December 22, 1934-The Chemical Age

The Chemical Age

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Notes and Comments

Low Temperature Carbonisation

EVIDENCE that the production of smokeless fuel, petrol and fuel oil from raw coal can be made a commercial success providing the process is right, was forthcoming at the annual meeting of Low Temperature Carbonisation, Ltd., on December 14, and again at Askern on Wednesday, when Mr. Ernest Brown, Secretary for Mines, opened the extension of their low temperature plant there, bringing the total number of

retorts to 288, a world's record. The balance sheet presented at the meeting showed a profit of about three times last year's amount and announced that the profits had now reached a figure that enabled a dividend of 3 per cent. to be paid on the whole of the ordinary shares, in addition to the

interest on the two classes of debentures. With the cooperation of the coal trade, the company has established all over the country a national system for the distribution of smokeless fuel. Nor is the process any longer a laboratory experiment full of promises for some future day. It is a working reality. Nine squadrons of the • Royal Air Force are actually flying on petrol produced from coal, and large quantities of the coal fuel oil are being used by the Admiralty, railway companies and other important users.

A factor which need not be stressed to men of foresight in the mining industry is the change in engineering practice resulting in more and more horse-power changing over from raw coal to oil. The British Navy is off coal and in the mercantile marine there is an enormous tonnage with motor engines and steam engines fired by oil. The railway locomotive, one of the best friends of coal, is beginning to be threatened by the success which the diesel engine has attained in the railway field abroad. Colonel W. A. Bristow, chairman of Low Temperature Carbonisation, Ltd., believes that the leaders of the mining industry will support the production of oil from coal so that they may serve these vast new markets from their own resources. "We don't want all our coal out of the ground in lumps; we want a great deal of coal out of the ground in bottles," says Colonel Bristow. A further aspect of the question is that the security of the British Empire, through its Air Force, Navy and Army, now rests on oil. Unless

we supply that oil ourselves, for the first time in history we shall have placed in the hands of others the mainspring that would set in motion the whole of the country's defences.

Chemical Warfare

DR. HERBERT LEVINSTEIN, who, as a member of the Chemical Warfare Committee, was one of the Allies' greatest poison gas experts in the war, provided popular copy for the

CHRISTMAS

A wealth of meaning lies behind the wellworn words when we say from our hearts

> A MERRY CHRISTMAS and a Prosperous New Year

The Proprietors, Editor and Publisher of

THE CHEMICAL AGE

the production of war material, and cited the message of President Wilson from the Peace Conference in 1919 that it was a policy of obvious prudence to make certain of the successful maintenance of many strong and well-equipped chemical plants. In England to-day, said Dr. Levinstein, we are much better prepared for war than in 1914, not because we have taken any steps of a warlike nature, but because our chemical industry is much stronger now, both absolutely and relatively, than in the year the war started.

fence.

Major-General C. H. Foulkes, in his "Gas-The Story of the Special Brigade," reminds us that those who believe that war between civilised communities can be abolished can find little comfort or encouragement in the lessons of history, but he concludes that it is far more profitable to make whatever progress is possible towards the abolition of war itself rather than any particular method of waging it. Efforts have been made to dissuade the chemists of the world from producing warlike material, but distinctions between warlike and non-warlike chemical products are far too subtle to allow such a scheme to be workable. The only comforting feature we can find in Dr. Levinstein's address is his argument that scientific warfare is more humane and, because its continual inventiveness introduces an element of surprise, is more likely to bring war to a swift end. Unhappily, " the uninstructed, unprotected civilians " are terrified of poison-gas. Dr. Levinstein goes on to state that chemical warfare was prohibited in the Treaty of Versailles not because of its horrors but because Germany was better equipped industrially to prepare for it. Even if that is true, surely the suggestion cannot be sustained that all international condemnations of chemical warfare have been for equally limited reasons. The declarations of 1868, 1899, and 1907 were not thus inspired. Nor were the British and American plans of 1932. It may be true that it is difficult to draw a line between peaceful and warlike chemical inventions, but it is superfluous to defend the chemical industry on the ground that our foregn trade must be " secured " by humane poison-gases. Let us, particularly at this season of peace and goodwill, concentrate on the advantages that the chemical industry can confer upon humanity rather than upon its potentialities in the creation of panic in the " next war."

Chemical Industry and Road Surfacing

THE inter-relation of the technical problems of the twentieth century was never better demonstrated than in the address given by Colonel Hughes to the joint meeting of the Society of Chemical Industry with the Institution of County and Municipal Engineers. The address dealt with the problems of road surfacing and was remarkable for the sound scientific outlook with which Colonel Hughes, who is County Surveyor for This tribute is Hampshire, attacked the subject. deserved even though the speaker maintained that chemists are apt to produce a substance said to be capable of solving all road problems without having understood what those problems are. Surface dressing carried out with tar or bitumen was originally introduced for the purpose of laying the dust. We recollect the use of calcium chloride also for this purpose. It was then found that the spraying material waterproofed the surface and finally that it bound the surface grit, preventing slip. The greatest problem of the roads to-day is that prevention of slip-the attainment of non-skid roads.

A road surface becomes slippery for one of two major reasons, to which a third was added by another speaker, the president of the Institution of County and Municipal Surveyors. When conditions are such that the tar or bitumen overflows the top of the particles of surface grit, usually the result of using too much fluid material, the surface becomes slippery; that is primarily a problem of application, not of chemistry. When the binder can no longer hold the grit particles they become detached and again a slippery surface results; that is a problem for the chemist and physicist. The third cause of slip suggested was that roads become covered with a thin film of grease; the demand was made that the chemical industry should produce a simple and inexpensive material to clear roads from grease. It was with the second of these problems that the address was primarily concerned.

A Challenge to the Chemist

BOTH tar and bitumen, when properly applied, will hold the stone firmly at first; the difficulty is that after a winter or so the dressing fails, and generally the period of renewal is every two years, whereas the hard road beneath lasts for twelve or fourteen years. Too frequent application of dressing causes the surface to

become bumpy, 'so that the problem of slip prevention resolves itself into the major problem of providing a sufficiently cheap-and preferably home-producedbinder. The interesting fact was disclosed that not all stones suffer from this difficulty. The trouble occurs with any highly siliceous stone. A siliceous stone is also hygroscopic and on that account ultimately the contact angle between the tar or bitumen and the stone becomes unsatisfactory; the fluid material which at first embeds the stones to a depth of perhaps one-third or less of their height, and lies level, is slowly depressed at the edges assuming, when viewed from above, a convex surface. Colonel Hughes has his own solution for the problem, which is to coat the surface of the stone with cement, thereby rendering it basic and preventing this slow water film formation. That this solution is good appears to be proven; that it is cheap is less sure, the cost being given at 2s. 6d. per ton of gravel. The chemist has received a decided challenge to do something better. It is, moreover, a contest international in character, for whether tar or bitumen wins will profoundly affect their sales during the next few years.

The stone which causes the trouble is not confined to any one area nor to any one type of stone. Everything depends on the silica content of the stone. Nevertheless there is an area covering wide tracts in the south, southeast and east of England, perhaps east of a line from the Solent to the Humber, where only acidic gravel is available at an economic price. Colonel Hughes and other road surveyors naturally want to use their gravel and insist that the chemist shall make it possible for them to do so. One suggestion that already seems to have met with some success is to add rosin to the tar to increase its content of acidic substances. Care must be taken in making any additions that they are not such as to cause injury to fish or cattle. A recent legal case, to which reference has been made in these columns, shows that the attribution of all the ills to which cattle and fish are heir dies hard. Nothing must be done to revive it if an important chemical product is to retain its present favour with road engineers.

Ammonia as a By-Product from Coal

THE economic exploitation of synthetic products touched ammonia during the war period. Competition exists between products and materials as distinct from the conscious competition between firms making those products. On all sides the synthetic product is ousting the natural product, and no sooner is the synthetic product apparently established than a turn of fortune's wheel causes the newer material to be in turn supplanted, sometimes by the original and sometimes by yet another synthesised chemical. The displacement of by-product ammonia from gasworks and coke ovens by synthetic ammonia is now ancient history. It seems almost incredible that less than a couple of decades ago ammonia was the chief by-product from carbonising plants! The margin, however, is not large and if some means could be found of recovering and selling ammonia without the use of acid, the tables might be again turned and by-product ammonia might recover its place. The announcement that the United States Bureau of Agriculture has begun to experiment with a new material known as ammoniated peat might prove the forerunner of an ammonia "Box and Cox" act.

Progress in Fuel Research

Meeting the Immediate Needs of Industry

ACCORDING to the annual report of the Fúel Research Board (H.M. Stationery Office, 3s. net), the year ended March 3t, 1_{034} , has been one of great activity in fuel problems, and there have been a number of developments affecting the direct combustion of raw coal by various methods, its conversion into solid, liquid and gaseous fuels by carbonisation and hydrogenation and the use of various fuels in the internal combustion engine. All these developments the Fuel Research Board have followed closely in order to adjust its programme to the immediate needs of industry and to ensure that the necessary fundamental investigations are undertaken in preparation for the future.

The Cleaning of Coal

Two of the main problems being investigated are concerned with the cleaning of fine coal obtained by screening or dedusting, and the removal of the slurry from washery water. It is understood that certain large units are being erected on the vacuum-flotation process, one of the systems being investigated at the Fuel Research Station. In addition, a dry cleaning process for the treatment of coal below $\frac{3}{4}$ inch, without further screening, is being developed. Great interest has been taken in the work in progress on the sedimentation of washery slurries.

The experiments on the introduction of steam during the carbonisation of coal in horizontal retorts have been continued, and have shown that the yield of gas can be materially increased by this means. The method has been tried by at least three gas undertakings in the country and a number of inquiries has been received for details of the process. The narrow vertical brick retorts, designed at the Fuel Research Station for the carbonisation of coal at temperatures from 600° to $1,000^\circ$ C., have continued in satisfactory operation, and have dealt successfully with a number of coals differing widely in character. The vertical chamber ovens completed in November, 1932, have been used in the first instance for an investigation into the effects of blending coals for the production of a free-burning domestic coke.

The "Grid" burner, embodying a principle developed at the Fuel Research Station, is now in commercial use both for steam-raising and for heating metallurgical furnaces. Experiments have aimed at adapting the system to burn satisfactorily coals containing as low as 15 per cent. volatile matter in Lancashire boilers. The problem of stabilising dispersions of coal in oil has been further investigated; new light has been thrown on some aspects of this problem by the work in progress in the Department of Colloid Science at •Cambridge University.

Lubricating Oils

The supply of lubricating oils from home sources is as important, from a national point of view, as a home supply of motor spirit and other oil fuels, and at the Fuel Research Station oils which have lubricating properties, although they are not yet suitable as commercial lubricants, are being obtained from coal products. The production of synthetic oils by the treatment of low-

The production of synthetic oils by the treatment of lowtemperature gas- and tar-spirits with anhydrous aluminium chloride has been carried out on a larger scale. A quantity (about 80 gallons) of gas spirit from the carbonisation of coal at a temperature of about 650° C. has been treated, with a view to obtaining viscous oils by polymerisation of the unsaturated hydrocarbons. The spirit was washed with one-third its volume of caustic soda (sp. gr. 1.111) to remove tar acids and dissolved hydrogen sulphide, with sulphuric acid (sp. gr. 1.07) to remove the alkali, and finally with water. It was dried, and then refluxed for 12 hours at 78° C. with 5° per cent. by weight of powdered aluminium chloride. A fo-gallon iron still fitted with a stirrer-and reflux condenser was used. After separation from the sludge, the product was washed with caustic soda (sp. gr. 1.111) and with water. It was topped to 220° C., using superheated closed and open steam in an iron still. The residue was.some 23 per cent. by weight of the original spirit. Analysis of the spirit before and after treatment gave the following results :-- Unsaturated Aromatic Saturated

	hydro- carbons		hydro- carbons	
Original spirit per cent, by weig	ht 32.0	28.2	39.8	
Spritt after treatment			145.00	

per cent. by weight 1.3 30.7 68.0 It is seen that the unsaturated hydrocarbons have been almost completely eliminated from the spirit fraction by polymerisation, with the production of higher boiling oils.

A sample of the residue was distilled in the laboratory under reduced pressure with superheated steam, and four grades of viscous oil were collected. Grade I corresponded roughly to a spindle oil, grades II and III, together, to a motor car oil, grade III, alone, to a cylinder oil, and grade IV to a heavy gear oil. The combined yields amounted to 8 per cent. by weight of the spirit treated. They were all clear, good-smelling oils, yellow in colour, and possessing a faint blue fluorescence.

Cracking of Coal Products

It has been suggested that lubricating oils might be obtained from coal products by cracking and the subsequent building up of high-molecular-weight hydrocarbons of suitable types. Before attacking the problem from this angle, it was thought advisable to synthesise and examine one or two high-molecular-weight hydrocarbons of types that might be obtained in this way. To this end, cetyl benzene was prepared, and hydrogenated to cetyl cyclohexane, and the properties of these two hydrocarbons were investigated.

Cetyl benzene was synthesised from cetyl iodide and bromobenzene by the Wurtz method. A 50 per cent. yield of cetyl benzene, together with some di-phenyl and di-cetyl was obtained. Cetyl cyclohexane was made by hydrogenating cetyl benzene with pure hydrogen under 50 atmospheres pressure at 100° C., in the presence of palladium black. The reaction was carried out in a glass flask enclosed in a steel container. It was necessary, in order that the catalyst should not be poisoned, to remove all traces of iodide from the cetyl benzene by treatment with fused sodium. An almost theoretical yield of the naphthene was obtained; traces of unchanged cetyl benzene was freed from the sodium salt of the cetyl cyclohexane was freed from the sodium salt of the cetyl

Both cetyl benzene and cetyl cyclohexane are white waxy solids melting just above room temperature to water-white oils, with a very faint and pleasant odour. Their melting points are 27° C. and $29^{\circ}-30^{\circ}$ C. respectively. Both compounds are readily soluble in cold ether, petroleum ether and benzene, but sparingly soluble in cold alcohol. Cetyl benzene is fairly soluble in acetone, but cetyl cyclohexane is only slightly soluble.

Results show that cetyl benzene and cetyl cyclohexane are stable to oxidation and do not lose viscosity very rapidly with rise of temperature, although their absolute viscosities are low compared with those of lubricating oils. They would not in themselves, however, be suitable as lubricants, since they are low-melting solids. In admixture with other similar compounds, the melting points would be depressed. It would therefore be advisable to prepare an oil consisting of a number of hydrocarbons of this kind, and to investigate its properties, and finally to prepare oils of a similar type from coal products by breaking down the hydrocarbon molecules and building up, from the fragments produced, hydrocarbons of the desired structure. Before attempting this, it is proposed to investigate the effect of admixture of cetyl benzene and cetyl cyclohexane with poor-quality oils obtained from coal products.

Hydrogenation of Coal

The study of the hydrogenation of coal has been continued during the year and has made considerable progress, due chiefly to the results obtained with the mechanically stirred converter described in the last report. In this converter a stream of hydrogen is passed over the coal charge under treatment, and the volatile products of hydrogenation are carried off and separately condensed. This procedure gives much more information per experiment than is the case with 2-litre rotary converters, since a measure is obtained of the rate of reaction, and the nature of the products may be examined periodically. As a result, the 2-litre rotary converters have not been extensively used except to obtain preliminary data regarding a new coal or a new set of conditions.

The experiments have been confined principally to the study of the hydrogenation of one particular coal, from the Beamshaw seam. A stage has now been reached where the knowledge gained can be applied to the treatment of this coal in a continuously-operated plant, which is now almost complete. This plant has been designed to treat, in the form of a paste. The oil products are to be removed in the hydrogen stream, and a sludge of coal ash and unconverted to carry out a series of quantitative experiments in this plant under varied conditions, and then to investigate, under conditions similar to those used in the treatment of tar, the further hydrogenation of the oil produced.

Effect of Catalysts

Progress has been made with the study of the effect of catalysts upon the early stages of reaction. The work has been extended to smaller quantities of stannous hydroxide has been found to diminish rapidly as the quantity employed is reduced. The reduction in the oxygen content of Beamshaw coal up to 400° C. when 0.1 per cent. of stannous hydroxide was used was no more marked than in the complete absence of catalyst and was very much less than when employing 5 per cent. of luxmasse. From the point of view of the early stages of the reaction, therefore, it would appear more conomical to employ a large quantity of a relatively cheap catalyst than a small amount of a more expensive material such as a tin compound

The search for fresh catalysts for the hydrogenation of coal has not been prosecuted actively since it appeared, as reported last year, that in the presence of a vehicle a catalyst possessed only a limited activity. It was considered more profitable to devote attention to the detailed study of the effect of one particular substance (stannous hydroxide) in the presence of a vehicle.

In the first place, experiments were carried out in 2-litre electrically-heated converters to investigate the rate of reaction when using 0.1 per cent. of stannous hydroxide. By comparison of the rate of fall of the ratio of pressure to absolute temperature during the period of heating up a paste of Beamshaw coal and vehicle to 450° C. under hydrogen pressure, it was found that in the presence of the catalyst the fall commenced earlier and proceeded more rapidly than when no catalyst was used. The presence of a catalyst appears therefore to accelerate reaction even though little difference is made to the final conversion to liquid.

The Products of Hydrogenation

The products obtained by the hydrogenation of coal in 2litre converters are black, tarry liquids containing the inorganic constituents of the coal and a proportion of the partially converted and the unconverted coal. Experiments have been carried out to investigate the further hydrogenation of these products with various molybdenum catalysts. Such experiments have met with little success, whether the coal was used in the presence or absence of a vehicle. Since it has been found that molybdenum catalysts readily effect the 'hydrogen which has been passed at high temperature and under pressure over coal, it appears that it is the presence of the residual sludge of coal ash and partially converted and unconverted coal which has a deleterious action on the activity of the molybdenum catalysts.

and inconcrete our winn has a calculation of the activity of the molybdenum catalysts. The National Physical Laboratory has completed the spectroscopic examination of the ashes of four selected coals chosen on account of the facility or difficulty with which they could be hydrogenated in the absence of a vehicle. The results undoubtedly show that the coal most difficult to hydrogenate contained the least of the elements, tin, lead, zinc, molybdenum and vanadium, and the most amenable coal the largest amount. The conclusion that ease of hydrogenation depends upon the amount of possible catalytic

elements present in the ash must not be drawn at this stage, since too many other variables are involved. None of the four coals contained germanium or tungsten.

The mechanically-stirred converter, which was described in the last report, has been extensively used during the past year to study, first, the effect of temperature and pressure upon the hydrogenation of Beamshaw coal paste, and, secondly, that of varying quantities of a catalyst (stannous hydroxidu, upon the hydrogenation of the same coal alone and of the coal paste. The coal paste used in this work consisted of a mixture of approximately equal proportions of coal and vehicle; the latter, as in previous experiments, was a "topped" low-temperature tar. The coal was pulverised, approximately 93 per cent. passing a 240 B.S. test sieve. These experiments were all carried out at a somewhat faster

These experiments were all carried out at a somewhat faster rate of heating than in the experiments previously reported, in which the rate of rise of temperature was restricted so as to conform to that used when hydrogenating the coal alone. The revised rate of heating was such that 400° C, was reached in about 3 hours and 450° C, in 5½ hours from the time of switching on the heating currents.

Increase of Pressure and Temperature

It was found that with a reaction temperature of 450° C., an increase of pressure from 200 to 250 atmospheres, resulted in an increase in the rate of production of liquid products and a higher total yield. An increase of reaction temperature from 450° C. to 470° C, while retaining a hydrogen pressure of 200 atms, naturally quickened liquid production in the early stages but resulted in a lower total yield being obtained as a result of more extensive gas formation. A simultaneous increase of the pressure to 250 atm., however, was sufficient to counteract the effect of the increased temperature in reducing the total yield, while retaining the enhanced rate of production, in the early stages, due to the higher reaction temperature.

