

Private company. (534,781.) Capital £100. Technical advisers in all types of metallurgical, chemical, electrical, mechanical and constructional and engineering affairs, etc. Directors: Mark Van Der Borgh, Frank W. Shilstone, Robert S. Oliver, William A. Wales and Lazlo Szego. Reg. office: 30 St. George Street, W.1.

Agricultural Chemicals (Midlands) Ltd.

Private company. (535,112.) Capital £100. Agricultural merchants, manufacturers of and dealers in artificial manures, manurial products and fertilisers, etc. Directors: Wm. R. R. Lucas, Rosemary J. Lucas and Peter A. R. Ward. Reg. office: 'The Elms,' Priors Marston, near Rugby.

Industrial Dyestuffs Ltd.

Private company. (534,832.) Capital £25,000. Agents and brokers of and wholesale and retail dealers in dyes, dyestuffs, chemicals, drugs, paints, varnishes, colours, industrial, pharmaceutical and other preparations, natural and chemical fertilisers, tanning materials, etc. Directors: Fredk. Hindshaw, Herbert M. Lester, Wilfred Astles and Arthur J. Gemmill. Reg. office: 94 Market Street, Manchester 1.

Marfleet Refining Co. Ltd.

Private company. (535,007.) Capital £100. Manufacturers, crushers, producers, distillers of and dealers in animal foods and feeding stuffs; manufacturers of and dealers in all kinds of by-products arising from the manufacture or treatment of any of the above products, including fuels of all kinds, fertilisers, meals, oils, manures and feeding stuffs, oil merchants, blenders, purifiers, separators and refiners, manufacturers of greases, lubricants, glues, gelatine and size, varnish makers, coal, salt and hide merchants, etc. Directors: Graham Hillyer and Charles P. Hudson. Reg. office: St. Andrews Dock, Hull.

Wm. J. MacNab & Co. Ltd.

Private company. (N.I. 3,371.) Capital £10,000. To acquire the business of Wm. J. Macnab carried on at 76/8 Donegall Pass., Belfast; and to carry on the business of merchants, drysalters, and dealers in all kinds of chemicals and dyestuffs, etc. Directors: Wm. J. Macnab, Mrs. Annie Macnab and Peter F. Macnab.

Company News

Schimmel Boehm Ltd.

Schimmel & Co. Inc. of New York and Fredk. Boehm Ltd., of London, announce the formation of a new company to be known as Schimmel Boehm Ltd. This company will combine the aromatic business of Boehm with the production in the United Kingdom of Schimmel specialities, for sale in the UK and the Commonwealth, and to areas where it may from time to time be advantageous to transact business in sterling.

The firm of Schimmel originated in Leipzig and has for many years been a supplier of essential oils, perfume bases, aromatic chemicals and flavours.

Schimmel & Co. Inc. has been established in America since the early 1930's and became an independent company at the beginning of

the second world war. It is controlled by Mr. Gert Keller, as president, who has recently been joined by Dr. Keller, previously in charge of the Leipzig technical operations, and who now heads the research for the group.

The new company will be administered from 19 Bentinck Street, and Mr. J. A. Clark, formerly Boehm's aromatic sales manager, will control the buying of raw materials and the sales staff.

Eventually it is planned to offer the whole Schimmel range, but this undertaking may take some little time to complete. However, operations will commence in August and the new company will be in a position to deal with inquiries for Schimmel materials. It is stated that the new company will continue to act as merchants for essential oils and will handle the Schimmel American oils, including their range of peppermint, spearmint, orange and grapefruit.

William Walker & Sons Ltd.

William Walker & Sons Ltd., the Bolton tanners and curriers, have acquired through a subsidiary the business of Arthur Ashworth Ltd., chemical manufacturers, of Bury. Ashworth's was one of the first companies to make formaldehyde commercially in Britain, and steps are already being taken to enlarge the production of this material and chemicals derived from it.

Evans Medical Supplies Ltd.

Evans Medical Australia (Pty.) Ltd. has been formed to develop Evans Medical's interests in Australia which up to the present have been the responsibility of a branch of the parent company. Mr. J. A. Davies, who was manager of the branch, has been appointed managing director of the new company. The head office of Evans Medical Australia (Pty.) Ltd. is in Sydney and there is a branch office in Melbourne.

