

BRITISH CHEMICAL ABSTRACTS

B.—APPLIED CHEMISTRY

AUGUST 6, 1926.

I.—GENERAL; PLANT; MACHINERY.

Distillation studies. E. H. LESLIE and J. C. GENIESSE (Ind. Eng. Chem., 1926, 18, 590—596).—Chloroform-toluene mixtures were distilled in an apparatus fitted with a specially designed laboratory fractionating column. Thermal efficiencies of all parts of the apparatus were determined, and the results compared with those of a hypothetical column with an infinite number of equilibrium units. The data obtained indicate that reflux ratio may be without influence on the effectiveness of a well-designed fractionating column, while vapour velocity can be neglected as a variable factor in column design and operation provided it is not high enough to cause excessive entrainment. The effectiveness of column packings varied inversely with the diameter. Charts are shown representing the relationship of reflux ratio, number of equilibrium units, and change in composition of chloroform-toluene mixtures. B. W. CLARKE.

Dialysis, filtration, percolation. Pore diameter of separating surfaces. A. MÜLHAUS (Kolloid-Z., 1926, 39, 37—40).—A discussion of various filtering and sieving surfaces, special attention being devoted to wire and silk gauzes and the discrepancies which sometimes occur between the actual pore diameter and that calculated from the number of filaments per centimetre as stated by the manufacturer. N. H. HARTSHORNE.

Some little-understood factors affecting lubrication. E. G. GILSON (Ind. Eng. Chem., 1926, 18, 467—470).—Changes in room temperature were found to cause a difference of 20% in the friction of a bearing. An apparatus was constructed in which a ring was rotated with a clearance of 0.013 in. within a bowl of shafting steel, and the friction curve for a bronze ring was found to be considerably higher than for copper. When run in an atmosphere of hydrogen the friction increased in the case of mineral oils, but decreased with castor and sperm oils. The oils blackened and sludged in air, but not in hydrogen. Minimum friction is accompanied by a reaction between the oil and metal dependent upon the presence of oxygen or air. In another apparatus runs were made *in vacuo*, and the friction was found to be greater than in air. The friction in oxygen was less than in air. After running in air or oxygen the friction gradually increases on running in hydrogen or *in vacuo*, but rapidly decreases on running again in air or oxygen. The addition of moisture to the hydrogen causes diminution of the friction. H. MOORE.

Surface action and fluid film lubrication. A. E. BECKER (Ind. Eng. Chem., 1926, 18, 471—477).—An apparatus was devised for measuring the thickness of an oil film by the capacity of the insulated surfaces of a bearing as an electric condenser. Polished flat thrust bearings $\frac{1}{2}$ in. in diameter were used, the lower one being mounted in a bakelite-micarta block, and the upper one attached to a revolving spindle, which could be weighted as desired. The bearing surfaces were connected electrically to a Wheatstone bridge including an audio-oscillator and telephone receiver, the condenser capacity of the bearing being balanced by an adjustable capacity. Cast iron on cast iron was used as a bearing in which the lubricant adheres to both surfaces, magnesium on magnesium as a bearing in which the lubricant adheres to neither surface, and cast iron on magnesium for the case in which the lubricant adheres to one surface only. The bearing temperature was kept at 21.1°; the speeds varied from 1395 to 400 r.p.m., and the loads were varied. A number of graphs show the results of determinations of thickness of films and the effects of variations of temperature, pressure, and speed. A general equation for film thickness has been developed. H. MOORE.

Laboratory muffle kiln. MERRITT.—See VIII.

PATENTS.

Pulverising or grinding mills. J. B. C. SCHERBAUM (E.P. 245,434, 15.12.25. Conv., 30.12.24).—A disc grinder is provided with rings of teeth of special form. B. M. VENABLES.

Tube and ball mills. P. V. A. A. HERBST (E.P. 251,564, 5.1.26. Conv., 29.8.25).—The shell or drum of a ball mill is supported on a hollow trunnion which communicates with the interior of the shell, is closed at its outer end and has side openings through which the material passes. A driving mechanism in line with the shaft is connected, flexibly if desired, with the trunnion. S. BINNING.

Centrifugal separators. AKTIEBOLAGET SEPARATOR (E.P. 246,457, 6.1.26. Conv., 21.1.25).—The continuous discharge of a centrifugal separator passes, not into a casing surrounding the separator but through pipes into a closed tank which may be connected by one or more pipes to the casing of the centrifuge, thus providing a closed vapour circuit and easy access to collecting tank and centrifuge. S. BINNING.

Apparatus for obtaining intimate contact between gases and liquids. BRITISH OXYGEN CO., LTD., and C. R. HOUSEMAN (E.P. 251,331, 28.1.25).—The method described in E.P. 189,442 (cf. G.P. 381,444; B., 1924, 42) is improved by using elements in which the interstices or passages have a diameter smaller than 0.1 mm. An element composed of alternating corrugated and plain ribbons spirally wound is suitable. S. BINNING.

Interchange of heat between liquids. O. SODERLUND, T. GRAM, and TECHNO-CHEMICAL LABORATORIES, LTD. (E.P. 251,344, 30.1.25).—In the interchange of heat between liquids by means of a gaseous carrier which conveys vapour of the hotter liquid to the cooler one, the amount of carrier in the mixture of vapour and carrier circulating between the hotter and the cooler chamber is varied so as to maintain a more or less constant difference in temperature between the carrier and the liquid throughout the cycle, the volume of carrier passing regions of a chamber at different temperatures being varied as the heat-carrying capacity of the carrier varies. The circulating mixture may be divided into several streams flowing from successively hotter regions of the hot chamber to slightly cooler regions in the cool chamber. S. BINNING.