In the absence of vehicle, the yield of oil increases from 42.4 per cent. without catalyst to 64.4 with 0.1 per cent. of catalyst and to 67.4 with 2.5 per cent. catalyst. The effect of increasing the quantity of catalyst from 0.1 to 2.5 per cent., on both the rate of production and the total yield of liquid products, is comparatively small, though a marked advantage is derived as shown by the increased total yield when using 0.1 per cent, as compared with no catalyst.

With the methods now in use only 3 gallons of motor spirit can be obtained per ton of coal carbonised. It has been shown, however, that practically the whole of a tar produced at "low" temperatures and considerable proportions of other tars can be converted into first-class motor spirit by treating the tar with hydrogen under pressure. A study of this process forms an important branch of research at the Fuel Research Station. The fundamental aspects of the process are being investigated on a small-scale plant while the erection of a semi-commercial scale plant is nearing completion. It has been designed for a maximum of 400 atmospheres although it is intended to start at 200 atmospheres. The converter is constructed of British nickel-chromium-molybdenum steel. Its internal dimensions are 16 in. in diameter by 13 ft. long and the walls are 3 in. thick. A maximum wall temperature of 250° C. has been allowed for.

Motor Spirit from Rubber

Another section of the report describes preliminary experiments on the possibility of producing motor spirit from rubber by the action of hydrogen under pressure. It has been found that rubber is readily amenable to hydrogenation, and, further, that by suitably adjusting the temperature it is possible to produce either motor spirit or lubricating oil. It is realised, of course, that the manufacture of these products from rubber would not be economic unless the rubber were available at a very low price. Under the conditions described in the report a yield of

Under the conditions described in the report a yield of motor spirit corresponding to 50 per cent. by weight of the original rubber was obtained when the reaction temperature was 450° C. When the reaction temperature was 330° C, the process resulted in the production of a pale vellow viscous oil amounting to 13 per cent, by weight of the original rubber. This oil had properties which would make it suitable as a lubricant. Its viscosity, however, is its poorest quality but it is suggested as possible that the viscosity of the oil may be improved by some means of refining, such as solvent extraction.

The Production of Organic Acids by Fermentation—II

G ALLIC acid was discovered by Scheele, prior to 1787, in studying the result of the action of a mold on a water infusion of gall nuts. In 1867, Von Tieghem demonstrated that Aspergillus niger and Penicillium glaucum, would produce gallic acid by their growth of both organisms. Two other investigators, Fernbach ("Compt. rend.," 1900, 131, 1214) and Pottevin ("Compt. rend.," 1900, 131, 1215), independently took up an investigation of the fermentation of tannin and reported that the enzyme tannase could be produced by the growth of Aspergillus niger on solutions containing tannin and suitable nutrients and could then be separated and used to hydrolyse solutions of pure tannin to gallic acid.

Gallic acid has long been produced industrially by the action of molds on tannin. The old process, described by Duclaux in 1883 (Frémy, "Encyclopédie Chemique," 1883), consisted in piling the moist tannin-containing material in heaps, maintaining them at temperatures of around 30° C., and stirring the heaps from time to time. After about one month the action was complete, and the gallic acid was leached out. The process has been much improved in the last 30 years, and most of the gallic acid made by the mycological process to-day is undoubtedly manufactured by the method described by Calmette (Ger. Pat. 120,164) or some modification of it. Clear tannin extract is used, and pure cultures of one of the varieties of Aspergilli are generally employed. The sterile extract is innoculated and the solution agitated by blowing air through it and by mechanical agitators. Analysis of the mixture is made from time to time, and when the tannin has entirely disappeared the fermentation is terminated and the gallic acid is recovered in the usual manner.

Gluconic Acid

The discovery of the microbiological production of gluconic acid was made by Boutroux (" Compt. rend.," 1880, 91, 236), who isolated an acid from culture solutions of Mycoderma aceti on glucose which he concluded was lactic, but which two years later he recognised as gluconic acid. It has since been isolated from glucose solutions in which bacteria have been cultured. In 1922, Molliard ("Compt. rend.," 1922, 174, 881; 1924, 178, 41) separated the acid as the calcium salt, along with citric and oxalic acids, from cultures of Aspergillus niger on sucrose, and since then it has been recognised as a rather commonly occurring product of mold metabolism. Bernhauer and Wolf ("Zeit. Physiol. Chem.," 1928, 177, 270) concluded that the formation of gluconic acid was a strictly enzymic process induced by an oxidase which they termed "glucoxidase." They noted that toxic materials added to the fermenting solutions in concentrations sufficient to inhibit vegetative growth did not interfere with gluconic acid formation by a mycelium already developed, but that their addition completely suppressed citric acid formation, indicating that there is a wide fundamental difference in the mechanisms of the reactions leading to the formation of the two acids

The ease with which certain fungi oxidise gluconic acid led May, Herrick, Moyer and Hellbach (" Ind. Eng. Chem.," 10_{20} , 2t, 108) to investigate the possibilities of industrial production of the acid by the mold fermentation of solutions of commercial glucose. Using pans fabricated from highgrade aluminium, they were able to obtain yields of acid averaging around 57 per cent, of the theoretical, from 20 per cent. glucose solutions. The acid was recovered from the fermented solutions as the calcium salt, which, owing to its high solubility in hot water and relatively low solubility in cold water, is easily obtained in a high state of purity. It was demonstrated that this process has industrial possibilities.

The formation of lactic acid by fermentation was first recognised as such by Blondeau ("Journ. Pharm.," 1847, 12, 244). Ten years later, lactic fermentation was investigated

A Survey of Processes Applied to Carbohydrates in Particular

by Pasteur, and it served as a starting point for his contributions to the science of microbiology. Lister, in 1877, was the first to isolate pure cultures, and subsequently many different types of these bacteria were obtained and named. The first successful production of lactic acid on a com-

The first successful production of lactic acid on a commercial scale was accomplished in 1881 by Avery (" Ind. Eng. Chem.," 1930, 22, 1153). Owing to lack of demand production lagged, but as industry grew in the United States the lactic acid fermentation was established on a sound commercial basis. The raw materials used were usually glucose or sucrose, and the yields of acid obtained were around 60 per cent. of the theoretical amounts. The early methods were largely empirical, and a lactic fermentation entirely free from infection by butyric and alcoholic organisms was unusual. Many improvements have been made through the development of more successful methods of maintaining pure cultures, isolation of more productive strains, and better fermentation control.

Lactic Acid Process

As now practised, the process consists of a high temperature (50° C.) fermentation of sterilised solutions of cane and beet sugar molasses, starch or glucose. When starch is used, it must first be hydrolysed by either malt or acid. A sugar concentration of around 10 per cent. is generally used. Adjustment of the acidity of the raw mash to a pH of 3.7 to 4.5 permits an efficient sterilisation by heating without employing excessive temperatures and pressures. The addition of excessive temperatures and pressures. The addition of nutrient salts is also generally necessary. As the fermentation progresses, the accumulation of lactic acid affects the activity of the organisms, and it is therefore necessary to add a neutralising agent. This is generally accomplished by adding the entire calculated quantity of calcium carbonate at the beginning of the fermentation, although it may be added intermittently as the formation of acid takes place. The latter procedure is desirable, since the maintenance of a slight acidity in the mash minimises the danger of infecting organisms obtaining a foothold, but it necessitates rigid control of the fermentation if maximum yields are to be obtained. The sugar, as a rule, completely disappears in from four to six days. The calcium salt is recovered, and the lactic acid is liberated with sulphuric acid. The yield is about 90 per cent. of the theoretical, if the process is well controlled.

Malic Acid

Malic acid has been reported as occurring in small quantities among the products of yeast fermentations. According to Dakin (" Journ. Biol. (hem.,") 1024, dx, 139), the addition of sodium bicarbonate, and especially sodium fumarate, has a marked effect in increasing the quantity of malic acid formed. Kostytschew and Frey (" Zeit Physiol. Chem.,") 1925, 146, 276) have reported the formation of this acid in appreciable quantities in rapid alcoholic fermentationse brought about in the presence of calcium carbonate and in the absence of nitrogenous nutrients. They are of the opinion that it probably is derived from hydroxyglutamic, aspartic, or succinic acids resulting from the degradation of yeast protein. The origin of malic acid in fermentations is rather obscure, but its close structural relationship to succinic and fumaric acids suggests a common precursor.

Oxalic Acid

The accumulation of oxalic acid in carbohydrate cultures of molds has been observed with varieties of Aspergilli, Penicillia, Mucores, and other less common organisms. Wehmer ("Ber.," 1801, 9, 218) reported the production of large quantities of this acid from sucrose by a strain of Aspergillus niger and subsequently carried out a systematic study of conditions affecting its occurrence. Under definite cultural condition to grams of oxalic acid was produced from 15 grams of sucrose. Currie and Thom ("Journ. Biol. Chem.," 1915, 22, 287) studied the ability of *Penicillia* and *Aspergilli* to produce oxalic acid, and incidentally this survey led to the discovery of the production of citric acid by *Aspergillus niger*. The work of the last 15 years has indicated that the accumulation of oxalic acid in mold cultures is dependent largely on experimental factors and that in citric or gluconic fermentations this accumulation can be almost completely eliminated by a proper choice of the conditions under which the process is carried out.

Despite the ability of many organisms of the Aspergillus and Penicillium species to produce large yields of oxalic acid from various carbohydrates, this fermentation has no commercial significance, owing to the ease of manufacturing the acid by strictly chemical methods.

Propionic Acid

In 1841 Nöller ("Liebig's Ann. Chem.," 1841, 38, 299) isolated a substance from the products of spontaneous fermentation of moist calcium tartrate which he designated pseudo-acetic acid. Study of the properties of some of the salts of this acid indicates that he was dealing, at least in part, with propionic acid. The same acid was reported by different investigators under different names, such as "metacetonic acid" and "butyro-acetic acid." Dumas, Malagutti and Leblanc ("Compt. rend.," 1847, 25, 781) established that the three acids were identical and proposed the name "propionic acid."

While investigating the formation of "eyes" in Swiss cheese, Jensen ("Centr. Bakt.," 1898, 4 (2), 217, 265, 325) found a relation between the number and size of the eyes and the quartity of proponic acid in the cheese. Shortly after, Von Freudenreich and Jensen ("Centr. Bakt.," 1906, 17 (2), 520) succeeded in isolating propionic acid bacteria which they designated *Bacteria acidi propionici*. These bacteria occur These bacteria occur widely and in fairly large numbers in dairy products, such as milk, cheese and rennet. Sherman and Shaw ("Journ. Biol. Chem.," 1923, 56, 695) made a detailed study of the propionic organisms in cheeses of the Emmenthaler type and isolated vigorous strains of Bacteria acidi propionici having such strong propionic acid producing characteristics as to inspire a study of the possibility of large-scale production of the acid by fermentation (Whittier and Sherman, "Ind. Eng. Chem., "1023, 12, 720; 1024, 16, 122). It was found that carbohydrates, in particular the lactose of sterilised whey, could be fermented to propionic and acetic acids, the action being complete in 10 days when carried out at 38° C. An interesting feature brought out in this investigation was that the rate of acid production and the ratio of propionic to acetic acid were greatly increased by the presence of other organisms, such as Streptococcus lactis and Lactobacillus casei, in the mash.

Detailed Studies

The whole question of bacterial production of propionic acid has been reviewed by Van Niel (" The Propionic Acid Bacteria," 1928). He made detailed studies of the various organisms, suitability of different carbon sources, variations in nutrient media, and relations of the bacteria to oxygen. Foote, Fred and Peterson (" Centr. Bakt.," 1930, δ^2 (2), 379) have recently investigated the fermentation of pentoses by 20 different cultures of propionic acid bacteria, of which 13 were able to ferment arabinose and one to ferment xylose. These sugars differed from glucose mainly in that there was a decrease in the percentage of volatile acids and a corresponding increase in non-volatile acids.

Virtanen ("Chem. Abstracts," 1924, 18, 2538; 1927, 21, 3644) has carried out an important series of experiments with a view to formulating a mechanism which might express the reactions involved in propionic acid fermentation. The organism used was isolated from cheese and was capable of converting glucose and pyruvic and lactic acids to propionic and acetic acids in the ratio of 2 to 1. Experiments with glucose indicated that it is esterified with phosphoric acid as an initial step in the fermentation. As in the lactic fermentation, the organism possesses a cozymase complex, which may be removed by washing. An interesting fact is that the phosphatase co-enzyme of lactic acid will reactivate the dried and washed propionic bacteria as will also the wash water of the dried bacteria themselves.

Whittier and Sherman (" Ind. Eng. Chem.," 1923, 15, 729;

1924, 16, 122) have called attention to the utility of propionic acid esters as solvents for cellulose derivatives and have also pointed out the advantages of propionic over acetic acid as a solvent in some cases, owing to the wide range of tempera-tures over which it remains liquid. The possibility of preparing ketones from calcium propionate has also been suggested. The length of time required for the fermentation to days) and the necessarily low concentration of acid in the final fermented material (5 per cent. solutions of lactose were found to be best) have, however, apparently discouraged any industrial application of the work of Sherman and his associates. Nevertheless, Van Niel ("The Propionic Acid Bacteria," 1928) is of the opinion that the propionic fermenta-tion has distinct industrial possibilities. He found that the difficulties caused by the time required for a complete fermentation could be overcome by carrying out the process on a semi-continuous basis. Thus, complete fermentation of the substrate required from 7 to 10 days. After replacement of the mash five times, the final batch was completely fermented in two days. The ratio of propionic acid to acetic acid can be varied as desired by proper selection of organism and nutrient nitrogen and, although the ratio is two to one, under usual conditions, certain strains will produce the acids from glucose in a ratio of five to one.

Wilson, Fred and Peterson ("Biochem. Zeit.," 1030, 229, 271) have studied the comparative action of 11 strains of propionic acid bacteria on solutions of glucose, sucrose, maltose and lactose. With *Lactobacillus casei*, glucose gave the best yields. Sucrose and lactose followed closely, but maltose gave variable results. Selected strains vigorously fermented molasses and hydrolysed starch solutions. Thus, So per cent. of the carbohydrate of the latter (3.8 gram glucose per 100 c.c. of solution) was fermented in from four to five days. Over a 14-day period, 93 to 95 per cent. of this was accounted for as volatile acids, which consisted of 65 to 70 per cent. propionic acid.

From a consideration of the present state of the propionic fermentation, it appears that the production of propionic acid by this method might prove feasible. Establishment of the process on an industrial scale would entail considerable research and once established would require rigid control for successful operation. Competition would undoubtedly arise from the synthetic chemical industry, and the final success of the fermentation process would depend on its efficiency, the price of raw material, the cost of recovery of the desired products, and the volume of production.

Succinic Acid

Pasteur, in his paper on alcoholic fermentation ("Ann. Chim. et Phys.," 1860, (3), 58, 323), first reported the formation of succinic acid by micro-organisms. The acid has since been isolated in small quantities from the final products of a wide variety of yeast, bacterial and mold fermentations. It has been demonstrated that in a large number of fermentations succinic acid is formed from the glutamic acid which arises from the decomposition of protein material. On the other hand, it is certain that in some cases succinic acid is formed from the sugar. Thus, the large quantities of succinic acid found in his propionic acid fermentation led Virtanen ("Ber.," 1925, 58, 2441) to the belief that it is formed by the propionic organisms directly from the hexose without intersention of co-enzymes, as is indicated in the section of this circular dealing with propionic acid.

Foote, Fred and Peterson (" Centr. Bakt.," 1030. δ^2 (2), 370), in their investigation of the propionic fermentation of pentoses, observed the formation of comparatively large quantities of succinic acid (as much as 20 gram of the acid for each 100 gram of arabinose fermented) and concluded that it was derived from the carbohydrate rather than from the yeast water used in the substrate. Butkewitsch and Fedoroff (" Biochem. Zeit.," 1030, 270, 103) have noted the formation of appreciable quantities of succinic acid from sugars, ethanol and acetic acid by a strain of *Mucar stolonifer*, and they have suggested that the succinic acid is derived from acetic acid, which, in turn, is formed either by oxidation of ethanol or by dismutation of acetaldehyde.

Recent work therefore points to the possibility that a fermentation of sugar to succinic acid in which the yields of the acid might have an economic significance may eventually be found.

Sir Bernard Spilsbury's View of Chemistry

The Annual Chemical Dinner

NEARLY five hundred chemists and friends attended the annual Chemical Dinner at the Wharncliffe Rooms, Hotel Great Central, on Tuesday evening, and the function was, as usual, a great social success. Brigadier-General Sir Harold Hartley presided, and the guest of the evening was Sir Bernard Spilsbury, the eminent pathologist. The Chemical Dinner provides a unique opportunity once a year for bringing together the members of the various chemical organisations, and it was supported this year by representatives of the Chemical Society, Institute of Chemistry, Society of Chemical Industry, Society of Public Analysts, Faraday Society, Biochemical Society, Society of Dyers and Colourists, Ceramic Society, Institution of Chemical Engineers, Institution of Petroleum Technologists, Oil and Colour Chemists' Association, Association of British Chemical Manufacturers, British Association of Chemical, and the Chemical Club. Speeches were, in accordance with tradition, kept to a minimum both in number and length, only one toast being submitted after that of the King.

That of the King. Sir BERNARD SPILSBURY, who proposed the toast of "Chemistry," coupled with the name of the chairman, said it was a coincidence that Sir Harold Hartley and himself were contemporaries at Oxford. While he (Sir Bernard) studied physiology, Sir Harold contented himself with read-ing chemistry. Even medical students had to do a certain amount of elementary chemistry, and he recalled with a good deal of pleasure how they became skilled in dodging flying glass and corrosive fluids which generally terminated their experiments. Sir Harold wilfully, obstinately and of malice aforethought read chemistry rather than physiology, and from his conversation with him that evening he believed he was still unrepentant. The vaults and dungeons in which chemistry was carried on in those days had long since been superseded by wonderful laboratories, and, although physiology still flourished, chemistry had also come into its own. With change of time there had come changes of method. In his days chemistry was analytical; now it had become synthetic. For the benefit of the ladies he explained that analytical chemistry was concerned with taking things to pieces to see what they were made of, while synthetic chemistry had to do with putting things together to see what could be made of them.

"We poor doctors have been overwhelmed with the pro-ducts of the laboratory," said Sir Bernard. "My breakfast table is piled high with advertisements of various products which are supposed to cure almost all human ills." Concerning narcotic drugs, he believed the chemist nowadays had produced a drug for every day of the year, Sundays and Bank Holidays excepted. Synthetic chemistry had taught us how to produce artificial foods, and we never knew now how much of the food we consumed at banquets was natural and how much was artificial. It was well known that a member of the chemical profession had spent his life trying to turn salt into There was no question that there were many artificial sugar. foods to-day which imitated exactly not only the flavour but also the digestive properties of natural foods. When the seething multitudes covered the earth and we ate up all our animal food we should have artificial foods-artificial beef steaks and even artificial eggs.

What of the future? The chemist was already producing vitamins to build bonny babies and to make bone, but there was one vitamin that had not yet been discovered, or, if it had been discovered, the chemist had not told them anything about it. He referred to a vitamin capable of stimulating our nerve cells and producing bigger and better brains. When that came about they could be quite sure that the chemists would keep the discovery to themselves. Then the chemists would become the rulers of the earth and those who were not chemists would be their servants. They would rule the earth and control industry and science. The future, as he foresaw it, was one in which they must make the chemists their friends.