British Glues & Chemicals Ltd.

A final dividend of 15 per cent, making 20 per cent for the year to 31 March, compared with 15 per cent for the previous 11 months, is announced by British Glues & Chemicals Ltd. Group profit, including £24,000 from deferred repairs provision, but before tax, amounted to £676,896, against £243,424, for the previous 11 months. A free scrip issue is also proposed in the proportion of two 4s. ordinary shares for every £ ordinary stock held, with the preference shareholders also receiving two ordinary shares of 4s. each for every £3 of relinquishments of participating rights.

British Titan Products Ltd.

The accounts of British Titan Products Ltd. for the year 1953 show group trading profits of £2,257,539, against £1,179,596 for the previous year. After various deductions the net profits are given as £604,768, against £499,995.

Commercial Plastics Ltd.

A group trading profit of £219,034, against £129,291 for the previous year, is shown in the accounts of Commercial Plastics Ltd., for the year ended 31 March, 1954. Dividends, including 30 per cent—interim 10 per cent and a final of 20 per cent—on ordinary stock, absorbed £25,782.

Market Reports

LONDON.—A steady demand is reported from all sections of the chemicals market and deliveries to the chief consuming industries are well maintained, with the call for export continuing at recent levels. The supply position is fairly easy although a few items are a little tight for prompt delivery. Mercury is reported to be 50s. per flask dearer, otherwise chemical prices show little variation and the basis prices of the lead compounds are unaltered. The coal tar products market is without new feature, and many items are still in short supply.

MANCHESTER.—Traders on the Manchester chemical market during the past week have reported a steady movement of contract supplies of the soda and potash compounds, as well as a wide range of other products, to the textile and allied trades and other leading outlets. Replacement buying is going on steadily as the need arises. Only minor changes in the general price position have occurred since last report. A quiet business in fertilisers at early delivery quotations has been arranged. A continued good demand for most of the by-products has been reported.

GLASGOW.—Business generally is still inclined to be on the quiet side, especially for spot deliveries, although during the past week considerable tonnage has been placed for forward delivery. On the whole conditions are more or less what is expected at this time of the year. Prices have been firm with a marked tightening on products which are at the moment in short supply.

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.

AN EXPERIMENTAL OFFICER is required at the **ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKSHIRE,** to develop and supervise a microchemical laboratory engaged on quantitative analysis of organic compounds by microcombustion techniques. Experience in inorganic spectroscopic analysis would be an advantage. Applicants should have a Higher School Certificate (Science) or equivalent qualification and should be at least 26 years of age.

The salary range (male) is £690 to £850 per annum. Houses available within a reasonable period for married staff who live outside the Establishment's transport facilities. Application form from **ADMIN. OFFICER (RECRUITMENT), A.W.R.E., ALDERMASTON, BERKSHIRE,** Quote Ref. 170/W.G.E./38.

CHEMIST with honours degree required for research into component wear problems using radio-active methods and also other allied investigations. The position is most suitable for a young graduate without previous industrial experience, but who has a genuine interest in research of this nature. Please reply, stating age, qualifications and experience, to Personnel Manager, **JOSEPH LUCAS (ELECTRICAL) LTD., GREAT KING STREET, BIRMINGHAM,** quoting reference PM/D/17.

CHEMIST/ANALYST, with knowledge of modern methods of Inorganic and Organic Analysis, required by N.W. London Fine Chemical Manufacturers. Permanent pensionable position for right applicant, who should hold degree or equivalent. Particulars age, education, experience and salary to **BOX No. C.A. 3339, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

UNITED COKE AND CHEMICALS COMPANY LTD., producers of organic chemicals from coal, require two experienced **CHEMICAL SALESMEN,** aged 28-35. Honours degree essential, preferably in chemistry. Special knowledge of coal tar chemicals or plastics, paint or synthetic resin industries an advantage. Salary £800-£1,100 depending on qualifications and experience. Pension scheme. Reply, giving details of education, qualifications and experience, to the **COMMERCIAL MANAGER, 34, COLLEGIATE CRESCENT, SHEFFIELD, 10.**

TRANSPARENT PAPER LIMITED requires the services of **SHIFT CHEMISTS.** Candidates should have been trained to at least National Certificate in Chemistry, and any other experience in the field of cellulose chemistry would be an advantage. The work covers a continuous process manufacturing and converting regenerated cellulose film. Salary in accordance with qualifications and ability, and there is scope for further advancement.