Recovery of volatile solvents. J. H. BRÉGEAT (E.P. 251,492, 30.7.25).—The products of hydrogenation of alicyclic hydrocarbon compounds, such as hydroaromatic compounds, terpenes, pinene, and oil of turpentine, are used alone or mixed with other known absorbents, for the absorption of the vapours of volatile solvents. S. BINNING.

Drying plant. H. SCHULTZ (G.P. 426,829, 23.9.22).—The main pipe conveying air from the dryer back to the heater has two branches which are laid parallel to the main pipe and pointing in opposite directions. A valve slides across all three pipes. It consists of a flat plate with a perforation so placed that when the valve is depressed to the full extent the two branches are shut off and there is a through passage for the main. When the valve is elevated, the cross-sectional area of the main pipe is diminished and the inlet and outlet pipes are opened by an amount equal to the amount by which the cross-sectional area of the main has been diminished, so that the volume of air escaping from the system is exactly equal to the volume entering. E. S. KREIS.

Apparatus for chemical production and research. M. BRUTZKUS (U.S.P. 1,586,508, 25.5.26. Appl., 4.8.20. Conv., 4.8.19).—See E.P. 149,915; B., 1922, 87a.

Distillation. J. SCHNEIBLE (U.S.P. 1,587,188, 1.6.26. Appl., 7.12.20).—See E.P. 182,832; B., 1922, 680A.

Heat exchangers. GRISCOM-RUSSELL Co., Assees. of J. PRICE (E.P. 232,176, 31.1.25, and 235,147, 4.4.25. Conv., 12.4 and 3.6.24).

Apparatus for separating liquids [of different densities]. PIRBRIGHT CO., LTD., and A. BEALE (E.P. 252,077, 18.2.25).

Apparatus for separating solid substances from waste water and other liquids. W. E. EVANS. From GEIGER'SCHE FABRIK GES. (E.P. 252,642, 16.1.26).

[Discharging device for] continuously operating shaft furnaces. E. SOBEK (E.P. 253,391, 2.9.25).

Alloy for thermocouple casing (U.S.P. 1,581,380).—See X.

II.—FUEL; GAS; DESTRUCTIVE DISTILLATION; MINERAL OILS.

Oxygen bomb method for sulphur determination [in fuels]. M. J. BRADLEY, R. M. CORBIN, and T. W. FLOYD (Ind. Eng. Chem., 1926, 18, 583—584).—Pure sulphur burned in an oxygen bomb forms an equilibrium mixture of sulphur dioxide and trioxide, the composition of which depends on the maximum temperature attained, rate of cooling, etc.; it is not materially affected by increasing the initial pressure of the oxygen to 50 atm. The addition of compounds which form water vapour and oxides of nitrogen during combustion promotes an activating atmosphere in the bomb resulting in complete oxidation to sulphur trioxide. The sulphur content of coals, crude petroleum, oils, tars, asphalts, pitch, petrol, etc., can be determined in this way by the addition of ammonium nitrate to the charge in the bomb. B. W. CLARKE.

Low-temperature carbonisation of coal preliminary to coking. A. THAU (Fuel Econ., 1926, 1, 367—369).—Recent investigations show that by the addition of pitch to non-caking coal prior to carbonisation a good coke can be produced. The best results are obtained when the pitch is added in the form of a solution. The binding action is entirely due to a particular extractable high-melting fraction of the pitch, the addition of 7—8% of which will suffice to make even lignite yield a hard coke. By removing the low-boiling pitch constituents from coal by low-temperature carbonisation coke formation at subsequent higher temperatures is greatly favoured. The product resulting from distillation of coal at a temperature below which the bituminous bonding constituents distil, is uncaked and can be carbonised either alone or mixed with untreated coal at a high temperature to give a hard metallurgical coke. S. PEXTON.

Gasification and carbonisation of peat. G. KEPPELER (Stahl u. Eisen, 1926, 46, 631—635, 742—750).—The higher moors, by reason of the ground waters which permeate them, yield a purer peat. Figures are given relating to the use of peat producer-gas in various works. Any type of producer is suitable, but restriction of the blast

pressure and of the air-inlet orifice may be an advantage. The gas has a slightly higher calorific value than producer-gas from coal. Its uniformity of composition and its freedom from sulphur render it eminently suitable for metallurgical processes. Peat gave good results in a revolving producer when gasified with coal, and when it was used alone no trouble in the routine of works processes was experienced. The cost of producer-gas from peat is slightly less than from coal. Owing to the low ash-content of peat clinkering of the producer is but occasionally necessary. In the carbonisation of peat drying takes place up to 100°; from 100° to 200° more water is split off and carbon dioxide is evolved; above 200°, and markedly at 250°, the process becomes strongly exothermic, most of the tar is evolved, hydrogen, hydrocarbons, and carbon monoxide appear in increasing quantities, but much carbon dioxide still comes off; in the interval 350° to 480° the carbon dioxide gives place to combustible gases. The resulting coke possesses a low ignition-temperature and a high reactivity. Its low sulphur and phosphorus contents enhance its value for metallurgical purposes. A block of peat on carbonisation and gasification shrinks, but maintains its integrity to the end, except for some abrasion. Carbonisation processes using internal heating are highly efficient thermally, but the combustible gases are largely diluted, especially if there is much moisture in the peat. A reactive coke is obtained but gasification reactions may take place with attendant disadvantages. In the Domnick process both internal and external heating are used and a series of chambers are provided, one for each stage of the carbonisation process. The by-products, acetic acid, methyl alcohol, acetone, and ammonia, do not occur in sufficiently high concentration in the inevitably large quantity of liquor to repay present methods of recovery.

R. A. A. TAYLOR.

Chemical reactions in the gas producer.