Sir HAROLD HARTLEY, responding to the toast, said that Sir Bernard Spilsbury had made an epoch at Oxford. This was proved by the fact that when he (Sir Harold) re-visited Oxford recently he was greeted with the remark, "O, you belong to Bernard Spilsbury's time." Sir Bernard had won the high esteem of the bench, the bar and the public. He discharged his great duties impartially in the interests of justice and he was a great servant of the public.' Speaking of the subject of the toast, Sir Harold invited his hearers to reflect upon what chemistry had added to the beauty of the ladies, and suggested that if they were divested of all that they owed to the chemist they would feel in an extremely embarrassing position. In the name of everyone he thanked Mr. F. A. Greene, the hon. organising secretary, for the tremendous amount of work he had done in organising the dinner. It was a great achievement to bring together 500 chemists and their ladies from the whole of the chemical organisations of this country. It was a good omen for the co-ordination which they hoped to see between those societies in a much closer way in the future.

way in the future. This concluded the speech-making and the remainder of the evening was devoted to dancing.

Safety in the Factory

Court Sequel to Revolving Shaft Accident

BRITISH Bemberg, Ltd., was fined \pounds_5 at Doncaster on Wednesday for failing to have a revolving shaft at its silk factory at Wheatley securely fenced. Mr. C. B. Roos, H.M. Inspector of Factories, Sheffield, prosecuted, and Mr. W. L. Crawford represented the firm. The case was a sequel to a workman's clothing being caught by a shaft and the workman being injured.

Mr. Roos said that on October 30 Arthur Brewitt was repairing a vat 7 ft. high and 6 ft. in diameter. A shaft, clutch and gear were driven by an electric motor, and they in turn drove paddles in the vat. The shaft and clutch were entirely unguarded and were running at the time at a fairly slow speed of 40 revolutions per minute. To gain access to the vat Brewitt and another workman used two short ladders, one on the outside of the vat and the other inside. The paddles in the vat were not running, but the shaft was. When Brewitt was getting into the vat on one occasion his overall caught a projection on the shaft and he was pulled up and jammed between the shaft and the floor of the gallery, which was just over 10 inches above the shaft. Brewitt sustained injuries (said Mr. Roos) to his arms, legs and other parts of the body.

It might be asked, Mr. Roos proceeded, why the shaft was not fenced. It was 8 ft. 8 in, from the ground, and therefore the defendants were relying, presumably, upon it being out of reach. He pointed out that the Act laid down that mill gearing must either be securely fenced or must be in such a position and of such construction as to be equally as safe as if it were securely fenced. In fairness to the firm, said Mr. Roos, the factory was one of the best in his experience. Everything was done for the comfort of the workpeople and a large number of precautions were taken.

Mr. Crawford said the injured workman was in court and if he had given evidence would have told the Bench that he knew perfectly well he must not approach any mill shafting while it was in motion. Every workman at the factory was provided with a copy of the works rules, one of which was in motion for any purpose whatever. In the process for which that mill gearing must not be approached while it was in motion for any purpose whatever. In the process for which that particular machinery was used, it was difficult to stop the machines for any length of time, and for that reason maintenance work was carried out during the ordinary working periods, except when an emergency arose, or a breakdown occurred, and that was what happened on that occasion. The firm could have taken proceedings against the employee, but it was the express wish that the blame should not be put on the workman. All workmen were instructed that if they were to ask the foreman. Brewitt and the other man did not realise there was any danger, and they took the risk.

Special Properties of Latex

Mr. F. H. Cotton Discusses Coagulation Phenomena

THOSE new to the study of latex should be warned that much of the literature regarding the coagulation of latex refers to the natural products before the addition of ammonia or caustic alkali which is invariably present in the preserved material, said Mr. F. H. Cotton in a paper read before the Institution of the Rubber Industry, on November 26. The coagulation phenomena of preserved latex are entirely different from those obtained with the natural product as it comes from the tree.

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When acids in small quantities are added to dilute natural latex, the negative charge of the rubber particles is first reduced by adsorbtion of positive hydrogen ion and the particles begin to aggregate. Their Brownian motion is reduced, and the fact that the rubber has a lower specific gravity than that of the serum results in the former slowly rising to the surface. As the action proceeds the latex becomes thicker and assumes the nature of a cream. The ammonia, which is added in order to preserve latex before it is sent to this country, undoubtedly has an effect on the protein envelopes surrounding the individual particles. At the same time it ensures that during acidification of the latex a considerable proportion of dissolved salt shall be present. This salt is largely ionised and makes difficult, if not impossible, the slow stages of coagulation natural with fresh latex. Some substances, such as sodium silicofluoride, act as "delayed coagulants." This substance, for example, may be

added to latex to the extent of 1 per cent. to 2 per cent. without causing any immediate effect; but when the mixture is allowed to stand for a period it gradually sets to a gel. The ability to produce delayed coagulation is naturally of considerable commercial importance. Many substances, other than silicofluorides, are capable of giving a similar effect, but few are susceptible of such delicate control. Salts of divalent metals, such as calcium and magnesium, can usually be added to latex in small quantities without causing immediate coagulation; in fact, the mixes may be relatively stable at ordinary temperature. However, on heating such mixes the divalent metallic ions become more active and may The same bring about an almost immediate coagulation. effect may be caused by adding to latex substances which

themselves are innocuous but which, when heated together, react to give a coagulant. Zinc oxide and ammonium sulphate are examples.

A considerable proportion of the latex used commercially at the present time is concentrated, by one or other of the methods available, until it contains from 60 per cent. to 75 per cent. of total solids. The simplest process by which latex may be concentrated is that termed "creaming." If normal ammonia-preserved latex is allowed to stand for a long time a portion of the rubber particles rises to the surface in much the same way as cream rises to the top of milk. The upper layer of the latex increases in rubber content; but the process is too slow for practical purposes and cannot readily be controlled. Certain gummy substances, such as extract of Irish moss, gum tragacanth and even gelatine, when added in small quantity to natural or ammonia-preserved latex have the peculiar property of causing it more rapidly to cream.

Two other methods of concentrating latex are at present use. The product of centrifuging is termed "Jatex," in use. whilst the reversible whole-latex cream produced by evapora-tion of latex is termed "Revertex." The centrifugal process depends in principle upon the slight difference between the specific gravity of pure rubber and that of the serum of latex. A similar process is employed to separate cream from cows' milk. In centrifuged latex containing approximately 60 per cent. of rubber the particles are so close together that the suspension is much less stable than ordinary latex. This method of stabilising has the advantage that the protective agent is volatile, so that the stability of the latex or of its mixes may be reduced at will by blowing off some of the ammonia.

In the production of Revertex advantage is taken of the protective action of small quantities of caustic alkali which react with some of the constituents of normal latex to produce soaps which are highly efficient stabilisers. The water is evaporated under carefully controlled conditions whilst the latex is kept in motion to prevent the formation of skin. The product is of creamy consistency and so stable that many fillers can be mixed into it direct without causing coagulation.

Anhydrous Rare Earth Compounds

Preparation by the Action of Fused and Solid "Onium" Salts on the Oxides

THE preparation of anhydrous rare earth compounds by the action of fused and solid "onium" salts on the oxides, was the subject of a thesis submitted by Mr. J. B. Reed in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Chemistry in the Graduate School of the University of Illinois, 1934.

In recent years considerable interest has been shown in the possibility of separating the rare earth elements by fractional crystallisation from non-aqueous solutions." In order to carry out such separations effectively anhydrous salts of these elements must be employed. Unfortunately, the rare earth salts which are reasonably soluble in the common non-aqueous solvents are the ones which are most difficult to prepare in anhydrous form. Therefore it was deemed advisable to study methods for the preparation of anhydrous rare earth compounds. In the attempt to solve this problem a new method of attack was developed. This method is based on the interaction of the rare earth oxides with fused or solid "onium" salts.

It is a well-established fact, however, that "onium" salts behave as acids when dissolved in their parent solvents.² It has also been shown that ammonium chloride in the vapour state behaves as an acid.3 However, it has only recently been recognised that all "onium" salts act as acids in the fused and solid states.4 Many facts support this point of view. Among them may be mentioned : (1) The use of ammonium acid fluoride and ammonium bisulphate as fluxing agents in the opening up of ores; (2) the reaction of ammonium salts with many metallic oxides and salts;³ (3) the use of ammonium chloride to prevent hydrolysis of hydrated rare earth chlorides with formation of basic salts during dehydration by heating.6

Acidity is usually thought of in terms of the solvent em-ployed. According to Brönsted's theory⁷ the original acidic substance reacts with a solvent having basic properties to form a new acid and a new base. This condition may be represented by the equations :

 $A_1 + B_2 = B_2 + A_1$ or $HCl + H_2O = Cl - H_3O +$ It is this new acid, the solvated hydrogen ion, which imparts to the solution its acidic properties. In the case of fused and

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solid "onium" salts the presence of the solvated hydrogen ion (a cation acid) lends acidic properties to these compounds even in the absence of a solvent. Thus "onium" salts may be considered as acids *per se*. From the above considerations neutralisation reactions between "onium" salts and basic oxides, hydroxides and carbonates are certainly to be expected.

The reactions between fusible "onium" salts such as aniline hydrochloride, pyridine hydrochloride, ammonium acetate, etc., and the rare earth oxides were carried out by gradually adding the oxides to an excess of the fused salt. In the case of "onium" salts such as ammonium chloride, which do not melt under atmospheric pressure, the oxide and an excess of the salt were intimately mixed and the mixture heated. In either case, after the reaction was complete, the excess "onium" salt was removed by heating under reduced pressure. For this purpose two types of apparatus, suitable for small and large quantities of material respectively, were designed and constructed. For the study of the rate of reaction between ammonium chloride and lanthanum oxide a thermobalance was used.

Oxides of typical rare earth elements such as lanthanum, praseodymium, neodymium, samarium and yttrium have been found to dissolve in fused aniline hydrochloride, pyridine hydrochloride, hydrazine hydrochloride, hydroxylamine hydrochloride, ammonium acetate and ammonium thiocyanate. They react in the solid state with ammonium chloride, ammonium bromide and ammonium iodide. These reactions are all of the same general type and may be represented by the reaction between lanthanum oxide and ammonium chloride

$La_2O_3 + 6NH_4CI = 2LaCl_3 + 6NH_3 + 3H_2O$

In spite of the fact that water is one of the products, these reactions, when carried out under proper working conditions, are capable of yielding anhydrous compounds.

A new method for the preparation of anhydrous rare earth chlorides by action of ammonium chloride on the oxides has been worked out in detail. This method has been extended to the preparation of anhydrous bromides and acetates of the rare earths. It has been found unsuitable for the preparation of the anhydrous iodides. However, a slight modification involving the use of rare earth sulphides and ammonium iodide has been found to be a promising method for the preparation of the iodides.

A study of the rate of the reaction between lanthanum oxide and anmonium chloride has indicated that the existence of the latter in two crystallographic forms may have an important bearing upon the mechanism of the reaction.

China Clay Drying-Past and Present

Left: Sixty years ago the china clay which accumulated in the settling pits after washing for the removal of coarse impurities was always dug out in the form of square blocks, which were then stacked in the open air for the purpose of drying. The stacks were protected against rain by the roofs of open-sided sheds or by a temporary covering of boards.

Right: This photograph shows the 20-ton filter press which is installed at the works of the Goonvean China Clay and Stone Co., Ltd., Par Docks. Here the washed china clay, when sufficiently settled to give a thick slurry, is pumped to the press, which effects the removal of the greater part of the moisture. The press is erected on a travelling bridge which can be propelled to any part of the "dry" for discharging the filter cake.



The above photographs show the tremendous change that has taken place in the production of china clay in Cornwall, during the past half-century.

Government Interest in Oil from Coal

Mr. Ernest Brown Opens New Plant at Askern

MR. ERNEST BROWN, Secretary for Mines, visited the Askern works of Low Temperature Carbonisation, Ltd., on Wednesday and opened an extension of plant which has resulted in the works becoming the largest of its kind in the world. With Mr. Brown were Colonel W. A. Bristow, chairman and (Anglo-Persian Oil Co., Ltd.), Mr. A. E. L. Chorlton, M. P., Sir Alfred Faulkner (Permanent Under Secretary for Mines), Professor G. T. Morgan and Dr. D. D. Pratt (Chemical Research Laboratory, Teddington), Dr. F. S. Sinnatt (Director of Fuel Research), Mr. E. A. Smith (Office of Works), His Excellency Ali Asghar Khan Zarrinkafsh (of the Persian Legation), and Mr. W. Theodore Instone (director of Doncaster Coalite, Ltd.).

The Askern works were erected in 1929 and the plant originally consisted of four batteries each of 36 retorts. In 1932 the number of retorts was increased to 216, and the extension which Mr. Brown opened on Wednesday comprised two further batteries (72 retorts) making a total of 288 vetorts, which now deal with 3,200 tons of coal per week.

Operation of the Plant

The retorts are discharged and re-charged every four hours, a strict time-table being adhered to. The plant is operated 24 hours per day in three shifts of eight hours each, so that the operation is continuous. The shift on each battery discharges its 36 retorts twice during eight hours, so that each retort carbonises six charges of coal in 24 hours. This is probably the highest rate of throughput of any plant in the The coal generally used is that normally described world. as washed smalls. During the process of carbonisation the gas is led from the top of each retort through an offtake pipe to the hydraulic mains and gas handling system. The gas is first cleaned by being passed through an electrostatic precipitator consisting of a vertical cylindrical chamber in which are suspended a number of electrodes standing at 90,000 volts direct current.

The electrostatic action on the gas causes any small globules of oil or suspended matter to be flung to the sides of the chamber from whence they drain and are led away to a collecting tank. In effect, therefore, the electrostatic precipitator acts as a highly efficient filter which cannot become clogged and which never requires cleaning. The gas next passes to a bubbler, where it is washed with a dilute solution of sulphuric acid for the removal of ammonia. After leaving the acid washer the gas passes to a condenser of the water tube type where any remaining light oil or vapours are removed. After passing through the exhausters the gas goes to a scrubber, where it is washed for the removal of petrol, the petrol being recovered from the wash oil by means of a steam-heated still of special design. The stripped gas is then passed to a holder and returned for heating the carbonising plant.

National Importance of the Industry

Although the carbonisation of coal at low temperature produces large quantities of heavy tarry matter containing a large percentage of pitch, the plant is so designed and operated as to prevent any blockages in the system, and the pipes' and mains are worked for many months at a time without any necessity for cleaning.

Nine home defence squadrons of the Royal Air Force are now flying on petrol produced from Yorkshire coal at Askern and the company's Barugh plant; and at the last Hendon air pageant over eighty fighting machines used it. Askern also supplies large quantities of fuel oil to the railways, industrial concerns and the Royal Navy. From one ton of coal Askern produces on an average 14 cvt. of smokeless fuel, 18 gal. of crude coal oil, 3 gal. of crude petrol, 30 therms of gas, 4 lb. of ammonium sulphate, and 20 gal. of liquor. For every 700 miners engaged in getting coal 300 are required to carbonise their output.

Mr. Ernest Brown formally opened the extension by releasing the necessary coal from a travelling skip to charge a

pair of retorts, and he and the other visitors inspected the works and laboratories.

Colonel W. A. BRISTOW, in introducing Mr. Brown, said this was the first occasion on which a Secretary for Mines had been good enough to come and open such a plant. It was most encouraging to the industry, and on behalf of the directors he thanked him for his trouble and for the encouragement and stimulus which his visit would give to that important Yorkshire industry.

How Parliament Has Helped

Mr. BROWN said that Parliament and industry were more closely connected to-day than ever in history. There were people who sighed for the day when industry and Parliament had little to do with one another, but they were sighing for the tender graces of a day that was dead. Parliament had a very real interest in the development of oil from coal, and last year it was his good fortune to pilot through the House of Commons a measure which would assist that very desirable development. The placing of that measure upon the Statute Book was but the beginning, and it was up to those who were concerned with the industry to apply it with a free impulse so that it would become a part of the common life.

The technique of low temperature carbonisation had involved the invention of a great many processes and the flotation of a great many companies. Some of them had ended in liquids and a lot had ended in liquidations. There seemed to be a real hope that the next few years would witness material advance in the development of an industry the primary object of which was the production of a good smokeless fuel for domestic use. It was a matter of national importance for no man could disagree about the desirability and the necessity for improving the atmosphere in our great towns. Smoke-laden atmosphere was detrimental to health, it damaged public buildings, and it detracted from the general amenities of life.

Harnessing the Earth's Forces

The production of heavy oils and motor spirit was an important aspect of their activities at Askern, especially having regard to the use that was being made of their products by the home defence squadrons of the Royal Air Force and by the Navy. The Admiralty had stated that it could take larger quantities as soon as further supplies were available. The development of home supplies of oil was of prime importance. One other feature in connection with the development of low temperature carbonisation was the interesting fact that compressed gas was now being used for motor transport. The Government was concerned with the public well-being and it welcomed the erection of additional plant which would provide more employment, and hasten national recovery. By recent legislation which had the effect of giving a preference to home-produced oils, the Government had encouraged the industry in its development and it was watching with great interest the successful efforts of Colonel Bristow and his fellow directors. Not only did they get Coalite, gas, crude oil, tar, creosote, tar acids, sulphate of ammonia, fuel oils and naphtha from the processes carried on at Askern, but their products were rendering an infinite variety of services to humanity, from the fertilisation of Yorkshire farms and the provision of sheep dips, to the disinfecting of drains in India and the manufacture of soap for the use of the housewife. He congratulated Colonel Bristow and all who were taking risks to harness the forces of the earth and he wished them great success in the days ahead.

Colonel BRISTOW, in thanking the Secretary for Mines, said it was a matter of profound satisfaction to the board that in these tempestuous and troublous times they should have received such approval and commendation of the work they had done. They rejoiced that the Government and the public generally recognised the success they had achieved in this modern development of the treatment of coal.

Official Secrets at Woolwich Arsenal

Employee's Alleged Offer to Imperial Chemical Industries, Ltd.

As alleged offer of secret documents to Imperial Chemical Industries, Ltd., by a civil servant employed at Woolwich Arsenal was the subject of a series of charges under the Official Secrets Act, 1911, against William Burges (59), a second-grade computer, of Macoma Road, Plumstead, at Bow Street on December 15. It was alleged that he had obtained "certain sketches, documents and information which might be directly or indirectly useful to an enemy," that he had communicated them to another person at Millbank, Westminster, and that he had attempted to communicate them to another person in Parliament Square, London.

Mr. E. Clayton, for the Director of Public Prosecutions, said that during the whole of the proceedings Burges used the name of "George Vincent." He was employed in a department in which he would have access to all the documents and information that would be produced in the case.

Information which had been Refused

On November 29 last Imperial Chemical Industries, I.td., received a letter dated November 28 signed "George Vincent. In the interests of the safety of the State it was not desirable that the whole of this letter should be read in public. The letter was directed to the managing director of I.C.I., Ltd., and referred to certain technical information which that company had applied for and had been refused by the Government. I.C.I., Ltd., were in constant communication with the War Office, not only in relation to the interchange of technical details but also to certain contractual work which they had undertaken on behalf of the Government. Through the proper channels, I.C.I., Ltd., had asked for certain information, and it was refused. The information was such as could have been applied for not only by I.C.I., Ltd., but by any similar firm. When the letter was received, Mr. Grimwood, of I.C.I., Ltd., immediately realised what it was, and, as one would expect of any firm of that standing, he communicated with the War Office. After that the company acted under the directions of the War Office. The letter stated : "I am in a position to obtain the information under these two heads, and if you wish to pursue the matter further will you insert a notice in the 'Daily Mail' personal columns on Monday next?"