Apply in writing or person to the **PERSONNEL OFFICER, BRIDGE HALL MILLS, BURY, LANCS.**

SITUATION VACANT

UNITED COKE AND CHEMICALS COMPANY LTD., producers of organic chemicals from coal, require a **TECHNICAL ASSISTANT TO THE COMMERCIAL MANAGER.** His duties will include market research and technical liaison with research and works departments and he should have practical experience of sales or development or market survey work involving visits to outside firms on his own. Age preferred 28-35. Honours degree in chemistry essential. Salary £800-£1,100 depending on qualifications and experience. Pension scheme. Reply, giving details of education, qualifications and experience, to the **COMMERCIAL MANAGER, 34, COLLEGIATE CRESCENT, SHEFFIELD, 10.**

FOR SALE

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

GILLED STEEL STEAM TUBING—3 in. O./D., 3,000 ft. **"JUNIOR" MIRACLE MILL AND CYCLONE.** 36 in. and 30 in. diam. **WALL-TYPE VENTILATING FANS**—230-volt, 1-phase.
KIMMINS & SONS, LTD., LYNDHURST ROAD, WORTHING

JOURNALS AND PERIODICALS in sets and back files bought and sold. American, British, Foreign—Chemical Scientific, Technical. Large stock. Catalogues issued. **J. S. CANNER, INC., BOSTON, 19, MASS., U.S.A**

ONE TORRANCE MICRO TWIN-ROLLER MILL. Cast rolls, 14 in. by 8 in. Water cooled. Fast and loose pulley-drive.
TWO DE LAVAL SEPARATORS, VEE-BELT DRIVE. Good condition.
THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET, LONDON E.14. TEL. EAST 1844.

SACK AND BAG MERCHANTS AND MANUFACTURERS. New and reconditioned for Home and Export. (Use **JUTEX** for sack repairing). **ALTRINCHAM JUTE LTD., WRIGHT STREET, BROADHEATH, ALTRINCHAM, CHESHIRE.** ALTrincham 4360.

FOR SALE

9—VERTICAL CYLINDRICAL MIXING VESSELS Heavy Cast Iron—1¼ in. thick, complete with Belt Driven Stirring Gear with Stainless Steel Paddles. Size of Vessels 6 ft. diam. by 6 ft. 9 in. deep.

10—SETS STIRRING GEAR STAINLESS STEEL PADDLES to suit Vessels similar to above.
Inspection by arrangement.

MADEN & McKEE LTD., 317, PRESCOT ROAD, LIVERPOOL, 13.

FOR SALE

MORTON, SON AND WARD, LIMITED,
offer
MIXERS

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

Three Tilting Trough **MIXERS**—25g., 50g., 100g., by **RICHMOND & CHANDLER**—double "Z" blades, with or without jackets. Stainless steel interior pans if required.

50g., 75g., 100g. Heavy Duty **MIXERS** by **FALLOWS & BATES.** Agitators driven through bevel gears from fast and loose pulleys.

3-cwt. Trough **MIXERS** by **CHALMERS and GARDNER**—stainless steel lined troughs.

JACKETED PANS

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

200g. Stainless Steel Jacketed **PAN** and One Jacketed **AUTOCLAVE,** with detachable cover, 150 lb. in jacket.

PUMPS

A selection of **MONO** and other **PUMPS** in stock, 2 in. to 5 in. New and second-hand.

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

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6 BRAND NEW Jacketed STERILIZING VESSELS—7 ft. long by 3 ft. diam., complete with fittings.

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

8—Worssam ROTARY PRESSES.

POWDER DRESSING OR SIFTING MACHINES.