J. A. GOFF (Ind. Eng. Chem., 1926, 18, 585—588).—Assuming that producer-gas contains no free oxygen, and is in chemical equilibrium with the fuel (considered as pure carbon), and that just enough steam is introduced with the air to keep the temperature in the producer constant, the behaviour of the producer under varying conditions can be calculated from the laws of chemical equilibrium and thermodynamics, the fundamental equations involved being $C + O_2 = CO_2$, and two of the equations $C + H_2O = H_2 + CO$; $C + 2H_2O = 2H_2 + CO_2$; $C + CO_2 = 2CO$; $CO + H_2O = CO_2 + H_2$. Thus the nitrogen content of the producer-gas will increase with rise of temperature, since the higher the temperature the less steam is required to maintain the temperature constant. A maximum hydrogen content is obtained at about 950°, but this diminishes at higher temperatures, while the carbon monoxide content increases to a definite maximum, and then remains approximately constant. Above 1150°, carbon dioxide and water practically disappear, while below 700° steam or water vapour goes right through the producer

as such without reacting at all. The efficiency of the producer increases up to about 1100°, but then decreases owing to sensible heat losses in the producer-gas. Approximately 0.4 lb. of steam should be used per 1 lb. of carbon for maximum efficiency under the conditions assumed.

B. W. CLARKE.

Combustion in gas engines. W. T. DAVID (Faraday Soc., June, 1926. Advance proof).—A study of recent work on gaseous explosions in closed vessels leads to the conclusion that incomplete combustion is an important factor in limiting the maximum pressure developed. In one instance, where the calculated pressure rise in the cylinder of a gas engine, assuming complete combustion and no heat loss, and taking account of the variation of the specific heats with temperature, was 460 lb. per sq. in., the rise actually observed was 320 lb. per sq. in. Allowing about 7% for heat loss, there remains a loss of 115 lb. per sq. in., which is attributed to incomplete combustion. The effect of composition of charge, turbulence, density, temperature, radiation from the walls (cf. B., 1925, 793), position of spark, shape of chamber, and time of ignition on the rate of combustion in gas engines is briefly discussed.

A. B. MANNING.

Sulphur compounds of Kimmeridge shale oil. F. CHALLENGER, J. HASLAM, R. J. BRAMHALL, and J. WALKDEN (J. Inst. Petrol. Tech., 1926, 12, 106—141; cf. B., 1925, 161).—The fraction of Kimmeridge shale oil volatile in steam (about 30%) was redistilled up to 180° at normal pressure and above 180° at reduced pressure, and the distillates were subjected to repeated fractionation giving 7 fractions as follows:—(1) up to 93°, (2) 109—117°, (3) 117—126°, (4) 132—140°, (5) 158—167°, (6) 105—115°/27 mm., (7) 115—140°/27 mm. In addition to thiophen and 2-methylthiophen in the first and second fractions (cf. B., 1925, 161), 2-ethylthiophen, 2:3-dimethylthiophen, and tetrahydrothiophen were isolated from fraction (4). Fraction (5) gave a compound believed to be a propyl-, a methylethyl-, or a trimethyl-derivative of thiophen. Naphthalene and thionaphthen were isolated from fraction (6). An extensive bibliography is appended.

S. BOWMAN.

Explosive reactions considered in reference to internal-combustion engines. D. CLERK (Faraday Soc., June, 1926. Advance proof).—A very brief survey of previous work on the calculation of the efficiency of internal-combustion engines.

A. B. MANNING.

Effect of metallic sols in delaying detonation in internal-combustion engines. C. J. SIMS and E. W. J. MARDLES (Faraday Soc., June, 1926. Advance proof).—The action of lead tetraethyl and similar organometallic compounds in preventing detonation is probably related to the ease with which they decompose on heating, yielding the metal in a very finely-divided and chemically active state. The metallic particles act as combustion centres,

causing ignition in the gas which otherwise would detonate on compression. Colloidal solutions of iron, lead, and nickel are just as effective as the organo-metallic compounds, sometimes slightly more so, in delaying detonation. With gold and carbon sols, however, negative results were obtained. Most of the metal sols were prepared by heating solutions of the carbonyls or ethyl-derivatives to a sufficiently high temperature, and preventing coagulation of the metal by addition of a protective colloid such as caoutchouc. The tests were made on a Ricardo variable compression engine, the degree of pinking being determined by ear. When different metallic compounds were compared, using the same concentration of metal, the most efficient was iron pentacarbonyl, which, at a concentration of 2 g. of metal per litre of petrol, gave an increase of 61% in the H.U.C. (highest useful compression) value.

A. B. MANNING.

Explosions in petrol engines. H. T. TIZARD (Faraday Soc., June, 1926. Advance proof).—Recent work on the maximum pressures produced when mixtures of carbon monoxide or hydrogen with air or oxygen are exploded in closed vessels enables a re-determination to be made of the mean specific heats of water vapour and carbon dioxide, and of the degree of dissociation of the latter, up to 2500° (cf. Tizard and Pye, *Phil. Mag.*, 1922, 79). The re-calculated values are: C_v (50–2500°) of water vapour 11.2 cal. per mol., and of carbon dioxide 10.5 cal. per mol. These may be compared with Bjerrum's values (*Z. physikal. Chem.*, 1912, 79, 513) of 9.7 and 10.9 cal. per mol., respectively. At 2650° carbon dioxide is dissociated to the extent of about 23%. According to the revised figures the ideal efficiencies calculated previously by Tizard and Pye are, if anything, too high, whereas the high thermal efficiencies actually observed indicate that the calculated values are too low. A possible explanation of the discrepancy is that the figures for the dissociation, though consistent among themselves, are too high, and either that equilibrium is not reached at 2500° before the gases start to cool rapidly, or, more probably, that large differences of temperature exist in the gas after explosion. The cause of detonation is discussed, it being assumed as a working hypothesis that the occurrence of detonation with a particular fuel is dependent on the temperature in the unburnt part of the mixture reaching a definite value characteristic of the fuel. It follows that anything which lowers the minimum ignition temperature ought to increase the tendency to detonation. The effect of increasing the pressure and of altering the concentration of the fuel in the gaseous mixture is considered from this point of view. With few exceptions the experimental results can be reconciled with the hypothesis. No satisfactory explanation of the action of such "anti-knock" substances as lead tetraethyl has yet been proposed. Some modification of Callendar's suggestion (cf. following abstract) that these high-boiling constituents form liquid drops on compression which are more reactive than the vapour, will probably prove to be the right explanation. It

does not apply, however, when the hydrocarbon or other substance is easily volatile, the determining factor then being probably the attainment of a very high temperature in some portion of the gas during the explosion.