As an indication that Burges could obtain certain statements, the letter went on to give an extract from a report. An advertisement was inserted in accordance with the terms of the letter on December 3. Next day I.C.I., Ltd., received this letter, also signed "George Vincent": I hope to be free to-morrow afternoon, the 4th, and in that case will telephone you at about 3 p.m. Failing that I will write again." On the afternoon of December 4 a telephone message was received by I.C.I., Ltd., from a man who gave the name of "George Vincent." He said that he had seen the advertisement in the paper. The message was received by Mr. Grimwood. Mr. Ottaway, formerly superintendent in the City Police, was in Mr. Grimwood's office at the time. It was suggested over the telephone that "Vincent" should call with the information he had got. A little later on that afternoon Burges called at the I.C.I. premises and was there introduced by Mr. Grimwood to Mr. Ottaway, who was using the name of Stewart. Mr. Grimwood told Burges he understood that he had some information and asked him what form it took. Burges replied that it was in paper form, and said that he was prepared to bring the papers for Mr. Grimwood to see.

Worth something like £100

Later the same afternoon Burges took certain documents to Mr. Grimwood. They were all marked "Secret," and it was obvious that they had come from a file. The contents were likely to assist an enemy, and of such a nature that it should not be disclosed. The documents should not have left Woolwich Arsenal at all, and Burges had no right to comnunicate the information contained in them to anyone.

As Burges was leaving he asked Mr. Ottaway if he thought the information was worth something like ζ too to him. An arrangement was made that he should communicate with Mr. Grimwood again and inform him when further information

would be available. On December 6 Mr. Grimwood received a further letter in which "Vincent" wrote: "I now have this report complete, and will hand it to you or Mr. Stewart on the 8th inst. at 11 a.m. at the corner of St. Margaret's, Westminster, Parliament Square. . . No doubt before Saturday you will have ample time and opportunity to assess the value to your company of information I can supply. . . . I suggest χ_{25} in small notes— χ_{11} and nos.—as I cannot conveniently deal with notes of larger denominations; the balance to be paid when you have seen the reports as may be of interest to you. The value I put on the transaction is χ_{100} . If you wish to get into touch with me before Saturday please use the 'Daily Mail' as before."

Arrested in Parliament Square

The police had been communicated with, and at 11 a.m. on that Saturday Detective-Inspector Kitchener saw Burges in Parliament Square. He was holding a large envelope. Asked if he was George Vincent, he said he was, and the inspector then told him he suspected that he was about to commit an offence under the Official Secrets Act. Burges replied: "I have never done such a thing." At Cannon Row police station he was asked for his correct name, and he then said that it was William Burges. The envelope he had contained eight sheets of printed matter marked "Secret." They were of the same type as the sheets previously handed over to Mr. Grimwood, and were of a technical nature.

Mr. Arthur John Grimwood, a delegate director of the ex-plosives group of I.C.I., Ltd., Millbank, said that he was concerned with the technical problems arising out of, and in connection with, explosives. When he saw the documents which Burges brought to his office he said to him : " These are very technical documents and refer to things we do not normally handle in this office. Before we know whether these are of any use to us we shall have to send them to our technical experts at Witton, Birmingham, and that will take at least a week." Burges agreed to leave the documents. He said that they were only some of the papers he could get and that there was one specimen document of importance or major interest. Mr. Grimwood said he asked Burges to let him have that document for consideration. He replied that he could not get that and leave it for a week, and asked if a manu-script copy would do. Told that this would not do, he then suggested letting Mr. Grimwood see the original, so that it "I am not alone," he added, "and can only copy it as I have opportunity." Mr. Grimwood told him that he did not want him calling repeatedly at the office, and suggested that he should post a list of what he had, with his valuation upon it.

Ex-Superintendent John Ottaway gave corroborative evidence.

An Unblemished Record

Detective-Inspector Kitchener, who, with Detective-Sergeant Hughes, made the arrest, said that Burges had an unblemished record apart from this matter. He won the Military Cross in the war and had been employed at Woolwich Arsenal for 12 years.

Captain Alfred Henry Dunlop Phillips, R.A. (retired), said he was employed at the Royal Arsenal, Woolwich. Burges would, in the course of his business, have access to these documents. A search of the files showed that copies of some of these documents were missing from the department in which Burges was employed. He had no authority to take such documents away from the Arsenal, nor had he any authority to communicate the contents to I.C.I., Ltd., or anyone else. These documents were such as were calculated to be of use to an enemy, either directly or indirectly. Burges had been employed at the Arsenal rather more than 11 years, and his pay was $\pounds 274$ a year. On December 4 he was granted leave from 2 p.m. until 5 p.m. Cross-examined, Captain Phillips said that the documents

Cross-examined, Captain Phillips said that the documents which had been put in were concerned with certain tests. It was true that the results shown by these tests could have

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been arrived at by anybody taking the proper research steps. The Magistrate (Mr. R. E. Dummett) asked Captain Phillips whether I.C.I., Ltd., could have ascertained the information for themselves had they taken the necessary trouble.

formation for themselves had they taken the necessary trouble. Captain Phillips replied that they might have done.

Mr. R. E. Borneman (defending).-Were you yourself concerned with the making of these tests?-Yes.

Would it be right that any highly-skilled person with knowledge of what he was doing would eventually arrive at the same results?—Yes, if the tests were carried far enough.

Mr. Dummett.—You don't mean that it is something that has come to your notice through luck. You mean something arrived at by scientists applying the right tests?—That is so. Mr. Borneman.—You have no doubt that if the experts of I.C.I., Ltd., had continued on the lines that your tester did they would arrive at the same conclusion ?—I could not say that.

Mr. Borneman submitted that on the answers given by Captain Phillips it was clear that any person could have arrived at the same results, and he contended, therefore, that the information contained in the documents was not prejudicial to the interests or safety of the State.

Mr. Dummett.—Would it not be prejudicial to the safety of the State to communicate to an enemy that which would save them six months' work? It might cover the whole period of a war. I am against you.

Burges was committed to the Central Criminal Court for trial.

Continental Chemical Notes

Belgium

Two BELGIAN CONCERNS are understood to have started calcium carbide manufacture in the course of this year.

France

THE DIRECTORS OF THE KUHLMANN CONCERN report that business during 1934 was maintained on about the same level as in the previous year and a dividend of 20 francs per share is considered probable. Following technical improvements, an appreciable reduction in production costs was achieved.

Russia

A NEW COPPER SULPHATE FACTORY has been built at Allawardu in the Caucasus.

VITAMIN C IS NOW BEING PRODUCED from cabbage at a new Leningrad factory attached to the Metchnikoff Hospital. At a later date it is intended to start the manufacture of vitamin B.

EXAMINATION OF FAU-DE-COLOGNE for its bactericidal power recently undertaken at the Institute of Hygiene, University of Greifswald, revealed a high degree of effectiveness on the part of numerous commercial brands in the concentrated form. Dilution with water, however, led to a marked reduction in the disinfectant power.

CITRIC ACID IS BEING EXTRACTED on an experimental scale from Ukrainian and Caucasian tobacco by a process discovered at the Moscow Institute of the Tobacco Industry. The acid is present to the extent of 6 to 8 per cent.; this exceeds the proportion of citric acid in the lemon. The experimental plant at Krasnodar in Northern Caucasia has a daily output of 0.7 kg. citric acid from 15 kg. crude tobacco. Nicotine is also extracted and the treated tobacco possesses an industrial value.

Germany

A NEW PROCESS FOR CONVERTING GLYCERINE into glyceric acid is based upon oxidation with dilute nitric acid at moderately elevated temperatures in the presence of sulphuric acid and traces of inorganic metal salts. The acid is isolated in the form of a salt and concentrated in vacuum. A yield of as much as 66 per cent. is claimed (German Pat. 605,307).

OXYGEN IN PURITY EXCEEDING 99 PER CENT. (which is the maximum purity of the commercial compressed gas) can now be conveniently prepared in the laboratory by catalytic decomposition of hydrogen peroxide ("Chemische Fabrik," December 12). One litre of 30 per cent. hydrogen peroxide yields 100 litres of oxygen at normal pressure and the special platinum catalyst (supplied by the Elektrochemische Werke, of Munich) can be regenerated by simple ignition.

THE DEUTSCH GOLD AND SILBER SCHEIDANSTALT, in its annual report, states that satisfactory trading was experienced by the platinum refining subsidiary concern, G. Siebert, G.m.b.H., of Hanau, and output was increased by the wood distillation subsidiary (Hiag-Verein). The ceramic colours department made favourable progress, although export prices were further reduced. Results of the insecticides subsidiary, Deutsche Gesellschaft für Schädlingsbekampfung, Frankfurton-Main, were up to the previous year's level.

Bulgaria

A CONSIDERABLE EXTENSION OF RICINUS CULTIVATION has been planned in Bulgaria for the coming year.

Italy

NATURAL GAS WILL BE USED as a source of motor spirit in a plant recently completed at Fornovo Taro, in the province of Parma, by the Società Petrolifera Italiana. The process is based upon absorption of the gasoline in the gas by means of active carbon and yields 1.2 tons gasoline per day.

BERGAMOT OIL has been discovered to equal phenol in its destructive action upon tubercular bacilli, and a new disinfectant is now being manufactured on the basis of this discovery. Experiments are also in progress with a view to using bergamot oil in the formulation of insecticides.

Czecho-Slovakia

THE PRODUCTION OF JOACHIMSTHAL RADIOACTIVE MINERALS for 1935 is estimated to be 3,300 mg. radium and 18,200 kg. uranium pigments.

CONSIDERABLE DEMAND FOR CARBON BLACK is reflected in the projected expansion in output of the Prague firm of Ing. Dusek and Co. The present daily output (from 3 working shifts) of 300 kg. is to be doubled.

THE CZECHOSLOVAK GOVERNMENT proposes to construct a tar distillation unit at Porub, near Orlau, mainly for the production of briquetting pitch and railway sleeper impregnating oil.

THE RAYON FACTORY OF THE BATA CONCERN, at Batisovce, will shortly resume production, according to a report in "Wirtschaft" (Prague). Work will also be resumed upon the construction of the rayon factory at Theresienthal by the Theresienthal Rayon Co.

Dyestuffs Industry Development

Committee to Advise the Board of Trade

UNDER the Dyestuffs (Import Regulation) Act, 1934, the Board of Trade has appointed a Dyestuffs Industry Development Committee whose function will be to advise the Board with respect to the efficient and economical development of the dye-making industry. The committee comprises the members of the Dyestuffs Advisory Licensing Committee and representatives of the textile industry, the heavy chemical industry, chemical science and such Government departments as appear to the Board to be specially concerned with such develop-The members are Major J. A. Barber-Lomax, Mr. ment. G. Garnett, Professor A. G. Green, Mr. A. Hittinger, Mr. J. R. Lane, Professor G. T. Morgan, Mr. W. Palmer, Mr. John Rogers, and Mr. G. S. Whitham, together with the following members of the Dyestuffs Advisory Licensing Com-Billowing includers of the potentiary Activity Electrising Con-mittee: Mr. R. Waldington (chairman), Mr. P. Caldwell, Major L. B. Holliday, Mr. S. T. Kinsman, Professor A. Lapworth, Mr. D. R. Mackay, Mr. N. G. McCulloch, Mr. G. H. Nisbett, Sir Henry Sutcliffe Smith, Mr. C. M. Whittaker, and Mr. W. J. U. Woolcock. Mr. F. W. Hammond has been appointed secretary to the committee.

New Technical Books

DRYING OILS AND DRIERS. Pp. 90. Oil and Colour Trades Journal. 3s. net.

This book is a reprint of certain articles which were first published in the "Oil and Colour Trades Journal." It is not a treatise on the chemistry of drying oils, but it gives a broad outline of the technology of the subject in a manner never before available. Tung oil and tung oil mixtures receive a considerable amount of attention, and there is a short chapter devoted to antioxidants.

CERAMIC CATALOGS (on Equipment and Materials with Supplementary Reference Guides to .Processes in the Manufacture of Brick, Enamel, Glass Pottery, Refractories, Sewer Pipes, Terra Cotta, Tile, etc.). Seventh Edition. Industrial Publications, Inc., Chicago.

The review of a book which modestly calls itself a "catalogue" among technical and scientific works, must surely be an exception. The very fact of this review proves that this catalogue is more than a mere matter of advertisement. Besides the perfectly visible catalogue material which is, of course, propaganda, and through the other part of the book even an excellent advertisement, the work contains a very large part of "editorial contents," embracing the chapters on raw materials; formulæ, batches and calculations; clay products manufacturing; non-clay refractories; pottery manufacturing; glass manufacturing; enamel products manufacturing; power and power transmission; fuel; control devices; fans, blowers, compressors, pumps; material handling; and drying, firing problems; kiln and tank design. Single chapters are arranged for the most part encyclopædically and thus clearly and easy to use. A general index facilitates the use of the whole book. Though it must be frankly admitted that single chapters and articles possess varying value, and are on varying literary levels, it can be stated on the other hand with special satisfaction that these "editorial contents" contain immensely extensive material. They contain very valuable tables, illustrations, facts, figures, etc., and certain of them might even serve as models for many a manual.

SHORT INTRODUCTION TO THE USE OF THE POLARISATION MICRO-SCOPE (Kurze Einführung in den Gebrauch des Polarisations-Mikroskops). By Dr. Fritz Kaestner, Leipzig. "Sprechsaal," Müller and Schmidt, Coburg.

(REVIEWED BY DR. FELIX SINGER.)

The author states in the foreword to his short introduction to the use of the polarisation microscope that the object of his work is, he hopes, to give chemists in general, and silicate chemists in particular, some help to further work in the laboratory and factory by increasing the interest in micro-scopy. Dr. Kaestner has thoroughly succeeded in his object. Thanks are due to him owing to the very great importance of microscopy in chemical science and industry, and all silicate reactions of a scientific and technical nature as well as the still increasing use of microscopical investigations for these The book is systematically compiled. Single purposes. chapters deal with the microscope; the polarisation microscope; crystallographical introduction; observations in ordinary light; observations in parallel polarised light; investigations in converging polarised light; observations in incident light; additional apparatus to the microscope; classification of methods of investigation; and literature. If it is admitted on one hand that Kaestner's book is a real "introduction" and that the field handled by him is not only a very large one but also one of continually growing importance, it must be emphasised, on the other hand, that the book does not exhaust all the big possibilities which follow from the use of the microscope for chemical and silicate-technical problems of science and industry. For this, a special study of immense proportions is necessary; only actual specialists are in a position to ascertain the minutest but very important differences in the crystallisations. To understand these nuances pre-supposes, however, the knowledge of an "intro-duction." In this sense, Kaestner's book is a valuable addition, more especially from the point of view of England, in which country there are already first-class experts in the field of microscopy, petrography, etc., of whose work industry and science have availed themselves.

GERMAN-ENGLISH CHEMICAL TERMINOLOGY: AN INTRODUCTION TO CHEMISTRY IN ENGLISH AND GERMAN. By Alexander King and Dr. Hans Fromherz. pp. 324. Thomas Murby and Co. 128. 6d, net.

The object of this book is primarily to aid English-speaking and German students, scientists and other people interested in chemistry and its allied subjects to acquire a knowledge of the chief terms used in the chemical literature of the language foreign to them. The chief terms are arranged with suitable contexts in the form of a text-book, each German paragraph being directly opposite the corresponding English paragraph. Moreover, in order to maintain close connection between the German and English texts, the corresponding paragraphs represent as close translations the one of the other as was found possible without sacrificing literary style too completely. Corresponding specific terms in both languages (about 4,000 expressions), on their first introduction in the text, are printed in italics and are collected together in an English and a German alphabetical index. By the use of this book much of the time and annoyance involved in frequently consulting dictionaries is avoided, and a more exact meaning can be obtained, for even the most voluminous technical dictionaries do not give the specific meanings of many important chemical terms.

Chemical Warfare Defended

Dr. Herbert Levinstein's Address at Bristol

DR. HERBERT LEVINSTEIN spoke on "Chemical Defence" at a joint meeting of the local sections of the Institute of Chemistry and the Society of Chemical Industry at Bristol on December 10, and claimed that the use of chemicals in war was an economy of force, material and lives and thai to blow combatants to bits by high explosives was not less bestial, wicked or cruel than to attack with gas. The loss of our finest young men in battle was biologically more serious than would have been the loss of an equal number of middle-aged or elderly civilians of either sex. He made the suggestion that in the next war youth would take control of the home front and the oldest classes would constitute the storm troops. War had been largely mechanised. Trenches were dug by powerful machines. In fact, recent progress had made war a less unsuitable occupation for middle-aged people than it was in 1014. Middle-aged men could drive a tank as well as anybody. If engineers set their minds to it, the unnecessary physical discomforts of war could be further alleviated.

' If they considered the total casualties caused by gas and the small percentage of fatalities, the great military results and the small tonnage of production, they got a striking picture of the economy of applying inventiveness, and consequently surprise, in war. It had been urged for some years that the chemists of the world should agree not to work on discovering or producing any substance which could be used for warlike purposes. That idea was unworkable. If invention were stifled, carnage would still proceed. The distinction made between an offensive and defensive war was part of the cant of modern politics. The casualities to the American troops caused by gas numbered 75,5000, of which only 1½ per cent. proved fatal. That was an instance of what had been proved to be generally true, that toxic substances caused far less mortality than high explosive shells, but were more effective in military results. Thus, the evidence was against the statement that the introduction of science had made war more dangerous to life.

The destructive power of science in war was absurdly overrated. One might imagine that invention had rendered it possible to destroy a city, to wipe out humanity in the mass, as it were, by pressing a button. The application of chemical science to war had not made war more dangerous either to soldiers or to civilians. It had done something quite different and of significant military importance. It had introduced fresh possibilities of effecting a strategic surprise.

introduced fresh possibilities of effecting a strategic surprise. Professor J. B. S. Haldane, when he heard the suggestion that youth should take control of the home front, remarked : "That is bunk."

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British Overseas Chemical Trade in November

Imports and Exports Decrease

The Board of Trade returns for the month ended November 30 shows that exports of chemicals, drugs, dyes, and colours were valued at $\pounds_{1,779,176}$ as compared with $\pounds_{1,794,685}$ for November, 1933, a decrease of $\pounds_{15,509}$. Imports were valued at $\pounds_{902,312}$, as compared with $\pounds_{1,009,753}$; re-exports were $\pounds_{91,935}$.