1—Johnson FILTER PRESS—47 plates, 32 in. sq.

1—Johnson FILTER PRESS—30 plates, 25 in. sq.

Wood FILTER PRESS—69 plates, 2 ft. 8 in. sq.

24 in., 30 in. and 36 in. HYDRO EXTRACTORS.

Heavy Cake CRUSHING MILL—2-pair high, by Nicholson.

2—No. 4 MIRACLE MILLS.

1—BALL MILL, 3 ft. long by 4 ft. diam.

3—5-roll REFINERS by Baker Perkins.

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

2—Excellent Nickel-lined Jacketed TILTING PANS.

5—Excellent Porcelain DISC MILLS.

1—Very Fine GARDNER SIFTER and MIXER, trough 5 ft. 9 in. by 24 in. by 28 in. deep, with wood-built hopper, elevator, A.C. motor and starter.

2—GARDNER 'G' size SIFTERS AND MIXERS.

2—GARDNER 'H' size steam jacketed MIXERS.

6—JOHNSON FILTER PRESSES 30 chamber 24 in. square.

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

TRACTOR NEWS

THE PLATYPUS 39 H.P. DIESEL CRAWLER now ex-stock. Bare Tractor from £1,080, or complete 7 ft. Hydraulic Angledozer, £1,430.

Also Boughton Winch, Rotavators, Hydraulic Scrapers, etc.

MAIN DISTRIBUTORS AND STOCKISTS,
WILLIAM R. SELWOOD, LTD., CHANDLER'S FORD, HANTS.
'Phone 2275.

FOR SALE

C. BARBER, LTD.

SEVERAL HORIZONTAL JACKETED TILTING MIXERS, 25 gallons capacity. New and unused.

500-gal. Over-driven M.S. **MIXING VESSEL.** M.S. pressure filter, 4 ft. 3 in. diam. by 5 ft. 3 in. overall height.

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

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

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

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

C. BARBER LTD.
SILVERDALE GARDENS
HAYES MIDDLESEX
Telephone—Hayes 2735/6

'PHONE 98 STAINES

JAC. AUTOCLAVES OR VACUUM OVENS—8 ft. by 5 ft., 8 ft. by 4 ft., 7 ft. by 4 ft., and 7 ft. by 3 ft. 6 in. diam.

RUBBER LINED CYL. ENC. TANKS—850 galls. each. 1,500 gall. **ALUMINIUM CYL. ENC. TANK.**

LAB. FILTER PRESS—9 in. sq. plates and frames, with pump.

UNUSED ELEC. STIRRING ARMS, 24 in. long—400/3/50.

JACKETED 'U' TROUGH MIXER—6 ft. 3 in. by 2 ft. 3 in. by 2 ft. 7 in. deep.

120 gall. **JAC. CYL. MIXING PAN,** 100 lb. w.p.

'ALLEN' CONDENSERS, 300 sq. ft. brass tubes; ditto by **"WEIR,"** 105 sq. ft.

100 gall. **S.S. JAC. MIXING PAN. PUMPS, BOILERS, HYDROS, STILLS, DRYERS, CONVEYORS, etc.**

HARRY H. GARDAM & CO., LTD., STAINES

WANTED

WANTED URGENTLY

"GARDNER or similar type **POWDER MIXERS,** ½ to 1 ton capacity. **BOX No. C.A. 3335, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

SERVICING

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

SERVICING

GRINDING, CRUSHING AND GRADING
FINE GRINDING LTD.,
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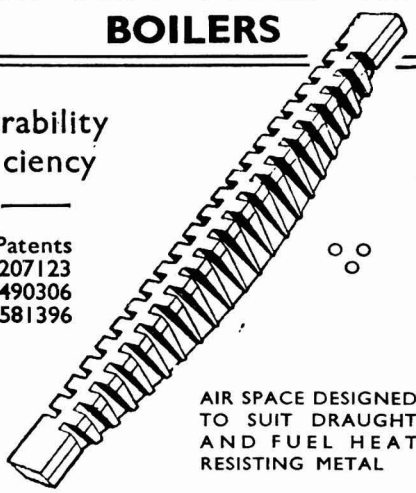

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