A. B. MANNING.

Dopes and detonation. [Motor fuels.] H. L. CALLENDAR, R. O. KING, and C. J. SIMS (*Engineering*, 1926, 121, 475–476, 509–511, 542–545, 575–576, 605–608).—After a brief statement of the general theory of the detonation of liquid fuels and a review of previous work, a nuclear theory of self-ignition is outlined. The nuclei of liquid heavy paraffins present in the compressed air-fuel mixture on ignition are thought to be the most usual cause of detonation with ordinary petrol. These heavy paraffins have the lowest ignition temperatures of all the constituents of the petrol. A certain amount of adsorption may take place on the carbon present in the cylinder. The organo-metallic anti-knock "dopes" appear to coat the nuclei with a film of metal and so check the tendency to detonate. Three types of detonation are distinguished, viz., the pressure-wave type in which the mixture is fired by a compression wave of sufficient intensity; the nuclear type, depending on the presence of particles of relatively low ignition temperature; and the molecular type in which the temperature of a completely gaseous mixture is raised sufficiently to induce direct molecular combination. The nuclear type is the most common in petrol engines. The anti-knock effect of carbon disulphide and the knock-inducing effect of ether are explained on the nuclear hypothesis. Experiments were made in a sealed tube to investigate the behaviour of organo-metallic "dopes" at high temperatures and pressures. Lead tetraethyl began to boil at 210°, and exploded at 215°; when the substance is used in minute quantities in petrol, this explosion would be enough to cover the surface of the nuclei with metallic lead, while it would not be sufficiently violent to pre-ignite the mixture. Lead tetraethyl when mixed with ether at 243° decomposed with formation of yellow clouds, probably lead oxide; this would explain the destruction of the anti-knock effect of lead tetraethyl by ether. "Ethyl fluid" (a mixture of lead tetraethyl and ethylene dibromide) showed separation of lead, which reacted later to form lead bromide. A mixture of lead tetraethyl and water decomposed at 193°, leaving a pellicle of lead at the surface of the water. Nickel carbonyl started to deposit nickel at 100° and was heated to 260° without explosion. The inferiority of nickel carbonyl compared with lead tetraethyl is thought to be due to its greater volatility. Other organic compounds were sought which would be expected, from their physical constants, to raise the ignition temperatures of the petrol nuclei; the criteria desired were solubility in petrol, high critical temperature, high ignition temperature, and b.p. about 200°. The aromatic amines were found to possess these properties. From an examination of the critical temperatures and pressures, the latent heat and specific heat of the higher paraffins likely to be present in petrol, it was shown that the presence of liquid drops in an engine cylinder at the time of

ignition was possible. Some engine experiments on detonation were made in a Ricardo variable-compression engine. With an addition of 0.2% of lead tetraethyl to the fuel a 33% increase in the highest useful compression ratio (H.U.C.R.) was obtained, whilst with an addition of 0.4% the increase was 50%. The greater the charge density, the greater is the effect of lead tetraethyl. The H.U.C.R. of hexane, octane, and nonane were found to be 4.8, 4.6, and 3.9, respectively. Arranged in order of decreasing anti-knock efficiency the order was alcohol, toluene, benzene for a 25% addition, and toluene, alcohol, benzene for a 100% addition. A large number of organic substances were tested for anti-knock properties in 5% solutions in petrol. Methylaniline possessed half the anti-knock efficiency of aniline, and dimethylaniline showed no anti-knock properties; the toluidines and xylenes arranged in descending order of efficiency were *meta*, *ortho*, *para*. For solutions of methylaniline and *m*-toluidine a maximum value of H.U.C.R. appears to be attained at 15% concentration. The distillation curves of standard fuels were not affected by the addition of 5 c.c. of lead tetraethyl per gallon. The calorific values of various aromatic amines were determined, and it was estimated that a 15% solution of an aromatic amine in a standard petrol would lower the calorific value 2%.

W. N. HOYTE.

Retarding of ignition produced by substances known as anti-detonators. M. DUMANOIS (Compt. rend., 1926, 182, 1526—1528).—An experiment using a gas mixture containing 1/1000 part of lead tetraethyl has shown that premature explosion is perceptibly diminished by this substance. The so-called anti-detonators, therefore, play the part of retarders.

J. GRANT.

Regulations proposed following lead tetraethyl investigation (Ind. Eng. Chem., 1926, 18, 432—433).—The regulations follow the recommendations of the U.S. Surgeon General's Committee (B., 1926, 260). In manufacturing lead tetraethyl and its blending to make "ethyl fluid," for addition to gasoline, the workers shall be given sanitary instructions and submitted to periodical medical examination, records being kept. Efficient ventilation is to be provided, containers labelled, and cleansing and filling must take place in a closed system. A dye shall be added to the "ethyl fluid." The maximum amount to be added to the gasoline shall be 1/1260 of the commercial, or 1/1300 of the pure compound. It shall generally be done in tank car lots at distributing centres, which shall be registered, and be in the open air, or provided with adequate ventilation. Precautions must be taken against leaks or spilling. A group of at least forty men must be periodically medically examined, the results being reported and recorded.