	Quant Month Novem 1933.	ities. ended ber 30. 1934.	Valu Month Novemb 1933.	ne. ended per 30. 1934.		Quanti Month Novemi 1933.	ities. ended per 30. 1934.	Valu Month (Noveml 1933.	ie. ended er 30. 1934.		
t t Imports											
Acids-					Medicinal oils cwt.	3,742	3,030	8,273	9,958		
Acetic cwt.	12,700	13,623	20,453	21,806	Ointments and liniments	541-	51-5-	-1-15	5195-		
Boric (boracic) ,,	3,872	4,021	3,752	3,922	cwt. Proprietary medicines	8	14	382	660		
Tartaric	2,302	1,869	8,932	8,207	value		—	38,291	64.021		
All other sorts value	_		11,875	10,111	All other sorts "			46,693	44,829		
Calcium carbide cwt.	102,021	76,898	61,611	43,612	Raw or simply prepared			(100 0 100		
Caustic and lyes	14.554	15 866	16 600	20 350	Finished dyestuffs (coal		-	67,776	40,047		
Chloride (muriate) "	83,113	36,130	32,283	11,540	tar) cwt.	3,979	3,653	107,569	97,541		
Kainite and other min-					Extracts for tanning-						
eral potassium fertil-	100 011	112.070	00 107	T = 802	Chestnut cwt.	31,067	22,514	21,621	15,500		
Nitrate (saltpetre)	9.650	5,300	9.164	4.527	All other sorts	23.022	43,103	19,355	10,600		
Sulphate "	57,220	25,885	26,626	9,147	All other dyes and dye-	- 51	- 5/5/ 4	-77			
All other compounds "	10,158	11,902	16,463	20,270	stuffs, etc cwt.	5,277	5,411	18,746	23,920		
Carbonate including					frainters colours and ma-						
crystals, ash and bi-					White lead, basic carbo-						
carbonate cwt.	11,563	25,403	3,854	7,560	nate cwt.	8,559	7,279	10,353	8,610		
Chromate and bichro-	0				Lithopone ,,	20,932	18,905	14,506	12,938		
Cvanide	1,738	2,074	2,915	2,777 1.887	Ochres and earth colours	14 510	22.611	6.815	8 085		
Nitrate "	31,651	40,080	6,735	7,793	Bronze powders "	1,904	1,832	13,343	11,320		
All other compounds ,,	21,108	23,217	15,183	15,344	Carbon blacks "	48,724	25,655	45,376	36,788		
Other chemical manufac-			062 117	110 005	Other pigments and ex-	21.228	05 510	6.628	86.0		
Drugs medicines etc.—			203,117	229,905	All other descriptions	14.525	16.728	36.183	32 406		
Quinine and quinine salts		A second				-+,5-5					
oz.	84,895	62,881	6,377	5,292	Total value			1,009,753	902,312		
				Exp	orts						
4 - 13 -					Zina orrida tona				- (
Citric cwt	2.061	3 554	7 508	12.266	All other descriptions	1,521	1,441	29,140	20,973		
All other sorts value			25,575	21,161	value		-	185,130	250,215		
Aluminium compounds				0	Drugs, medicines-						
tons	5,575	3,094	49,024	30,781	Quinine and quinine salts	101 416	77.240	0.558	0.668		
Sulphate tons	30,924	16,901	195,802	96,456	Proprietary medicines	101,410	77,340	9,550	9,008		
All other sorts ,,	1,102	2,654	16,793	30,617	value			133,295	106,787		
Bleaching powder (chlor-	6	0	-6		All other descriptions ,,			137,937	145,329		
Ide of lime) cwt.	01,784	80,179	10,301	20,109	tar)-						
Tar oil, creosote oil, etc.					Alizarine and indigo						
gal.	798,967	1,969,484	16,415	37,896	(synthetic) cwt.	564	713	4,478	4,236		
All other sorts value			34,036	34,306	Other sorts,	6,293	7,161	86,031	103,042		
Disinfectants insecticides	1,730	1,591	25,109	21,270	Painters' colours and ma-	23,750	29,287	20,408	33,331		
etc cwt.	32,883	36,998	71,028	81,397	terials—						
Glycerine ,,	19,223	17,121	38,713	40,658	Ochres and earth colours						
Lead compounds "	15,913	15,152	19,077	17,794	Cwt.	15,875	12,753	16,960	12,609		
magnesium compounds tons	525	464	12,080	12,844	tenders, dry cwt.	24.038	29.342	27.875	37 136		
Potassium compounds cwt.	5,678	7,632	12,622	13,437	White lead "	5,409	5,795	10,376	10,733		
Salt (sodium chloride) tons	34,249	30,447	88,613	67,473	Paints and painters' ena-				0		
Carbonate including					Varnish and lacquer gal	33,089	38,127	90,557	102,387		
crystals, ash and bi-					All other descriptions cwt.	37,848	39,977	74,746	81,478		
carbonate cwt.	277,718	259,882	79,270	69,294							
Caustic "	166,168	213,801	99,575	117,102	Total value			1 50 4 68 5			
All other sorts "	171,304	102,079	112,103	97,140 D . E	Total value	_	_	1,794,085	1,779,170		
Ke-Exports											
Chemical manufactures					Raw or simply prepared						
and products value			17,126	10,665	Dyes and dyestuffs and	T	-	8,278	13,831		
Drugs, medicines and med-					Painters' colours and ma-	1,510	430	2,911	877		
icinal preparations-					terials cwt.	365	606	756	801		
Manufactured or pre- pared value			9,028	9,761	Total value	-	-	38,099	41,935		

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Notes and Reports from the Societies

Society of Chemical Industry

Road and Building Materials Group

Two exceedingly interesting papers were read before a meet-

ing of the Road and Building Materials Group of the Society of Chemical Industry, held in London, on November 28. In a paper on "Problems of Porous Bodies and Their Behaviour as Building Materials" Mr. B. H. Wilsdon, B.Sc., of the Building Research Station, pointed out that most middless metasible bit bit is the second station. building materials which it was economic to employ were and it was their porosity which largely determined porous, their liability to deterioration by weathering. Mechanical strength was not a criterion of resistance. The physical behaviour of porous materials was to be referred for the most part to the capillary actions which resulted from liquid held in the pores, and might be defined in terms of permeability, suction and the mechanical effects produced by wetting. Mechanical effects might be produced in porous solids, both by liquids and solids, which seriously affected their dura-bility. The unrestrained movements which it had been customary to measure were of less significance than the available work involved, measurements of which were now possible; results had shown that the forces necessary to restrain completely the movements of several typical porous building materials were remarkably small. The action of solids, as by frost action or by the crystallisation of salts, appeared to be due mainly to rapid changes of state. Recent work showed that undercooling of frozen water, or delayed transition, such as was involved in the hydration of sodium sulphate, were much accentuated in microporous structures. It was suggested that this might prove to be the reason why many highly microporous materials displayed poor resistance to weathering, while corresponding coarsely-grained material was resistant.

The second paper, by Dr. E. A. Rudge, M.Sc., F.I.C., concerned "The Decay of Wood." Seasoning, said Dr. Rudge, now assumed a new significance, for modern methods of kiln-drying were, as a rule, hit-and-miss processes, devoid of scientific basis. From the standpoint of the new theory the prevention of fungus attack was not the sole function of a successful preservative. Creosoting was to-day practically the universal method of timber preservative treatment. Observations, however, indicated that the existing meaningless and arbitary specifications for creosote might profitably be replaced or augmented by one expressing not only the toxic character of the material, but also such physical properties as surface tension and viscosity of the higher and less volatile characters, since these would have reference to the efficiency of the creosote as a whole. In the application of timber to building construction, the great importance of maintaining it out of contact with lime, plaster and concrete was generally recognised. From the viewpoint of the infiltration theory the reasons were obvious, but it should be borne in mind that the situation had also to provide sufficient moisture before decay could begin. It would be appreciated that the character of the concrete very considerably affected the life of the timber embedded in it, yet, notwithstanding the wellestablished and pernicious effect of damp concrete and the repeated recommendations of research departments, it still remained a common practice to lay floor joists direct upon a concrete of high permeability

Birmingham Section : Chemistry in Agriculture

SIR JOHN RUSSELL, director of the Rothamsted Experimental Station, lectured on the "Applications of Chemistry in Modern Agriculture" before the Birmingham and Midland Section of the Society of Chemical Industry at Birmingham University, on December 13.

When chemists first made experiments in agriculture, said Sir John; they confined their attention to the effects of artificial fertilisers. It was only in recent years, with deepening agricultural depression, that soil and plant variability had become so important, because farmers were asking what was the minimum dressing required for their land and manufacturers were asking what use could be made of their waste and by-products. The function of the soil was to supply water and nutrients to the plant as and when they were needed and

to be free from anything likely to injure the plant, the commonest noxious substances being soil acids. Soil might be regarded as consisting of sand, clay, calcium carbonate and phosphate and organic matter derived from the residues of dead plants. Many modern applications of chemistry in agriculture turned on the treatment of the clay to render its constituents available for plant growth. Continued use of ammonium sulphate on clay soils induced acidity, which could only be corrected by subsequent addition of lime or chalk. The use of salt should be carefully regulated, as it might lead to the gradual conversion of good calcium clays into infertile and sticky sodium clays. The physical properties of clays were gradually being linked up with their chemical and physical constitution, and important advances in agricultural science might undoubtedly be expected when more was known about this difficult subject.

A new branch of agricultural chemistry was also opening up in regard to insect control and the partial sterilisation of the soil, the former requiring for its solution the large-scale production of such insecticides as rotenone and pyrethrin, and the latter a satisfactory range of substances for killing soil insects and fungi.

Society of Dyers and Colourists

West Riding Section : Water Purification for Bleaching and Dyeing

APPEARANCE is no guide as to the suitability or otherwise of a water supply for bleaching and dyeing, since the chemical and biological characteristics are equally as important as the physical condition, said Mr. A. H. Waddington in a paper read before the West Riding Section of the Society of Dyers and Colourists held at Bradford on December 13.

Coagulation, sedimentation and filtration generally convert a turbid coloured raw water into one which is clear, free from visible suspended matter and practically colourless. No bleacher or dyer can produce perfect work if the water is not of the highest quality, and anything inferior to this quality is bound to result in brownish or other stains which are so often a source of considerable trouble. By using the proper coagulant in the correct manner, the colour of the majority, if not all water supplies, can be considerably reduced, but if the water so treated has to be used for special work, then some secondary treatment is necessary. The residual colour can be bleached out, and for this purpose chlorine can often be usefully employed, but to achieve the maximum colour reduction an excess of chlorine must be used in conjunction with a dechlorinating agent to remove the residual chlorine. For this latter purpose, one of the oldest dechlorinating agents-carbon-will ensure that the water is free from chlorine, and will also add brilliancy and absorb certain taste and odour compounds.

Iron and manganese are the two most common and objectionable metallic constituents of water. It is usually found that iron, when associated with organic matter, presents the greatest problem, as in this form it reacts tardily and is not thrown out of solution by the usual methods of aeration and liming. Troubles arising from iron and manganese may be due to bacteria which often thrive in the pipe lines which are conveying 'or have conveyed iron or manganese-bearing water.

One of the essential requirements of the bleaching and dyeing industry is undoubtedly the ability to wash fabrics effec-tively and economically. Uneven dyeing, spotting, etc., results from erratic penetration of the colouring matter, following uneven bleaching. The formation of insoluble compounds from the interaction of calcium and magnesium salts, with alkalies and soaps must be avoided. In addition, it is recognised that hard water is not as good a solvent as soft water, and at the same time requires an increased quantity of chemicals to be used in certain processes

To-day, continued Mr. Waddington, it is the exception to find an up-to-date factory without one or more base exchange softeners capable of reducing the greater volume of the water used to zero hardness, that is, to considerably less than one degree of hardness. A soft water is generally more corrosive than a hard water, and although dissolved oxygen is an important factor in corrosion, it is usually found that the balance between alkalinity and free carbon dioxide is at fault, and it is by adjustment of this latter constituent that the corrosive can be most conveniently corrected. The greater the quantity of carbon dioxide present in a water of a given temporary hardness the lower is the pH value, and, consequently, the greater is its tendency to prove corrosive. The addition of a suitable alkali will neutralise a portion of the free carbon dioxide and so result in an increase in the pH value of the water and, other factors being constant, the higher the ρ H value, the less corrosive will the water become. The corrosive action of water on iron reaches a minimum at a ρ H value of q.

In all plants using coagulants it is necessary to adjust the chemical dose in accordance with the variation in the raw

Letters to the Editor

Reclaimed Rubber

SIR,—In The CHEMICAL AGE, December 8, you have an article regarding the Rubber Regenerating Co., Ltd., of Trafford Park, Manchester, the following statement being made:—

"The Rubber Regenerating Co., Ltd., whose works are at Trafford Park, Manchester, is the largest producer of alkali reclaim rubber in the United Kingdom and produces more than all its competitors put together."

So far from this being the case, no one of the four largest manufacturers of reclaimed rubber in Lancashire produces more than 50 per cent. of the total home output.

Obviously the above quoted mis-statement is prejudicial to our business interests and is calculated to cast reflection upon our standing as important manufacturers of reclaimed rubber.

We shall appreciate it if you will correct the statement.— Yours faithfully,

G. CORNWELL,

Director, Joseph Anderson and Sons, Ltd. M. H. MACKUSICK,

M. H. MACKUSICK, Managing Director, Northwestern Rubber Co. H. TOPPING,

Director, British Recovered Rubber and Chemical Co., Ltd.

Director, British Recovered Russer and Chemical Co., 1.td.

[Joseph Anderson and Sons, Ltd., was established in 1879; the British Recovered Rubber and Chemical Co., Ltd., 1872; the Northwestern Rubber Co., 1901. In all three cases the chief product is alkali reclaim, although a small proportion of acid and oil reclaimed rubber is also made. The Northwestern Rubber Co. exports 20 per cent. of its total sales, whilst the British Recovered Rubber and Chemical Co. and Joseph Anderson and Sons export practically nil.—ED., C.A.]

The Farce of Pharmacy

SIR,—Mr. Corr's letter in THE CHEMICAL AGE of December 8 calls for some reply as there are many contentious points. The pharmacist may be regarded as a qualified member of the Pharmaceutical Society or one with further qualifications in pharmacy. The Society ensures that such people are knowledgeable as regards the various drugs and medicaments coming within the scope of the Poisons Act, and, at the same time, their working knowledge of the processes of analysis as applied to such drugs, etc. What chemists who are not pharmacists have similar qualifications?

Mr. Corr overlooks the point that the possession of a qualification such as "M.P.S." does not *ipso facto* mean that the holder will be able to control manufacture, etc.—it merely ensures that persons otherwise qualified by specialisation to supervise will be under the disciplinary control of a professional body. Very few university-trained chemists would be able to dogmatise on the chemistry of drugs, etc., and all chemists, whatever their origin, would require to make a special study of the manufacture under discussion. Mr. Corr is in error in saying that pharmacists are considered fully trained in nine months, and his eulogy of technical chemists differs materially from the recently expressed opinion of Dr. Lessing.—Yours truly,

LEONARD A. BAILEY, Ph.C., M.P.S.

water. Faulty coagulation means faulty floc formation, and this will cause either floc to pass through the filter, or else it will shorten the filter runs and so lead to a large increase in consumption of wash water. Only when a properly formed floc is obtained can the highest efficiency from sedimentation tanks and filters be attained. Some flocs are very small and do not aggregate readily, and these not only do not settle but also tend to pass through the filter bed, causing trouble in whatever subsequent processes the water may be used. Generally, an underdosage of alum, or deficiency in alkalinity, is the cause of this type of floc formation. Overdosage with coagulant or alkaline reagent often leads to the formation of light, fragile, almost fluid, type of floc, which is also slow-settling and tends to pass the filter, yielding an opalescent filtrate.

Liverpool Chemistry Dinner

Professor J. F. Thorpe Talks of Chemistry House

LIVERPOOL'S annual "Chemistry Dinner" was held at the Adelphi Hotel on December 15. The dinner was as usual organised by the local sections of the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry and the British Association of Chemists, and was attended by the presidents of all four organisations. Professor W. H. Roberts, city analyst of Liverpool, presided. It is interesting to note that this year both the president of the Society of Chemical Industry and the president of the British Association of Chemists belong to Liverpool.

Ordental Lines, Jone Verspool. Professor JOCLIN F. THORPS, president of the Institute of Chemistry, proposing "The City and Commerce of Liverpool," spoke of the tremendous expansion of Liverpool's commercial interests in the past 100 years. It was perhaps unfortunate, he said, that the invitations to the dinner had not been postponed for 100 years, because then the meal would probably consist of a vitamin tabloid and a dose of Ultra-violet ray. "I am perfectly sure," added Professor Thorpe, "that as soon as we get our Chemistry House, we can get together and form some sort of permanent combination."

The Lord Mayor of Liverpool (Alderman F. T. RICHARD-SON), who was accompanied by the Lady Mayoress, said there were many things about Liverpool of which he was very proud. He understood that receipts from the new Mersey Tunnel had so far exceeded the estimates that since Queensway was opened more had been taken in revenue already than was estimated for the whole twelve months and it was quite possible that the toll period might be reduced, if the revenue as at present.

Professor ROBERTS proposed the toast of the guests, and referred in particular to Alderman Edwin Thompson, president of the Society of Chemical Industry, and Alderman Muirhead, chairman of the health committee. They had, he said, attended every chemistry dinner since the war.

Professor G. T. MORGAN, president of the Chemical Society, said the problem of reunion between the three chemical bodies had been engaging attention for a long time, but he was afraid that the first step would not be a very popular one. The great point to remember was that it was the first step. "Little by little," he added, "I think we shall effect economies in publication and possibly in administration." Speaking of Liverpool's importance from the viewpoint of chemistry, Professor Morgan said that at the University there were "quite a number of Professorships of Chemistry," and he believed he was right in saying that the Brunner chair was one of the first to be founded in the country. All over the world where chemistry was practised the alumni of the Liverpool school were found.

Alderman THOMPSON proposed a vote of thanks to Professor Roberts.

EXPERIMENTS have recently been made in France with the incorporation of rosin in road-resurfacing materials. Tests carried on consist of mixing dark grades of rosin with various proportions of tar or bituminous emulsions. If these experiments are successful and rosin prices are not too high, a large outlet for rosin should be developed.

News from the Allied Industries

Shale Oil

SCOTTISH OILS, LTD., have confirmed that two bores near West Calder have struck shale. Shale supplies are diminishing at another of the company's mines, and the new seams may be worked in the near future. Scottish Oils, Ltd., are controlled by the Anglo-Persian Oil Co., Ltd.

Beet Sugar

IT IS UNDERSTOOD that the Centrale Suiker-Maatschappij (Central Sugar Co.), of Holland, has sold its interests in English beet-sugar companies. The buyers are a strong financial group headed by a City finance house. Tate and Lyle, Ltd., the leading British refining company, which already has considerable interests in the beet-sugar industry, is not associated in the purchase. It is believed that the Central Sugar Co.'s decision to sell its British interests was to a large extent due to its desire to find funds to redeem outstanding bond issues. The Central Sugar Co.'s British interests included the Ely Beet Sugar Factory, the King's Lynn Beet Sugar Factory, and the English Beet Sugar Corporation, and it has all along played a leading part in the development of the beet-sugar industry in this country.

Iron and Steel

PRODUCTION FIGURES released this month show that the Soviet Union has already produced more pig iron this year than England did in the peak year 1929. The 10,000,000 tons provided for in the "plan" for this year has already been produced. It is 48 per cent, more than last year's production, and amounts to 17 per cent. of the world's total annual output. The number of blast-furnaces now operating is 114. The production of steel is still lagging.

THE MONTHLY RETURN ISSUED by the British Iron and Steel Federation states that there were 96 furnaces in blast at the end of November, compared with 97 at the beginning of the month, two furnaces having been blown in, and three baving ceased operations during the month. The production of pig iron in November amounted to 507,600 tons, compared with 527,100 tons in October, and 374,900 tons in November, 1933. The production includes 131,400 tons of hematic, 248,000 tons of basic, 113,600 tons of foundry and 8,400 tons of forge pigiron. The output of steel ingots and castings amounted to 706,0000 tons, compared with \$12,000 tons in October and (55,000 tons in November, 1933.)

Tanning

TRADE IN THE TANNING INDUSTRY HAS IMPROVED during the last two months after the usual late summer lull. Sole leather tanners are receiving more inquiries. Manufacturers of all kinds of chrome leather are very busy. The Danish firm, Bjornow, has taken the vacant works at Grantham for the production of light and upper leathers. Inquiries for speciality chrome leathers are very numerous. Shoe suede leathers are having a good run. There is a growing demand the high-class fat liquoring oils owing to activity in the manufacture of cheap gloving leathers. The Christmas demand for cellulose, finished hard-grained goat skins appears to be greater than ever and large quantities of cellulose finish in all shades are being consumed in this way.

Non-Ferrous Metals

THE WORLD ZINC FOUNDRY PRODUCTION during October totalled 105,640 tons, according to the Metal Company of Frankfort, against 94,226 tons in September.

COPPER PRODUCERS in New York regard the opening months of 1935 as the earliest possible date for the gathering of a copper restriction conference. Belgian producers are understood to be viewing the idea of restriction more favourably.

A DEPUTATION FROM SWANSEA, headed by the Mayor and Deputy Mayor, attended the London offices of Sir William Firth, on December 7, to make representations for the reopening of Sir William's smelting works, at Cwmfelin Wells.

BOWATER'S PAPER MILLS, LTD., held their annual general meeting in London on December 6. Mr. Eric V. Bowater (chairman of the company), who presided, said that the year had been one of exceptional difficulty for the newsprint industry; nevertheless, the company had produced and sold more newsprint than in any previous year, as had also their associated company, Bowater's Mersey Paper Mills. The results attained had been made possible by the fullest operation of the company's mills, the increase in sales, and the modern plant and machinery with which their mills were equipped. The large sums of money spent in maintaining the plant and equipment at a high state of efficiency and in keeping it up to date were now standing them in good stead. sugar from abroad.

Personal Notes

DR. L. G. PAUL, until recently Huddersfield Borough Analyst, has died at his home in Huddersfield, at the age of 77.

MR. HERBERT WILLIAM WALKER, J.P., owner of the Whitehaven and Workington tanneries, died in Whitehaven Hospital on December 14.

LORD GREENWAY OF STANBRIDGE EARLS, one of the founders and the first president of the Anglo-Persian Oil Co., died on December 17, aged 77.

PROFESSOR ANDREW HUNTER has announced his intention of resigning from the Chair of Physiological Chemistry at the Glasgow University as from September 30, 1035, in view of his appointment to the Chair of Pathological Chemistry in the University of Toronto.

MR. A. T. S. ZEALY, J.P., of Norton-on-Tees, chairman of the Billingham Urban District Council, and a member of the Durham County Council, has been appointed managing director of the Billingham works of Imperial Chemical Industries, Ltd., in succession to Dr. R. E. Slade, who has moved to London. At present works manager and delegate director, Mr. Zealy, who thirteen years ago was process manager of the first synthetic ammonia plant to be erected, became associated with the firm in 1921 when the Billingham works were controlled by Brunner, Mond and Co. VISCOUNT WOLMER, M.P., has been appointed chairman of the Cement Makers' Federation.

PROFESSOR A. W. NASH, F.C.S., is to advise the National Coke and Oil Co. on technical questions on oil production, in collaboration with Professor C. H. Lander, D.Sc.

MR. J. MORRISON WEIR, M.A., B.Sc., British Dyestuffs Corporation, Ltd., has been appointed external examiner for Bachelors' and Masters' degrees and for diplomas in technical chemistry at the University of Edinburgh.

MR. ERIC WATSON, until recently manager of Lever Brothers' oil refinery and hydrogenation plant at Bromborough, is to succeed Mr. J. R. Campbell as general manager of the Bromborough margarine works of Van den Berghs and Jurgens, Ltd.

DR. ERNEST MATTHEWS, assistant lecturer in chemistry and demonstrator in prosthetics in Guy's Hospital Dental School, London, has been appointed director of the prosthetics department in the dental hospital and lecturer in dental prosthetics at Manchester University. Dr. Bernard Cavanagh has been appointed honorary research Fellow for 1934-5 in physical chemistry, Dr. Isador Fankuchen in physics, and Dr. E. T. Stiller in organic chemistry.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

THERE are no changes to report in the general prices of heavy chemicals, rubber chemicals, wood distillation products, per-fumery chemicals, essential oils and intermediates, but there have howevery chemically, essential one and intermediates, but there have been a few slight changes in pharmaceutical products. Citric acid is now 113d, per B., sodium barbitonum 16s, to 17s., and epinedrine hydrochloride 5s. 9d, to 6s. 3d. In the coal tar pro-ducts section the price of medium soft pitch has been reduced to 43s, per ton. Unless otherwise stated the prices below cover fair quantitis net and nakd at sellers' works.

LONDON.—There is no change to report in the heavy chemicals market. There is still a steady demand. Prices of coal tar products continue firm and there is no change to report from last week.

MANCHESTER .- Conditions on the Manchester chemical market during the past week have been definitely subsiding into seasonal

General Chemicals

ACETONE .- LONDON : £65 to £68 per ton ; SCOTLAND : £66 to £68

- ACKTONE.-LONDON: £65 to £68 per ton; SCOTIAND: £66 to £68 ex wharf, according to quantity.
 ACID, ACKTLC.-TCECH, 80%, £38 5s. to £40 5s.; pure 80%, £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; kech., 80%, £38 5s. to £42 5s.; tech., 60%, £39 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech. 80%, £38 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £52, tech., 80%, £25 10s.; per ton; crystal, £26 10s.; powdered, £27 10s.; extra finely powdered, £29 10s. packed in 1-cwt, bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots.

- ACID, CHROMIC.--103d, per lb., less 24%, d/d U.K. ACID, CHROMIC.--112d, per lb., less 5%. MANCHESTER: 11d. to 114d. ACID, CRESVID.-97/99%, ls. 8d. to ls. 9d. per gal.; 98/100%,

- ACID, CRESVILC.-97/99%, 1s. 8d. to 1s. 9d. per gal.; 98/100%, 2s. to 2s. 2d.
 ACID, FORMIC.-LONDON: £40 to £45 per ton.
 ACID, FORMIC.-ENDOR, 50, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works. full wagon loads.
 ACID, LACTIO.-LANCASTIRE: Dark teen., 50% by vol.; £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £25, 50% by weight, £43; 80% by weight, £35; edible, 50% by vol., £41. One-ton lots ex works, barrels free. barrels free
- barrels free.
 ACID, NITRIC.—80% DJ 1011, 1111 OD 121 1018 02 10111, 1111 OD 121 1018 02 10111, 11111, 1111 OD 121 1011, 1111, 11111, 1111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 11111, 111

- £7 to £8 ex store.

- £7 to £8 ex store.
 AMMONIA, ANHYDROUS.—Spot, 10d, per lb. d/d in cylinders.
 SCOTLAND : 10d. to 1s, containers extra and returnable.
 AMMONIA, LIQUID.—SCOTLAND : 80°, 24d. to 3d. per lb., d/d.
 AMMONIUM BICHROMARE.—Sd. per lb. d/d U.K.
 AMMONIUM CARBONATE, SCOTLAND : Lump, £30 per ton;
 powdered, £33, in 5-ewt, casks d/d buyers' premises U.K.
 AMMONIUM CHLORIDE.—237 to £45 per ton, carriage paid. LONpon: Fine white crystals, £18 to £19. (See also Salammoniac.)
 AMMONIUM CHLORIDE.—SCOTLAND : Erlibid do tooth
- ANTMONIV OXIDE.—SCOTLAND : British dog tooth crystals, £32 to £35 per ton carriage paid according to quan-tity. (See also Salammoniac.) ANTMONIV OXIDE.—SCOTLAND : Spot, £34 per ton, c.i.f. U.K.
- ports.
- ports. ANTHMONY SULPHIDE.—Golden 6jd. to 1s. 1jd. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb., according to quality. ARSENIC.—LONDON: £16 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £21 to £22 ex store. ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb. BARTING CHILORIDE.—£11 per ton. SCOTLAND: £10 10s. BARTING.—66 10s. to £2 per ton. BISULPHITE of LIME.—£6 10s. per ton f.or. London. BISULPHITE of LIME.—£50, 35/37, £7 19s. per ton /d station in casks, special terms for contract. SCOTLAND: £8 in 5/6 cwt, casks for contracts over 1934/1935. BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in

duiness. Stocktaking operations at a number of consuming establishments have resulted in a curtailment of deliveries and these will be reduced much more substantially towards the end of duiness. the week and almost throughout next week, in consequence of the week and almost throughout next week, in consequence of the holidays. On the other hand, extensions of stoppages due to the improved trade conditions will be less in evidence than they have been in recent years. Apart from some new contracts over next year, largely in the nature of replacement business, market conditions have been relatively slow this week, though the general steadiness of prices is still a feature. Traders are mostly disposed to look for a resumption of business on at least the such of weard marking as you are the suggest and the start of the start scale of recent months as soon as the seasonal quietness has passed.

SCOTLAND,---The Scottish heavy chemical market is extremely quiet at the present time.

1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots, CADMIUM SULPHIDE.--28. 5d. to 22. 9d. CALCIUM CHLORIDE.--Solid 70/75% spot, £5 5s. per ton d/d

- station in drums.

- CARBON BISULPHIDE.—£30 to £32 per ton, drums extra. CARBON BISULPHIDE.—£30 to £32 per ton, drums extra. CARBON BLACK.—32d, to 5d. per lb. LONDON: 44d, to 5d. CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums
- extra.
- CHROMIUM OXIDE.-103d, per lb., according to quantity d/d U.K.; green, ls. 2d. per lb. CHROMETAN.-Crystals, 34d. per lb.; liquor, £19 10s. per ton d/d.
- COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works. CREAM OF TARTAR.—LONDON: £4 2s. 6d. per cwt. SCOTLAND:

- CREAM OF LARGAR. -LONDON: 2.4 28. 6d. per CWL. SCOTLAND: £4 28. less 24 per cent. DINITROTOLUENE.-66/68° C., 9d. per lb. DIPHENYLIGUANIDINE.-28. 2d. per lb. FORMALDEHTVDE.-LONDON: £25 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.
- IODINE .- Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.
- IODINE.—RESUDINGU D.F., 08. 30. 10 88. 40. per m.
 LAMPELGK.—L45 to 448 per ton.
 LEAD ACETATE.—LONDON : White, £34 108. per ton; brown, £1 per ton less. SCOTLAND : White, £34 to £35; brown, £1 per ton less. MANCHESTER : White, £34; brown, £32.
 LEAD NITRATE.—£27 108. per ton.
 LEAD, RED.—SCOTLAND : £24 to £26 per ton less 24%; d/d buyer's worked.
- works.
- LEAD, WHITE.-SCOTLAND : £39 per ton, carriage paid. LONDON : £36 10s.
- £36 10s.
 LITHOPONE.-30%, £.7 to £17 10s. per ton.
 MAGNESTE.-SCOTLAND: Ground calcined, £9 per ton, ex store.
 METRUTATED SPIRIT.-61 O.P. Industrial, 1s, 6d, to 2s, 1d, per gal. Pyridinised industrial, 1s, 8d, to 2s, 3d. Mineralised, 2s, 7d, to 3s, 1d. 64 O.P. 1d, extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., METRUTATED SPIRIT.--GI O.P. Industrial, 1s, 6d, to 2s, 1d, per gal. Pyridinised industrial, 1s, 8d, to 2s, 3d. Mineralised, 2s, 7d, to 3s, 1d. 64 O.P. 1d, extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s, 9d, to 2s, 4d.
 NICKEL AMMONIUM SULPHATE.--£49 per ton d/d.
 NICKEL SULPHATE.--£49 per ton d/d.
 PHENOL.--81d. to 83d. per 1b. without engagement.
 POTASIUM BICHMONTE.-Crystals and Granular, 5d. per 1b. net d/d U.K. Discount according to quantity. Ground 54d. LONDON: 5d. per 1b. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or ci.f. Irish Ports. MANCHESTER: 5d.
 POTASIUM CHLORATE.-LONDON: £37 to £40 per ton. SCOTLAND: 992/100%, powder, £37. MANCHESTER: £28.

- Portassium Childrate.—London : £37 to £40 per ton. Scotland : 993/100%, powder, £37. Manchester: £38. Porassium Chromate.—63d, per 1b. d/d U.K. Portassium Nirate.—Scotland : Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store. Portassium Permanorate.—London: 93d. per 1b. Scotland : B.P. crystals, 9d. Manchester: B.P., 104d. Portassium Prussiate.—London : 93d. per 1b. Scotland : Yellow spot, 83d. ex store. Manchester: Yellow, 84d. Salammonica.—First lump spot, £41 17s. 6d. per ton d/d in barrels. barrels
- Borreis.
 SODA ASH.--58% spot, £5 15s. per ton f.o.r. in bags.
 SODA, CAUSTIC.--Solid 76/77° spot, £13 17s. 6d. per ton d/d station.
 SCOTLAND: Powdered 38/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 10s. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4ton lots; contracts 10s. per ton less. £14 contracts.
- SODA CRYSTALS .- Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
- SODIUM ACETATE .- £22 per ton. LONDON : £23.

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- SODIUM BIGARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND. Refined recrystallised £10 15s. ex quay or station. MANCHESTER: £10 10s. SODIUM BIGHROMATE.—Crystals cake and powder 4d. per lb. net
- d/d U.K. discount according to quantity. Anhydrous, 5d per lb. LONDON: 4d per lb. net for spot lots and 4d. per lb. with discounts for contract quantities. SCOTLAND: 4d. de-
- livered buyer's premises with concession for contracts. SODIUM BISULTHITE POWDER.-60/62%, £18 10s. per ton d/d 1-cwt iron drums for home trade.
- SODIUM CARBONATE (SODA CRYSTALS) --SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots

- per ton extra. Light Soda Ash 27 ex quay, min. 4-ton lots with reductions for contracts. SODIUM CHIORATE.—452 10s. per ton. SODIUM CHIORATE.—44, per lb, d/d U.K. SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £95 s. per ton ex stations, min. 4-ton lots, Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER : Commer-cient (10.45) s. Source and the station of the stat cial, £10 5s.; photographic, £15.
- SODIUM META SILICATE.—£16 per ton, d/d U.K. in cwt. bags. SODIUM IODIDE.—B.P., 6s. per lb. SODIUM NITRITE.—LONDON. Spot, £18 to £20 per ton d/d station in drums.
- SODIUM PERBORATE.-LONDON : 10d. per lb.

- in drums,
 SODIUM PERBORATE.—LONDON: 10d, per lb.
 SODIUM PRUSSHATE.—LONDON: 5d, to 5jd, per lb.
 SODIUM PRUSSHATE.—LONDON: 5d, to 5jd, per lb.
 SODIUM PRUSSHATE.—LONDON: 5d, to 5jd.
 SULPHUR.—SULPATE. (GLAUBER SALTS).—24 2s, 6d, per ton 2, 50 to 5jd.
 SODIUM SULPHATE (GLAUBER SALTS).—24 2s, 6d, per ton d/d SCOTTAND: EB 10s.
 SODIUM SULPHATE (GLAUBER SALTS).—24 2s, 6d, per ton d/d SCOTTAND: EB 10s.
 SODIUM SULPHATE (GLAUBER SALTS).—24 2s, 6d, per ton d/d SCOTTAND: EDITION SULPHATE (SALT CARE).—Unground spot, £3 15s.
 SODIUM SULPHATE (SALT CARE).—Unground spot, £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s.
 SODIUM SULPHIDE.—Solid 60/62%, Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 2s. 6d., d/d buyer's works on contract, min, 4+ton lots. Spot solid 5s, per ton extra. Crystals, 20/32%, £11; solid 50/62%, £12, sper ton c) (d) station in kegs. Commercial spot, £13 10s. per ton d/d station in kegs. Commercial spot, £19 10s. d/d station in kegs. Commercial spot, £19 10s. d/d station in bags.
 SULPHATE (SALT).—RANCHNSTER: £14 5s. per ton f.o.b.
 SULPHATE (SALT).—RANCHNSTER: £14 5s. Per ton f.o.b.
 SULPHUR CHLORIDE.—5d, to 7d. per tb, according to quality. Commercial, £50 to £60 per ton according to quality. Commercial, £50 to £60 per ton according to quality. Commercial, £50 to £60 per ton according to quality. Commercial, £50 to £55.
 VERMILION.—Pale or deep, 3s. 11d, to 4s. 1d. per 1b.
 ZINC CHLORIDE.—SOL 55.
 VERMILION.—Pater EDITIAN 10 to 55.
 VERMILION.—Pale or deep, 3s. 11d; to 4s. 1d. per 1b.
 ZINC CHLORIDE.—SON 51; E12 per ton. SCOTLAND ; £10 10s.

- ton f.o.b. U.K. ports. ZING SULPHATE.—LONDON: £12 per ton. SCOTLAND: £10 10s. ZINC SULPHIDE.—11d. to 1s. per lb.

Coal Tar Products

- CUAI 121 FTUGUEUS ACID, CARBOLIC.—Crystals, 8]d, to 83d, per lb.; crude, 60's, to 2s. 2]d. per gal. MANCHESTER: Crystals, 73d. per lb.; crude, 1s. 11d. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d. ACID, CRESTLIC.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale 98%, * 1s. 6d. to 1s. 7d.; according to specification. LONDON: 98/100%, 1s. 3d. to 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3g. BEX201.—At works, crude, 9d. to 94d, per gal.; standard motor, 1s. 3]d. to 1s. 4d.; 90%, 1s. 4d. to 1s. 4d.; pure, 1s. 74d. to 1s. 8d. LONDON: Motor, 1s. 6jd. SCOTLAND: Motor, 1s. 6jd. CRE050TE.—B.S.I. Specification standard, 4d. to 4d.d, per gal. f.or. Home, 33d. d/d. LONDON: 33d. f.or., North; 4d. Lon-don. MANCHESTER: 4'd. to 4'd.; light, 4jd.; heavy, 4d. to 4'd. to 41d.
- to 44d. NAPHTRA.-Solvent, 90/160%, 1s. 6d. to 1s. 7d. per gal.; 95/160%, 1s. 7d.; 99%, 11d. to 1s. 1d. LONDON: Solvent, 1s. 34d. to 1s. 4d.; heavy, 11d. to 1s. 04d. f.or. SCOTLAND: 90/160% 1s. 3d. to 1s. 34d.; 90/190%, 11d. to 1s. 2d. NAPHTHALENS.-Purified crystals, £10 per ton in bags. LON-DON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s. PTICH.-Medium soft, 48s. per ton. LONDON: 47s. 6d. per ton, f.o.b. East Coast port. PYRIDINE.-90/140, 6s. 9d. to 2s. 6d. per gal.; 90/180, 2s. 3d. TOLUDC.-90%, 1s. 10d. to 1s. 11d. per gal.; pure, 2s. 2d. to 2s. 3d. XYLOL.-Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 1d. to 2s. 2d.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).-1s. 9¹/₃d. per lb. ACID, GAMMA.-Spot, 4^s, per lb. 100% d/d buyer's works. ACID, H.-Spot, 2s. 4¹/₃d. per lb. 100% d/d buyer's works.

- ACID NAPHTHIONIC .- 1s. 8d. per lb.
- ACID, NEVILLE AND WINTHER .- Spot, 3s. per lb. 100%.
- ACID, SULPHANILIC .- Spot, 8d. per lb. 100% d/d buyer's works.

- ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works. ANILINE SAITS.—Spot, 8d. per lb. d/d buyer's works, esks free. BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra. BENZALDEHYDE.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.
- BENZIDINE HCL.-2s. 5d. per lb.
- p CRESOL 34.5° C.—2s, out per 15, in ton lots, m CRESOL 34.5° C.—2s, per 1b, in ton lots, D1CHLORANILINE.—1s, 111d, to 2s, 3d, per 1b,
- DIMETHYLANILINE .- Spot, 1s. 6d. per lb., package extra.
- DINITROBENZENE.—8d. per lb. DINITROBENZENE.—8d. per lb. DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 011d.
- DINITROCHLORBENZENE, SOLID.-£72 per ton.
- DIPHENYLAMINE.-Spot, 2s. per lb., d/d buyer's works.