H. MOORE.

Determination of unsaturated hydrocarbons. J. S. S. BRAME (J. Inst. Petrol. Tech., 1926, 12, 221—222).—In continuation of previous work (B., 1926, 395) the effect on the aromatic hydrocarbons of the sulphuric acid used for the removal of

unsaturated hydrocarbons has been determined. Acid of 85% concentration removed about 30% and 88% acid removed 50% of the aromatic hydrocarbons from a mixture of cracked spirit and toluene.

S. BOWMAN.

Direct production of "end-boiling-point petrol" from heavy oils. G. EGLOFF and V. HENNY (Petroleum, 1926, 22, 606—609).—By marketing cracked petrol in the state in which it leaves the cracking plant, polymerisation in further processes and the loss of anti-detonating hydrocarbons is avoided. The yields of the "no residue" process, which yields 53—78% of petrol, are compared with those of the residue process. The production of a Dubbs' plant in which the residue was continuously withdrawn, operating on Kevin-Sunburst fuel oil, was 50—61% of the raw material, and on another plant, operating on Kentucky fuel oil, 58—61%. Details are given of results with one passage of the raw material. Californian cracked distillates often contain 1% of sulphur, more difficult to remove than that in petrols from Mid-Continental oils. The oil of the Smackover field is difficult to refine, but produces 48.9—52.1% of petrol of good anti-detonating qualities. The method of simultaneous cracking and coke production requires but slight alteration in working conditions. Details are given of the production of "Navy end-point petrol" in a Californian plant with a yield of 58—66%.

H. MOORE.

Rôle of oiliness in industrial lubrication. W. C. WILHARM (Ind. Eng. Chem., 1926, 18, 463—467).—In the apparatus employed static friction, as a measure of oiliness, was ascertained by observation of the angle at which a slider moved on an inclined polished brass surface. The slider consisted of 3 balls 1 in. in diam. or 3 steel pegs 0.1 in. in diam. The surfaces were ground with fine emery and with alumina in a liquid of slight lubricating properties. With a Pennsylvanian lubricating oil the friction coefficient rose with increase of load up to 500 g., when it became constant at 0.176. The coefficient for a crude oil closely agreed with that of a refined oil prepared therefrom. In the tests the softer metal was cut, and the harder metal became coated with brass at the point of contact. It is probable that the polished surfaces still presented asperities, and the function of a good oily film is to prevent these interlocking. The friction is a function of the attraction of the metals, their tensile strength, and the internal friction of the lubricant.

H. MOORE.

Lubrication data from Co-operative Fuel Research [U.S. Bureau of Standards]. S. W. SPARROW and J. O. EISINGER (Ind. Eng. Chem., 1926, 18, 482—485).—Experiments were made on a 4-cylinder truck engine with 4½ in. bore and 6 in. stroke. The dilution of a lubricant in the crank-case tends to attain an equilibrium value. Equilibrium oils, to which a diluent has been added to approximate to that found under crank-case conditions, have been used successfully, the added diluent being evaporated

as additional diluent accumulates. Crank-case dilution increases with decreased volatility of fuel, with low temperature of cooling water and cylinder wall, and with increase of engine load and of fuel-air ratio. Viscosity of lubricant does not affect the rate of dilution. High crank-case temperature promotes the elimination of the diluent. Piston and ring fit does not affect dilution greatly. Break-away torque is not affected by the viscosity of oil on the cylinder wall, but is decreased by "oiliness," as by the addition of lard oil. Corrosion of parts may be caused by the temperature of the cylinder walls being below the dew point of water. The most favourable conditions for dilution and corrosion are frequent starting of the engine without prolonged running to enable it to attain normal temperature.

H. MOORE.

Lubricating value as related to certain physical and chemical properties of oils. L. W. PARSONS and G. R. TAYLOR (Ind. Eng. Chem., 1926, 18, 493—496).—Lubrication is mainly influenced by the ratio, viscosity \times speed of rotation/pressure on bearing, and by the capacity of the oil to form an adsorbed film. In a graph of the coefficient of friction the curve rises slowly with this ratio on that side of the critical point which appertains to fluid film lubrication, whilst it rises abruptly on the side representing partial lubrication, where the film-forming properties are of primary importance. Oiliness is best tested by the Wilson and Barnard static friction test and the Deeley friction test. In turbine lubrication the first sludge formed is soluble in hot oil, but separates on cooling, while on further oxidation an insoluble sludge is formed. The film-forming qualities of turbine oil are of minor importance. For cutting oils oiliness is essential and straight fatty oils are the best. In automobile engines, pistons, piston rings and cylinder walls operate in the region of partial lubrication, as also the brake surfaces of Ford cars. Graphs representing the working of a 6-cylinder Continental motor show that oils change decidedly in emulsion test after running for 15 min. The A.S.T.M. pour point test does not show the relative tendencies of oils to flow under pressure at low temperatures, this being better tested on a modified Bingham plastometer. Paraffin-base oils at -18° are not viscous but plastic, with low rates of flow at low pressures, asphaltic oils showing higher rates of flow. Gears which operate in the region of partial lubrication require greases of high viscosity and oiliness. These may be tested in the plastometer using a slightly larger capillary.

H. MOORE.

Power and the viscosity of oil. W. F. PARISH (Ind. Eng. Chem., 1926, 18, 525—526).—Tests were carried out in textile mills in Germany to compare Russian and American lubricating oils. While in some cases the viscosity of the oils was the same, the American oil showed a power saving of 15%, and while in laboratory tests oils of the same viscosity show the same coefficient of friction, more lengthy trials on machinery show an advantage for the more homogeneous oil against the blended one. Blended

Russian oils showed greater change in colour, acidity, and viscosity than the American oils after running for four weeks.

H. MOORE.

Possible tests for the oiliness of oils. A. H. and H. GILL (Ind. Eng. Chem., 1926, 18, 527).—Perrott's method for measuring the "length" of carbon blacks was used to determine the oiliness of oils. In place of carbon, infusorial earth ignited to burn out organic matter was used. The deflection of the oil was first measured in degrees MacMichael at speeds varying from 5 to 30 r.p.m. at 25° , and the results compared with that of a mixture of 10 g. of earth with 100 c.c. of oil. The "spread," or difference between the lines obtained with the oil and with the mixture, was converted to centipoises, using glycerin solutions of known gravities as standards. Castor oil and lard, which are known to be better lubricants than petroleum oils, give less "spread" than the latter, and the same may be said of porpoise jaw, lard, and rapeseed oils.

H. MOORE.

Distillation of Mexican crude oil emulsions and simultaneous preparation of asphalt emulsions. P. J. DE KADT (J. Inst. Petrol. Tech., 1926, 12, 217—220).—Experiments are described for the conversion of typical asphaltic crude oil emulsions of the water-in-oil type into the oil-in-water type suitable for road use and roofing purposes. The inversion was readily effected by the addition of potassium oleate, but the resulting product was unsuitable on account of the gasoline and kerosene present. This difficulty was overcome by combining distillation with the treatment, but under these conditions the hydrophilic tendency of the oleate was too strong and frothing occurred during distillation. Using a rosin soap, however, the inversion could be controlled so that distillation of the light products proceeded quietly. During this process the emulsion appears to be in a condition intermediate between the water-in-oil and oil-in-water types, and the residue is converted into an oil-in-water emulsion by the addition of sodium oleate. Generally 1—1.5% of rosin oil is required for the first stage and 0.5—1% of oleate for the second stage.

S. BOWMAN.

Factors affecting lubrication. GILSON.—See I.

Surface action and fluid film lubrication. BECKER.—See I.

Checker bricks for [water-gas] carburettors. PARMELEE and WESTMAN.—See VIII.

PATENTS.

Purification, cleansing or washing of carbonaceous and other materials. B. LAING and H. NIELSEN (E.P. 250,291, 27.11.24).—The carbonaceous material, containing a loose admixture of stones or other impurities, is subjected to a preliminary heat treatment (e.g., in a retort at $250-350^\circ$), the volatile products being recovered. The action of the heat is to render the carbonaceous material more porous, so that its subsequent separation from the impurities by any of the usual wet or dry methods is facilitated.

W. T. K. BRAUNHOLTZ.

Briquetting wood particles. H. H. HOLDAWAY, Assr. to L. F. PIKE and A. B. FLICKINGER (U.S.P. 1,580,299, 13.4.26. Appl., 21.1.25).—Comminuted wood material is dried and rapidly compressed, under the influence of heat, to about one-sixth of its free volume. The material may be exposed, during the process, to the action of a gaseous mixture of phenol (1 pt.), formaldehyde (3 pts.), alcohol (48 pts.), and water (64 pts.). W. T. K. BRAUNHOLTZ.

Combustion, gasification, or degasification of pulverulent fuels. G. SZIKLA (E.P. 245,461, 4.2.25. Conv., 4.2.24).—The fuel is held in suspension in a vertical shaft, flaring upwards, by an upward current of hot air (for combustion or gasification), or hot gas (for distillation or degasification) and any particles of fuel falling from the shaft are received by a grate beneath the shaft. The grate is mounted in a chamber connected to, and of greater cross-section than, the lower end of the shaft, and the whole or a part of the air or gas is supplied through this chamber. The air is preheated by passing it through or over the fuel burning on the grate, and devices are provided within the chamber for regulating the proportion of the air passing through the grate. H. HOLMES.

Heating of coke ovens. N. V. SILICA EN OVENBOUW MIJ, Assees. of C. OTTO v. Co. (E.P. 247,205, 4.2.26. Conv., 4.2.25).—The necessity of varying the height above the oven sole of the point of initiation of combustion in the flues may be due to the bottom of the charge being more rapidly coked than the top, or to the use of a richer or leaner gas, and is met by placing in the bottom of the combustion chamber a pipe-shaped brick arranged to take interchangeable pipe-shaped bricks of different lengths, giving the effect of burners of different heights. The changes are made through the roof of the combustion chamber. R. A. A. TAYLOR.

Heat treatment of materials for distilling, drying, or carbonising them. THERMAL, INDUSTRIAL AND CHEMICAL (T.I.C.) RESEARCH Co., LTD., and D. RIDER (E.P. 251,724, 27.2.25).—The material, e.g., wood waste to be carbonised, is conveyed by a screw with a shallow thread of small uniform pitch through a cylindrical retort mounted in a furnace with its axis vertical. As little clearance as possible is left between the thread and the wall of the retort to enable the heating to be effected under conditions approximating to those for film distillation. The shaft of the screw is mounted to allow for expansion and contraction. The retort is preferably provided with a jacket containing molten metal to ensure a uniform temperature. The volatile products from the material escape through perforations in the wall of the screw, and are withdrawn by suction to prevent overheating or cracking. H. HOLMES.

Generation of gas. E. S. SUFFERN (E.P. [A] 252,045, 12.1.25, and [B] 252,222, 23.1.25).—(A) The generator consists of a cylindrical or rectangular chamber lined with firebrick. Pulverised fuel and air preheated if necessary are admitted through a nozzle in a direction axial to the chamber and ignited.

When a suitable temperature has been reached, the supplies of fuel and air are regulated to give a suitable gas. The stream of reacting substances impinges on the further ends of the side walls and on the opposite end wall and returns to pass out through an opening in the side near the inlet end, in its course raising the temperature of the incoming stream. The velocity of the gases is sufficient to maintain the residue from combustion in suspension, so that it passes out with the gases and is removed subsequently. The side walls of the generator may be fitted with baffles to give an eddying motion to the gas. Steam may be introduced and the gases may be otherwise enriched. (B) An oil fuel is projected axially by an air blast through an atomiser into a cylindrical or rectangular generating chamber. The heat of the partial combustion is generally sufficient to maintain the reaction, but preheating may be necessary. The gases impinge on the far ends of the side walls and on the opposite end wall of the chamber and return to an exit near the inlet end. They thus set up an eddying motion and influence thermally the reacting mixture. A trap may be introduced for collecting molten slag or solid residues of combustion. R. A. A. TAYLOR.