- Differentiative.—Spot, 28. 4d, per lb., d/d buyer's works. g-Narhtfol.—Spot, 28. 4d, per lb., d/d buyer's works. g-Narhtfol.—Spot, £78 l5s, per ton in paper bags. α -Narhtfol.—Spot, £78 l5s, per ton. d/d buyer's works. g-Narhtfiltamine.—Spot, 28. 9d, per lb., d/d buyer's works. σ -Nitranitine.—Sso, 11d, per lb. σ -Nitranitine.—Sso, 126. 7d, per lb. d/d buyer's works.

- m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works. p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.
- NITROBENZENE .- Spot, 41d. to 5d. per lb.; 5-cwt. lots, drums extra.
- NTRONAPHITHALENE.—940. per lb.; P.G., 1s. 04d. per lb. SGDIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb. o-TOLUIDINE.—94d. to 11d. per lb.

- p-TOLUIDINE.-1s. 11d. per lb.

Wood Distillation Products

- ACETATE OF LIME.—Brown, £9 to £10. Grey, £15 to £16. Liquor, brown, 30° Tw., 7d. to 9d. per gal. MANCHESTER: Brown, £12 10s.; grey, £17 10s. ACETIC ACID, TECHNICAL, 40%.—£17 to £18 per ton. ANVL ACETATE, TECHNICAL, 40%.—£17 to £18 per ton. ANVL ACETATE, TECHNICAL, 40%.—£17 to £18 per ton. CHARCOAL.—£6 5s. to £10 per ton. WOOD CHESOTE.—Unrefined, 6d. to 9d. per gal. WOOD NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal. Solvent, 3s. 9d. to 4s. 6d. per gal.

- WOOD TAR.-£2 to £4 per ton.

Nitrogen Fertilisers

- SULPHATE OF AMMONIA.—Dec., £7 0s. 6d.; Jan., 1935, £7 2s.; Feb., £7 3s. 6d.; Mar./June, £7 5s.; for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.
- CYANAMDE.—Dec., £7; Jan., 1935, £7 1s. 3d.; Feb., £7 2s. 6d.; Mar., £7 3s. 9d.; Apr./June, £7 5s.; delivered in 4-ton lots
- Mar., & J. S., 9d.; Apr./June, & J. 5s.; delivered in 4-ton lots to farmer's nearest station. NITRATE OF SOA.--£7 12s. 6d. per ton for delivery to June, 1935, in 6-ton lots, carriage paid to farmer's nearest station for material basis 15.5% or 16% nitrogen. NITRO-CHAIK.--£7 5s. per ton to June, 1935, in 6-ton lots carriage paid to farmer's nearest station for material basis 15.5% nitrogen.
- nitrogen.
- CONCENTRATED COMPLETE FERTILISERS.-£10 5s. to £10 17s. 6d. per ton according to percentage of constituents, for delivery up to June, 1935, in 6-ton lots carriage paid to farmer's nearest station.
- NITROGEN PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton, for delivery up to June, 1935, in 6-ton lots carriage paid to farmer's nearest station.

Latest Oil Prices

- LONDON, Dec. 19.—LINSEED OIL was firm. Spot, £19 15s. (small quantities 30s. extra); Jan., £18 10s.; Jan.-April, £18 17s. 6d.; May-Aug., £19 10s.; Sept.-Dece, £20, naked. SOYA BEAN OIL was steady. Oriental (bulk), Dec.-Jan. shipment, £16 Oh, was steady. Ohenan (bulk), Dothal, extracted, 228 [16s, per ton. RAFE Oh, was steady. Crude, extracted, 228 [16s, technical refined, £30, naked, ex wharf. Corros Oh. was steady. Egyptian crude, £20; refined common edible, £24; and deodorised, £25 [10s., naked, ex mill (small lots 30s.)] American, spot, 45s. per extra). TURPENTINE was quiet. ewt.
- cwt.
 HULL—LINSEED OIL, spot, quoted £19 17s. 6d. per ton; Dec., £19 2s. 6d.; Jan.-April, £19 5s.; May-Aug., £19 7s. 6d.; Sept.-Dec., £19 12s. 6d., naked. COTTON OIL, Egyptian, erude, spot, £20 10s.; edible, refined, spot, £22 10s.; technical, spot, £22 10s. decodorised, £24 10s., naked. PAIM KERKEL OIL erude, f.m.q., spot, £15, naked. GROUNDWUT OIL, extracted, spot, £24 decodorised, £28. RAFE OIL, extracted, spot, £27 10s.; refined. £29. SOYA OIL, extracted, spot, £21 10s.; decodorised, £21 10s. per ton. CASTOR OIL, pharmaceutical, 37s.; first, 32s.; second, 29s. per ewt. TURPENTINE, American, spot, 47s. per ewt. spot, 47s. per cwt.

Inventions in the Chemical Industry

Patent Specifications and Applications

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Complete Specifications Open to Public Inspection

HYDROCARBON MIXTURES, separation.--Standard Oil Develop-ment Co. June 10, 1933. 7702/34.

PETROLEUM and like hydrocarbons.—Standard Oil Development Co. June 6, 1933. 10191/34. RESINOUS MATERIALS.—Standard Oil Development Co. June

6, 1933. 10231/34.

b, 1955. 19251/34. PHOSPHATDE PREPARATIONS, production.—Hanseatische Mühlen-werke A.-G. June 8, 1933. 10685/34. READERING PILMS of cellulose substances impermeable.—A. Maurer Soc. Anon., Ing. June 9, 1933. 10715/34. DYEING ANIMAL FIRES.—Soc. of Chemical Industry in Basle. Jung 9, 1993. 11057/24.

June 9, 1933. 11065/34.

June 9, 1955. 11003/34. POLYMERISATION FRODUCTS, manufacture.—Standard Oil De-velopment Co. June 6, 1933. 14134/34. CAREDONACEOUS SUBSTANCES, thermal treatment.—I. G. Farben-industric. June 8, 1933. 15410/34.

Industrie. June 8, 1953. 19410/54. TENTLE ASSISTATS, manufacture of products useful.—Soc. of Chemical Industry in Basle. June 9, 1933. 15830/34. PUER ALUMINA, manufacture.—Vereinigte Aluminium-Werke A. G., and T. Goldschmidt A.-G. June 8, 1933. 16396/34. TIN OXIDE from the instantaneous combustion of a mixture of is easd pulserised, bot, liquid works, marked of a commercially

air and pulverised hot liquid metal, method of commercially manufacturing.-M. Leroy and H. Migeot. June 6, 1933. 16562/34.

ARTIFICAL PRODUCTS OF VISCOSE, methods of manufacturing dulled.--Feldmühle A.-G. Vorm. Loeb, Schoenfeld, and Co. Rorschach June 6, 1933. 16617/34.

POLYMETHINE DYESTUFFS, manufacture.-I. G. Farbenindustrie.

June 10, 1933. 16720/34. SUSTITUTED ALKALI METAL AMIDES, manufacture.—K. Ziegler. June 7, 1933. 16846/34. MANUFACTURING SOAP.—V. Boulez. June 8, 1933. 16993/34.

DIPHENYLMETHANE DERIVATIVES, manufacture.--I. G. Farbeninustrie. June 9, 1933. 17065/34. 1.4-DIHALOGENANTHRAQUINONE-2-CARBOXYLIC ACIDS, manufacture. dustrie

G. Farbenindustrie. June 9, 1933. 17066/34. T.

INDIGOID VAT DYESTUFFS, manufacture.—I. G. Farbenindustrie. June 8, 1933. 17067/34.

Raw site, treatment.-E. I. du Pont de Nemours and Co. June 10, 1933. 17277/34.

DYEING ANIMAL FIBRES .- Soc. of Chemical Industry in Basle. June 9, 1933. 17288/34.

PLASTICISATION of cellulose esters or ethers.-British Celanese, April 13, 1932. 34813/34. Ltd.

Specifications Accepted with Dates of Application

DIPHENYL-AMINE SULPHONE SERIES, process for the manufacture

DITINGTORATING STATISTICS IN STATES, DATAS, DATA

Tion of compositions comprising.—Dunlop Rubber Co., Ltd., D. F. Twiss and A. E. T. Neale. June 28, 1933. 420,386. PLASTIC MATERIALS derived from urea and formaldehyde, method

PLASTIC MATERIALS derived from urea and formaldelyde, method of preparing.—Fabriques de Produits de Chimie Organique de Laire, and R. Armenault. June 30, 1932. 420,317. INSOLUBLE CEMENT and process of making same.—W. W. Triggs (H. G. Halloran). Sept. 16, 1933. 420,401. ALKYLOLAMINE SOAPS and related products, treatment.—W. J. Hund and L. Rosenstein. April 11, 1933. 420,269. SOLUBLE STARCH, process of manufacture.—Duintjer Wilkens Meihuizen and Co. Naanulooze Vennootschap. May 5, 1933. 200 275.

420.275.

420,275. DYESTUFFS, production and use.—British Celanese, Ltd., G. H. Ellis and F. Brown. Feb. 17, 1932. 420,591. DYESTUFFS, production and use.—British Celanese, Ltd., G. H. Ellis and F. Brown. Feb. 17, 1932. 420,593. CHLORINATION OF HYDROARBONS.—L. A. Levy and D. W. West. April 24, 1933. 420,520. FERTILISERS.—Atmospheric Nitrogen Corporation. May 13, 1929. 490.5698

1932. 420,598.

RESINOUS CONDENSATION PRODUCTS, manufacture and production. anonyuco usubessarius PRODUCTS, manufacture and production. J. Y. Johnson (I. G. Farbenindustrie). May 25, 1933. 420,525. REFINING OF COPPER.—H. W. Brownsdon and Imperial Chemical Industries, Ltd. May 29, 1933. 420,671. REFINING ZINC, process.—D. R. Tullis, P. Oakley and G. P. Fenner. May 30, 1933. 420,672.

PLASTIC COMPOSITION OF putty.-C. W. Richards, H. Dodd and Imperial Chemical Industries, Ltd. May 30, 1933. 420,528. CELULOSE ESTERS, manufacture.-L. Rubenstein and Imperial Chemical Industries, Ltd. May 30, 1933. 420,529. POLYMERIC CARBOXYLIC ACID, and the production of shaped arti-

cles therefrom, manufacture of metal salts.—I. G. Farbenindustrie. June 2, 1932. 420,533.

DYEING PELTS, furs, or the like.-W. W. Groves (I. G. Farben-industrie). June 2, 1933. 420,751.

OXAZINE DYESTUFFS, manufacture .- I. G. Farbenindustrie. June 4, 1932. 420,683.

DYESTUFFS of the anthraquinone series, process for the manufacture.—I.G. Farbenindustrie. June 6, 1932. 420,688.

DYESTUFF INTERMEDIATES .- Imperial Chemical Industries, Ltd., June

M. Mendoza and F. L. Rose. June 7, 1933. 420,825. ZINC CHLORIDE, manufacture.—Grasselli Chemical Co. 9, 1932. 420,828.

ARTIFICIAL LEATHER, manufacture.—E. I. du Pont de Nemours and Co. June 9, 1932. 420,836. COMBUSTION GASES, purification.—R. Lessing. June 14, 1933.

420.439

AQUEOUS EMULSION of a water-insoluble substance and process of forming the same.—H. Bennett. June 23, 1932. 420,760. ACID AMIDE DERIVATIVES, process for the manufacture.—I. G. Farbenindustrie. Feb. 29, 1932. 420,545.

PRINTING CELLULOSIC MATERIALS with dyestuffs.—Soc. of Chemi-cal Industry in Basle. Dec. 22, 1932. 420,729.

cal Industry in Basic. Dec. 22, 1952. 420, 237.
FEMALE SEXUAL HORMONES, processes for the manufacture.—F.
Hoffmann-La Roche and Co. A.-G. Feb. 24, 1933. 420,632.
MONOAZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Jan.
24, 1933. 420,775.
ALKYL DERIVATIVES of phenolic compounds, production.—
ALKYL DERIVATIVES of phenolic compounds, phenol

Sharples Solvents Corporation. March 24, 1933. 420,636. POLYVINYL COMPOUNDS, manufacture of combinations contain-ing.—Consortium für Elektrochemische Industrie Ges. March 8, 1933. 420,564.

HYDROGEN, manufacture.-G. Natta. June 5, 1934. 420,652. POLYMERIC CARBOXYLIC ACIDS and the production of shaped arti-POLYMERIC CARDOXILC ACDS and the production of snaped arti-cles therefrom, manufacture of metal salts.—I. G. Farbenindus-trie and W. W. Groves. June 1, 1933. 420,589. REACTION FRODUCTS OF ACID AMINES, process for the manufac-ture.—I. G. Farbenindustrie. March 2, 1932. 420,883. FATTY ACIDS, process for the manufacture of reaction products.

1. G. Farbenindustrie. March 2, 1932. 420,884. DYESTUFFS, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). May 29, 1933. 420,743.

Applications for Patents

(December 6 to 12 inclusive).

MERCURY-VAPOUR RECTIFIERS.—Brown, Boveri, et Cie. (Ger-many, Dec. 8, '33.) 35501.

FOAM FORMATION, reduction.—Aktieselskabet Dansk Gærings-Industri. (Denmark, Dec. 12, '33.) 35588. ALUMINOUS MATERIALS, manufacture.—D. Anderson. 35305.

CELLULOSE ESTER PRODUCTS .- H. A. Anden, E. Berl, Distillers o., Ltd., and H. P. Staudinger. 35197.

Co., Ltd., and H. P. Staudinger. BASE-EXCHANGING PRODUCTS.—Auxiliaire des Chemins de Fer et 2'l'Industrie. (France, Nov. 12.) 35689. CASTING METALS.—M. Barre. 35644.

de'l'Industrie.

SUBSTITUTED PYRIDINE-ORTHO-DICARBOXYLIC ACID AMIDES, manufacture .- A. G. Bloxam (Soc. of Chemical Industry in Basle). 35712.

HYDROCARBONS, etc., coking.--H. A. Brassert and H. A. Brassert and Co., Ltd. 35080.

RESINOUS COMPOSITIONS .- British Thomson-Houston Co., Ltd.

(United States, Dec. 20, '33.) 35585. Porous BODES, manufacture.—Carborundum Co. States, Dec. 8, '33.) 35251. (United

ABRASIVE ARTICLES, manufacture.—Carborundum Co. States, Dec. 8, '33.) 35252. (United

ABRASIVE-COVERED DRUMS .-- Carborundum Co. (United States,

Dec. 8, '33.) 35253. COMPOSITION of matter.—Carborundum Co. (United States. Dec. 11, '33.) 35469.

TITANIUM PIGMENTS, manufacture.--A. Carpmael. 35363, 35364. AZO DVESTUFFS, manufacture.—A. Carpmael. 35584. PRODUCT CONTAINING CASEIN, etc.—Casein Manufacturing Co. of America, Inc., and H. V. Dunham. 35360.

35610 DYEING NATURAL FIBRES .- N. H. Chamberlain.

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AZINE DYESTUFFS, manufacture.-Imperial Chemical Industries, Ltd., and F. H. S. Curd. 35623.

CELLULOSE PRODUCTS, treatment .- Deutsche Hydrierwerke. (Germany, Dec. 12, '33.) 35738.

COMPOSITE RUBBER SHEETING, manufacture.—T. J. Drakeley, E. W. S. Press and W. Ruddy, 35058.

ORGANIC COMPOUNDS, manufacture.-H. Dreyfus. 35189

EXTRACTING COPPER from its compounds.—J. E. Driver. 35636. CONVERSION of olefines into sulphuric esters.—E. I. du Pont de Nemours and Co. (United States, Dec. 7, '33.) 35263. (Cognate with 35262.)

PERFUME-EMITTING MATRIALS, manufacture.—E. I. du Pont de emours and Co. (United States, Dec. 8, '33.) 35477.

Nemours and Co. (United States, Dec. 8, '33.) 35477. CYCLE ESTERS, manufacture.—E. 1, du Pont de Nemours and Co. (United States, Dec. 12, '33.) 35744.

DEUTERIUM, production, etc.-A. and L. Farkas and E. K. Rideal. 35346.

DYEING LEATHER .- J. R. Geigy. (Germany, Dec. 7, '33.) 35193, 35222. AZO DYESTUFFS, manufacture.—W. W. Groves. 35711

WORKING-UP MATERIALS containing lead .- D. Harkort. (Germany, Feb. 5.) 33567.

DYED FILAMENTS, etc., manufacture.—I. G. Farbenindustrie. Germany, Dec. 6, '33.) 35110. (Germany, Dec. 6,

DYEING WITH VAT DYESTUFFS.—I. G. Farbenindustrie. many, Dec. 9, '33.) 35203. (Ger-

WATER-INSOLUBLE AZO DYESTUFFS, etc., manufacture .-- I. G. Farbenindustrie. (Germany, Dec. 8, '33.) 35282.

WATER-INSOLUBLE AZO DYESTUFFS, etc., manufacture.--I. G. Far-benindustrie. (Germany, Dec. 8, '33.) 35283. (Cognate with (Cognate with 35282.)

INJECTION MOULDING .- Imperial Chemical Industries, Ltd. 35622.

AZINE DYESTUFFS, manufacture.-Imperial Chemical Industries, Ltd. 35623.

DECORATIVE EFFECTS in moulded articles, process for obtaining, nperial Chemical Industries, Ltd. 35742. Imperial Chemical Industries, Ltd.

Indertal Chemical Industries, Ltd., 3072.
 IRON OXIDE PIGMENTS.—Imperial Chemical Industries, Ltd.,
 G. W. Midgelow, and P. E. Evans. 35743.
 GOODS OF CELLULAR RUBBER, etc., manufacture.—International

Latex Processes, Ltd., S. D. Taylor and F. W. Modge. 35026

PRODUCING CHLORINATED RUBBER, etc.—International Latex Processes, Ltd. (United States, March 2.) 35405. PRODUCING OLEFINE GASES.—R. G. Israel and H. P. Stephen-

son. 35242, 35243.

COKE, etc., production .- R. G. Israel and H. P. Stephenson. 35244

MONOBASIC ALCOHOLS, production .- R. G. Israel and H. P. 35245 Stephenson. LIGHT OILS, etc., production.-R. G. Israel and H. P. Stephen-

son. 35483. SEMI-COKE, etc , manufacture.---R. G. Israel and H. P. Stephen-

on. 35484, 35485. Chlorine, etc., derivatives of ethane, production.—R. G. son.

Israel and H. P. Stephenson. 35734. COMPOSITION OF MATTER.-J. A. Jackson (Vanderbilt Co.).

35267, 35268, 35269.

WASHING, ETC., AGENTS, manufacture.-J. Y. Johnson. 35441.

COARSELY CRYSTALLINE AMMONIUM SULPHATE, manufacture .---J. Y. Johnson. 35060.

- VALUABLE CARBONACEOUS SUBSTANCES, manufacture.-J. Y. John-35442 son
- QUATERNARY AMMONIUM COMPOUNDS, manufacture,-J. Y. John-35443.
- ACETALDEHYDE, manufacture .-- J. Y. Johnson. 35444 NITROGENOUS CONDENSATION PRODUCTS, manufacture.-J. Y.
- Johnson. 35445.
- ALKALI ORTHOPHOSPHATES, process for production.—Kali-Fors-chungs-Anstalt Ges. (Germany, Dec. 9, '33.) 35427. LIQUID RUBBER LATEX, anti-coagulation, etc.—A. T. B. Kell. 35507.
- RODS, etc., from artificial resin, manufacture.—P. Kopp. (Ger-many, Dec. 12, '33.) 35101. CERAMIC PRODUCTS during firing, prevention of discolouration.—

F. Krauss. 35030.

HYDROGEN PEROXIDE, apparatus for producing .-- F. Krauss. 35699.