Purification of coal gas. T. V. MILES, G. W. ALLOTT, and NEWTON CHAMBERS & Co., LTD. (E.P. 251,755, 17.4.25).—Where oxide dry purifiers are used, the gases are raised to a temperature requisite for the reaction by passing through a heat exchanger. This has for its hot element the system of leads from the hydraulic main to the condensers and scrubbers, and for its cool element the leads from the scrubbers to the purifiers. The heat exchanger is designed so that the gases follow a sinuous path, of which turns can be by-passed in order to maintain uniformity in the temperature of operation of the purifiers. R. A. A. TAYLOR.

Fuels for internal - combustion engines. ALLGEM. GES. FÜR CHEM. IND. (E.P. 245,072, 23.10.25. Conv., 27.12.24).—Petrol, benzol, and like fuels are enriched in respect of constituents soluble in liquid sulphur dioxide, in order to prevent "knocking," by the addition of products, boiling up to 200°, obtained by extracting mineral oil or lignite tar distillates, boiling at 150–300°, with liquid sulphur dioxide. H. HOLMES.

[Alcohol-ether] fuels. A. P. MACKILLIGIN and F. GARLAND (E.P. 251,157, 19.8.25).—A motor spirit consists of a mixture of alcohol and ether in proportions varying between 7 : 3 and 3 : 7 according to the compression ratio employed. To this mixture is added 0.5% of pyridine, 0.5% of caoutchoucine, and 1% of kerosene, by volume. These additions act as denaturants, and the first also as a neutralising agent. Caoutchoucine is obtained by the distillation of crude rubber at 176°. S. BOWMAN.

Explosive fuel mixture. Fuel mixture for internal-combustion engines. J. E. BABB, Assr. to WAVERLY OIL WORKS Co. (U.S.P. 1,579,801-3, 6.4.26. Appl., [A] 15.12.24, [B] 14.2.25, [C] 22.4.25).

—The fuel contains (A) a gum resin soluble in gasoline and an oxide of lead, (B) lead oxide and a quantity of acids obtained by distillation of rosin greater than that equivalent to the lead oxide, or (C) lead oxide and an organic acid in quantity sufficient to combine with the lead present after combustion and render it volatile. S. BOWMAN.

Motor fuel. L. EDELEANU (U.S.P. 1,585,473, 18.5.26. Appl., 2.12.25).—A motor fuel distilling between 130° and 220° is obtained by treating a mineral oil distillate boiling between 120° and 300° with liquid sulphur dioxide, freeing the extract from sulphur dioxide, and fractionating. W. N. HOYTE.

Cracking of hydrocarbon oils. M. MELAMID (E.P. 231,190, 20.3.25. Conv., 22.3.24).—The oil to be cracked is introduced in an atomised condition, together with hydrogen, into the reaction vessel, which contains a liquid contact substance such as molten tin at 300–400° (cf. E.P. 221,559; B., 1924, 1006). The temperature is so adjusted that the oils of lower boiling point are cracked, while the fractions of higher boiling point are withdrawn unchanged from the reaction vessel, thereby avoiding coke formation. W. N. HOYTE.

Production of aromatic hydrocarbons by cracking. A. E. DUNSTAN, R. PITKETHLY, and E. S. L. BEALE (E.P. 250,701, 29.1 and 29.10.25).—The extract produced in the treatment of kerosene and heavy oils with liquid sulphur dioxide, consisting largely of higher aromatic hydrocarbons, is freed from sulphur dioxide and subjected to cracking at a temperature of 420–440° and a pressure of 400–1000 lb. per sq. in. Under these conditions an extract originally showing 1% yielded 36% boiling below 200°, the distillate consisting chiefly of benzene, toluene, and xylene. S. BOWMAN.

Cracking oils. POWER SPECIALTY CO. (E.P. 251,404, 24.3.25).—In a tubular cracking plant the temperature of the gases is equalised and overheating avoided by supplying excess air to the furnace, and thus producing a large volume of heating gases at a lower temperature. Two furnaces may be situated side by side, each furnace being divided by a bridge into two compartments. In the first of these combustion takes place and tubes containing oil are disposed at the sides, and also in the roof over the two compartments and as a bank in the second compartment, where they are exposed to the heating gases. The gases leaving the furnace pass to a preheater, in which the air for combustion is heated, say, to 205°. The result is that the maximum furnace temperature is reduced, say, from 1370° to 1090°, with an increase of overall thermal efficiency, say, from 58.5% to 60.2%. H. MOORE.

Apparatus for cracking hydrocarbons. F. E. WELLMAN, Assr. to KANSAS CITY GASOLINE CO. (U.S.P. 1,581,895, 20.4.26. Appl., 21.4.20. Renewed 12.2.26).—The unit consists of two sloping tubes, connected together at one end. At the opposite end, the upper tube is connected to the oil preheater, and the lower one provided with a blow-out for the

carbon, both tubes being of sufficient diameter to allow the carbon formed to circulate without blocking. The tubes are filled to about one-half of their capacity and heated to a pressure of 300 lb., when half the contents are removed as vapour, the remainder, containing particles of carbon in suspension, being blown out. The whole system is controlled by a pump the capacity of which is greater than that of the tubes. E. S. KREIS.

Method of heating [cracking] oil. F. E. WELLMAN, Assr. to KANSAS CITY GASOLINE CO. (U.S.P. 1,581,896, 20.4.26. Appl., 30.1.22. Renewed 12.2.26).—The vertical still is heated around its sides by means of a rotating burner, which leaves the bottom portion, where the carbon settles, unheated. This bottom portion is, furthermore, protected by a shield. E. S. KREIS.