SOAPS, etc., manufacture .--- C. Leyst-Kuchenmeister. (Germany, Sept. 24.) 35172.

STABILISING VOLATILE SUBSTANCES in vegetable products, process. STABILISING VOLATILE SUBSTANCES IN VEGELADIC PRODUCTS, PROCESS, Dr. F. G. and H. Madaus and Co. (Germany, Aug. 28.) 35293, THERMODYNAMIC PROCESSES.—W. Mauss. (Union of South Africa, Nov. 23.) 35535. GOODS OF CELLULAR RUBBER, etc., manufacture.—E. A. Murphy,

F. W. Madge and International Latex Processes, Ltd. 35025 ATOMISING LIQUIDS .- L. Peycru. (Luxembourg, Dec. 13, '33.) 35723

THERMOSTATICALLY-OPERATED, ETC., VALVES .- M. T. Pickstone 35240

HYDROCARBONS by heat treatment, production.—H. E. Potts (In-ternational Hydrogenation Patents Co., Ltd.). 35528. OBTAINING DRY-RUBBER PARTICLES.—Rubber-Latex-Poeder-Com-

pagnie Naamlooze Vennootschap and M. J. Stam. 35500. manufacture.-Schering-Kahlbaum. ÖESTROGENOUS PRODUCTS.

(Germany, Dec. 6, '33.) 35106.

OESTROGENOUS PRODUCTS, manufacture.—Schering-Kahlbaum. (Germany, Dec. 7, '33.) 35107. (Cognate with 35106.) OESTROGENOUS PRODUCTS, manufacture.—Schering-Kahlbaum.

(Germany, Dec. 8, '33.) 35108, 35109. (Cognate with 35106.) SATURATED ALCOHOLS from germinal gland hormones, production. Schering-Kahlbaum. (Germany, Dec. 7, '33.) 35287.

INCORPORATING COLLOIDAL FILLERS in bitumen, etc.-R. Shaw.

Walles Dove and Bitumatic, Ltd., 34241. MOULDS for pulp articles, etc.—W. M. Sheffield. 35614. WETTING AGENTS.—Soc. of Chemical Industry in Basle. (Swit-

zerland, Dec. 9, '33.) 35224. (Switzerland, Dec. 9, '33.) ALXYLATED IMIDAZOLES of high-molecular weight, manufacture. Soc. of Chemical Industry in Basle. (Switzerland, Dec. 15, '33.) 35578.

ALKYLATED IMIDAZOLES of high-molecular weight, manufacture. Soc. of Chemical Industry in Basle. (Switzerland, Nov. 16.) 35579. (Cognate with 35578.)

KERTINS, Ireatment.—J. B. Speakman. 35495, 35496, MAGNESUM ALLOYS.—E. STRASSER. 35688. SEPARATION OF ACETIC ANHYDRIDE from mixtures.—Usines De Melle. (France, Dec. 12, '33.) 35589.

From Week to Week

THE BLAENAVON BLAST FURNACES have been acquired for demolition by Thomas W. Ward, Ltd., Sheffield.

PALMER'S STEELWORKS AND BLAST FURNACES at Jarrow may be restarted early next year according to a letter recently received in Jarrow from Sir John Jarvis.

DORMAN, LONG AND CO., LTD., have reduced their share capital by £9,240,875, the scheme being approved by Mr. Justice Eve in the Chancery Division on December 12.

THE NOMINAL CAPITAL of Carter and Sons (Sheffield), Ltd., has been increased by the addition of $\pounds 50,000$ in $\pounds 1$ ordinary shares beyond the registered capital of $\pounds 100,000$.

THE BOARD OF TRADE and Somerset House have agreed to the change of name passed by the shareholders of Motor Fuel Pro-prietary, Ltd. The company in future will be known as Coal and Allied Industries, Ltd.

AT THE ACKLAM WORKS of Dorman, Long and Co. an accident occurred on December 5 when Alfred Stockton was killed by falling into a blast furnace which had been covered by two corrugated iron sheets, one of which was defective.

THE "REICHSZOLLBLATT" of November 25, 1934, contains an Order, dated November 24, 1934, effective as from November 25, 1934, providing that Chile saltpetre may be imported into Ger-many free of duty to a total quantity of 80,000 metric tons, from November 25, 1934, to June 30, 1935, if accompanied by certificates of purity.

DORMAN, LONG AND Co., LTD., are lighting an additional blast furnace at their Cleveland works on Sunday for the production of ferro-manganese.

THE GERMAN POTASH SYNDICATE reports a sale of 76,000 tons during November, compared with 38,000 tons during the same month last year.

THE RELEASE OF LIQUIDATOR for Davey Paxman and Co., Ltd., of Standard Iron Works, Colchester, as from November 30, 1934, is announced in "The London Gazette," December 18.

A REVISED CUSTOMS TARIFF for New Zealand is reported in the "Board of Trade Journal" of December 13, including drugs, chemicals, and surgical, dental, and scientific apparatus.

MR. W. G. ANTROBUS, of 18/19, Ironmonger Lane, E.C.2, was appointed receiver and/or manager of the New Zealand Sulphur Co., Ltd., on December 7, 1934, under powers contained in instrument dated July 2, 1934.

THE BIRMINGHAM AND MIDLAND sales and service office of Ellison Insulations, Ltd., for tufnol will occupy larger premises after December 25. The new address will be Lombard House, Great Charles Street, Birmingham, 3.

THE IMPORT DUTIES ADVISORY COMMITTEE has received an application from the steel industry for an increase of duties, following an unsuccessful attempt by the industry to secure an arrangement for a share in certain foreign markets with the international cartel.

THE SHILLEY INSTITUTE had the revised plans for its laboratory extensions approved last week. The new buildings will have an apparent height of 6 ft. less than that in the original plan, Mr. Hill, the architect, having sunk the foundations to that extent.

SULPHUR SELENIUM, a new drug, is being used in conjunction with X-rays in cancer research work at Manchester. Dr. W. R. Douglas, presiding at a meeting at Manchester last week, expressed the opinion that 1935 might produce some astonishing results in cancer research.

MR. RHYS DAVIES, speaking in the House of Commons on December 14, deplored the fact that superphosphates produced from the Dead Sea, which was in mandated territory under British control, might be met with duties, making their import into the country an impossibility.

THE SHAREHOLDERS OF BELL BROTHERS (MANCHESTER), LTD., manufacturers of filtration plant, have received notification that an offer has been made by the National Provincial Bank "on behalf of responsible enstoners of that bank" to purchase for cash the whole of the issued capital of the company.

FOR THE THIRD YEAR IN SUCCESSION the festival appeal in aid of the Royal Commercial Travellers' Schools at Pinner shows an increase over the previous year. The total announced at the 89th anniversary festival dimer in London on December 14 was £15,608, an increase on the previous year of £1,953. It was announced that Sir Ernest J. P. Benn had consented to be next president of appeal.

THE COUNCIL OF THE IRON AND STREL INSTITUTE is prepared to make annually a limited number of grants from the research fund founded by the late Mr. Andrew Carnegie in aid of metallurgical research work. The object of the scheme is to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches on problems of practical and scientific importance relating to the metallurgy of iron and steel and allied subjects. Candidates, who must be under 35 years of age, must apply before the end of next Jannary on a special form to be obtained from the Scerctary of the Institute. In considering the allocation of grants, the council cannot pledge itself to accept any particular proposal, but will be guided by the nature of the subjects proposed for investigation, giving preference to those which, in its judgment, appear to be of the most practical advantage to the iron and steel and allied industries. Further particulars can be obtained from the Scerctary of the Iron and Steel Institute, 28 Victoria Street, London, S.W.1.

New Companies Registered

Coal Distillation Finance Corporation, Ltd.—Registered December December 14. Nominal capital £500. To raise money by share capital, and to invest the amount thereof in bonds, stocks, obligations, or securities, etc. A subscriber: Leonard J. Mison, Essex House, Essex Street, London, W.C.2.

E. A. Darley, Ltd., 19 Bold Street, Southport.—Registered December 13. Nominal capital, £300. Wholesale and retail chemists and druggists, opticians, surgical and photographic dealers, tobacconists, etc. Directors: Mrs. Hetty Hayward, Vera B. Darley.

E. C. D., Ltd., Town Mills, Tonbridge, Kent.—Registered December 18, Nominal capital, £30,000. To acquire the business and assets of the Electro Chemical Development Syndicate, Ltd., to develop electrolytic apparatus for the production of sodium hypochlorite or any other chemicals, apparatus and inventions for electrolvsis injecting or dosing or any other treatment of and obtaining by-products from or by use of sea and brine water or any other liquids or chemicals, chlorinating processes, etc. Directors: George P. Chamberlain, C. Wylie Bald, C. W. Bald.

H. W. Graesser-Thomas, Ltd., 49 Leadenhall Street, London, E.C.3.—Registered December 12. Nominal capital, £5,000. To acquire the business of a merchant and dealer in drugs and chemicals now carried on by Hermann W. Graesser-Thomas. Directors: Hermann W. Graesser-Thomas, and Violet M. Graesser-Thomas.

Haltord Processes, Ltd.—Registered December 12. Nominal capital, 43,000. To acquire from Hastings J. Holford the benefit of certain existing inventions relating to a process for the distillation of coal, shale, peat, torbanite, cannel, coal, tar and tar derivatives and all carboniferous material which can be treated for the extraction of hydrocarbons and volatile spirits. A subscriber: Hastings J. Holford, 2 Brookvale Road, Sonthampton.

W. & R. Hatrick, Ltd.—Registered December 10. Nominal capital £50,000. To acquire the business of W. & R. Hatrick & Company, manufacturing chemists and wholesale druggists, 152-170 Renfield Street, Glasgow. Directors: W. Lindsay Hatrick, 158 Renfield Street, Glasgow, Osborne R. Hatrick, George Mackay.

The Lincolnshire Ohemical Go., Ltd.—Registered December 12. Nominal capital, 425,000. To carry on the business of distilling and rectifying crude benzol; manufacturers of and dealers in coke, coal, tar, pitch, ammonical liquor and other residual products, etc. Directors: Josiah B. Lane, Sandhills House, near Walsall, Walter C. Forbes, Jas. R. Lane, Josiah B. Lane, Alistair G. Saunders, Walter C. Forbes.

Middleton's Consolidated Herbalists, Ltd., 122-124 Canterbury Street, Gillingham, Kent.-Registered December 14. Nominal capital £1,000. Medical herbalists, botanical and dietetic specialists, manufacturing chemists, health food manufacturer, etc. Directors: Walter W. H. Middleton, Albert A. J. Anderson, Winifred Middleton.

Nu-mel and Nu-Enamel Products Control Co., Ltd., 17-19 Stratlord Place, W.J.-Registered December 15. Nominal capitab e1,000. To acquire the rights in a formula or process for manufacturing or making a preparation known as Nu-enamel or Nu-mel and various stains, lacquers, paints, floor enamels, top-dressing varnish, paint remover and similar products; manufacturers of and dealers in and/or distributors of enamels, paints, pigments, varnishes, polishes, dyes, oils, shellacs, gums, sprints and tins, cams and containers. Directors: Charles L. Lloyd, Lloyd F. Pitts, Frederick J. R. Dickson.

Vacuum Drier and Chemical Equipment Co., Ltd.—Registered December 15. Nominal capital £10,000. Designers, manufacturers, builders and erectors of vacuum driers, vacuum evaporators, colloid mills and all chemical equipment and the like, and adoptors of an agreement with The Deutsche Vacuumapparate G.m.b.H., of 8 Rudolsteadstrasse Effort, Germany, Directors: Guy D, Stone, 61 Esmond Road, Bedford Park; Erwin Holland-Merten; Edwd, L. Johnson,

Williamson, Morton & Co., Ltd., 309 Dobbie's Loan, Glasgow.--Registered December 13. Nominal capital, £30,000. Wholesale and retail oil, paint, grease, colour and varnish merchants and manufacturers, drysalters, chemists, etc. Directors: Peter W. Williamson, D. S. Morton, John D. W. Davidson, Andrew Stirling, Stuart M. MacKellar, William M. MacKenley.

Sep. Wood and Co., Ltd., 17a (hestnut Grove, New Earswick, York.-Registered December 15. Nominal capital £800. Manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Directors: Septimus Wood, Ernest L. Wood, Lawrence E. Wood.

Company News

Canadian Industrial Alcohol.—A net loss of \$381,422 is reported for the year to September 30 last.

United Indigo and Chemical Co.—The half-yearly payment on the 5 per cent. preference shares is announced.

Cape Asbestos Co.—The half-yearly dividend on the 5 per cent. cumulative participating preference shares is announced, payable on January 1, 1935.

Tarmac.-The payment is to be made on January 1 of a dividend on the 51 per cent. free of tax cumulative preference shares in respect of the half-year ending December 31, 1934.

Foldal Copper and Sulphur Co.—The accounts for 1933 show a loss of £10,443, making debit £185,494; on working account the profit was £918.

Eastwoods Flettons.—The directors have declared an interim dividend on its preferred ordinary shares of 5 per cent., payable on January 1.

British Oil and Cake Mills.—An interim dividend is announced of 3 per cent., less tax, on the ordinary shares. No dividend was paid on these shares for last year, but a total of 8 per cent., consisting of 5 per cent, interim and 3 per cent, final, was paid for 1932, comparing with 10 per cent, for 1931.

Bag, comparing with 10 per cent. 10 1931. **Egyptian Salt and Soda Co.**—The gross profit to August 31 was (E,9).370; expenses take $\pounds E.4.780$; debenture interest, $\pounds E.102$; to reserve for bad and doubtful debts, $\pounds E.4.000$; to depreciation, (E,3).511; to special remuneration to committee of directors appointed to conclude agreements between principal cotton oil factories, $\ell E.2.000$, leaving net profits $\pounds E.54.915$, against $\pounds E.4.9.844$ last year. The sum of $\pounds E.2.168$ was brought in and a dividend of 2s, 3d, per share is to be paid, leaving to go forward, $\pounds E.2.512$.

Amalgamated Zinc (de Bavay's).—The report for the half-year to June 30 shows income £6,040, consisting of £4,027 interest earned and £2,013 dividends; deducting £3,511 for non-recurring special adjustment on previous sales of concentrates; £653 for workmen's compensation; £60 tax; net profit £389, which, with further transfer from equalisation reserve. £4,611, leaves £5,000 at credit account. Since close of period dividend 55 absorbing £5,000 paid October 5; also £1,303 received from dividends. Liquid assets show surplus over liabilities £213,076, not including £156,697 value shares other companies.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Holland .-- An agent established at Maastricht (which is an important centre for this industry) wishes to obtain the representation of United Kingdom manufacturers of oxide colours for use in the ceramic industry. (Ref. No. 553.)

Italy.--A merchant established at Milan wishes to obtain the sole representation for Italy, on a purchasing basis, of United Kingdom manufacturers of zinc oxide, and to purchase linseed fatty acid and selenium metal on own account. (Ref. No. 554.)

Egypt .- The Commercial Secretary to the Residency, Egypt, reports that the Egyptian Ministry of Agriculture is calling for tenders to be presented in Egypt by February 11, 1935, for the supply of 176,75 tons of sodium evanide, and 417,7 tons of com-mercial sulphuric acid. (Ref. F.Y. 2200.)

New Zealand.-A Wellington firm of agents wish to represent United Kingdom manufactures of waterproofed cement colours for the whole of New Zealand on a basis to be arranged. (Ref. No. 548.)

Other Inquiries

Malta. An agent in Malta is desirous of obtaining the representation of ammonium bicarbonate, cream of tartar and such-like products. (Information to the Editor, THE CHEMICAL AGE, Ref. 808).

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New Chemical Trade Marks

Compiled from official sources by Gee and Co., patent and trade mark agents, Staple House, 51 and 52 Chancery Lane, London, W.C.2.

Opposition to the registration of the following trade marks can be lodged up to January 12, 1935.

Olivia, 551,450. Class 2. Chemical substances used for agri-cuttural, horticnltural, veterinary, and sanitary purposes. Cooper, McDougall & Robertson, Ltd., Chemical Works, Ravens Lane, Berkhamsted, Hertfordshire. October 2, 1934.

Stancote, 550,691. Class 4. Raw, or partly prepared vegetable, animal, and mineral substances used in manufactures. Anglo-American Oil Co., Ltd., 36 Queen Anne's Gate, Westminster, London, S.W.1. April 27, 1931.

Vigorised. 555,271. Class 4. Raw, or partly prepared, vegetable, animal, and mineral substances used in manufactures. Pinchin, animal, and mineral substances used in manufactures. Pinchin, Johnson & Co., Ltd., 4 Carlton Gardens, London, S.W.1. November 2, 1934.

Books Received

Experimental Physical Chemistry. By Farrington I Howard Mathews and John Warren Williams. McGraw-Hill Publishing Co., Ltd. Pp. 490, 21s. By Farrington Daniels, J. London :

Chemical Engineering Plant Design, by Frank C. Vilbrandt, London: McGraw-Hill Publishing Co., Ltd. Pp. 341, 24s.

Varnish Making, by T. Hedley Barry and George William Dunster. London: Leonard Hill, Ltd. Pp. 132. 10s. 6d.

APPOINTMENTS VACANT

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PATENTS obtained, trade marks and designs registered, at home and abroad .- GEE AND Co. (Patent and Trade Mark advisers to THE CHEMICAL AGE), 51-52 Chancery Lane, London. W.C.2. Telephone : Holborn 1525. Established 1005.

R EGINALD W. BARKER & CO. (Estab. 1886.) Patent and Trade Mark Agents, 56 Ludgate Hill, London, E.C.4. Booklets sent gratis. Phone: City 5140.

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44 MPROVEMENTS in the Manufacture of Cellulose Ethers, in Particular Benzyl Cellulose." The Pro-prietors of British Patent No. 355,803 desire to arrange for the commercial working of this patent by sale outright or by licences granted on participating and reasonable terms. Particulars obtainable from TECHNICH. RECORDS, LIMITED, 59-60 Lincoln's Inn Fields, London, W.C.2.

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T HE proprietor of British Patent No. 357,658, dated July 2, 1930, relating to "Thermometers," is desirous of enter-- 1950, retaring to - inermometers, is desirous of enter-ing into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain. Inquiries to B. Singer, Steger Building, Chicago, Illinois.

 $\mathbf{T}_{\rm pub}^{\rm HE}$ owner of British Patent No. 308,343 relating to rule "Containers moulded by couching wood pulp or paper pulp" is desirous of entering into negotiations with one or more firms in Great Britain for the purpose of exploiting the invention either by the sale of the Patent rights or by the grant of Licences on reasonable terms. Interested parties who desire further particulars should apply to Albert L. Mond and Thiemann, 19 Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietor of British Letters Patent No. 261,693, dated November 17, 1925, for: "Improvements in or relating to Processes for Obtaining Tricalcium Saccharate," relating to Processes for Obtaining Treatering is satchinate, is desirous of disposing of the Patent rights or of negotiating for the granting of Licences to work thereunder. All inquiries should be addressed to Messrs. Mewburn, Ellis and Co., 70-72 Chancery Lane, London, W.C.2.

THE Proprietors of British Patents No. 357,396 entitled "An Improved Process for the Production of Ammonium Sulphate Nitrate," No. 358,301 entitled "An Improved Pro-cess for Producing Ammonium Sulphate Nitrate," No. 358,295 entitled "An Improved Process for the Production of Ammonium Sulphate Nitrate," design of the Production of Ammonium Sulphate Nitrate," desire to arrange for the commercial working of these patents by sale outright or by licences granted on participating and reasonable terms. Particulars obtainable from TECHNICAL RECORDS, LIMITED, 59-60 Lincoln's Inn Fields, London, W.C.2.