Apparatus for hydrocarbon - oil - cracking operations. K. V. KING, Assr. to STANDARD OIL CO. (U.S.P. 1,582,407, 27.4.26. Appl., 6.5.25).—The retort or still is electro-plated internally with chromium in order to make it resistant to corrosive action during cracking operations. S. BOWMAN.

Pressure oil still. R. E. HUMPHREYS, Assr. to STANDARD OIL CO. (U.S.P. 1,582,929, 4.5.26. Appl., 7.1.21).—The still consists of an upper and a lower drum arranged outside a heating chamber through which tubes connecting the drums pass. The oil is fed into the heating drums from two storage drums placed above and also outside the heating chamber. S. BOWMAN.

Apparatus for decomposition and recombination of hydrocarbons. A. T. STUART and G. N. MIDDLETON, Assrs. to F. G. CLARK (U.S.P. 1,584,048, 11.5.26. Appl., 5.7.17. Renewed 10.8.25).—A retort heated electrically to a cracking temperature is provided with an adjustable feed for oil and gas which is also connected to a reflux condenser fitted over the offtake of the retort. S. BOWMAN.

Continuously distilling and cracking hydrocarbon oils. J. W. COAST, JUN., Assr. to DOHERTY RESEARCH CO. (U.S.P. 1,585,233, 18.5.26. Appl., 14.7.19).—A body of oil is subjected to heat and pressure and the lighter fractions are distilled off, while at the same time the products of intermediate boiling point are cracked. A portion of the oil is withdrawn and its pressure released to cause the vaporisation of the products of intermediate boiling point and these are passed into contact with the oil feed to distil off its lighter hydrocarbons. H. MOORE.

Process of catalysing [hydrocarbon] oils. G. L. PRITCHARD and H. HENDERSON, Assrs. to GULF REFINING CO. (U.S.P. 1,585,263, 18.5.26. Appl., 28.2.22).—A mixture of the oil with aluminium chloride as catalyst is passed through a heating zone, and then allowed to expand freely, and the vapours of volatile hydrocarbons thus evolved are separated. W. N. HOYTE.

Conversion of [hydrocarbon] oils. J. H. ADAMS, Assr. to TEXAS CO. (U.S.P. 1,585,355, 18.5.26. Appl., 28.6.23).—Hydrocarbon oils of high boiling point are continuously converted into products of lower boiling point by heating a stream of the oil under pressure to the point of incipient vaporisation while maintaining it in liquid form. The heated oil is forced still under pressure through a cracking coil of small cross-section at a cracking temperature. In this the oil vaporises and is partially cracked, and is then expanded into a cracking chamber at substantially the same temperature and pressure, where further cracking takes place. The cracked and uncracked oils are removed from the chamber, and the vapours are condensed under pressure.

H. MOORE.

Controlling the supply of steam and oil to an oil-cracking still. C. J. GREENSTREET, Assr. to GASOLINE CORP. (U.S.P. 1,585,381, 18.5.26. Appl., 27.12.19).—The intake pipe to the cracking still is branched; the steam branch is fitted with a shut-off valve, a regulating valve, and a valve-controlled vent to the atmosphere located between the other two valves. The oil branch is fitted with a shut-off valve.

W. N. HOYTE.

Process for making gasoline. R. C. HOLMES, F. T. MANLEY, and O. BEHMER, Assrs. to TEXAS CO. (U.S.P. 1,585,496, 18.5.26. Appl., 13.8.25).—Hydrocarbon oil is forced through a heated coil and drum, the vapours developing pressure till decomposition of the hydrocarbon begins. The heat applied is then reduced, whilst the drum is secured against substantial loss by radiation and vaporisation. The necessary heat is continuously supplied to the drum by the stream of oil entering from the coil, which mingles with the hot condensate from the vapours.

H. MOORE.

Electrochemical treatment of unsaturated hydrocarbon compounds resulting from the cracking of oils. D. L. THOMAS (U.S.P. 1,585,573, 18.5.26. Appl., 9.2.25).—The compounds are subjected to a silent high-tension electric discharge, under high pressure and at high temperature, to produce by combination of their molecules (polymerisation) a stable product of different gravity and boiling point from the compounds treated.

H. MOORE.

Apparatus for treating hydrocarbon oils. O. BEHMER, Assr. to TEXAS CO. (U.S.P. 1,582,893, 4.5.26. Appl., 15.2.24).—An internally heated still is provided with a hinged jacket formed of heat-insulating material.

S. BOWMAN.

Distillation [of hydrocarbon oils]. W. E. CHENOT (U.S.P. 1,584,730, 18.5.26. Appl., 22.4.24).—The vapours from the still are passed up a dephlegmator, and the reflux from the dephlegmator is redistilled by heat interchange with the contents of the main still; the vapours from the redistillation are dephlegmated and condensed in the main condenser.

W. N. HOYTE.

Distilling [hydrocarbon] oils. C. M. ALEXANDER (U.S.P. 1,585,224, 18.5.26. Appl., 9.10.19).—The oil is passed through a pipe still, into which steam is injected at several points. Oil and steam are maintained in intimate contact; light and heavy fractions are then separated by fractional condensation.

W. H. HOYTE.

Vacuum distillation of lubricating oils and the like. V. L. OIL PROCESSES, LTD., O. D. LUCAS, and E. L. LOMAX (E.P. 251,363, 4.2.25).—For the production of lubricating oils heavy hydrocarbon oils are heated in a pipe still to a temperature slightly above the b.p. of the fractions it is desired to remove, under sufficient pressure to prevent the formation of vapour. The heated oil is passed to one or more dephlegmators maintained at a reduced pressure, where the heavier oils condense. The heat of the vapours serves to drive off lighter constituents from the condensate, and a jet of superheated steam assists to carry the vapours through the column, the steam passing over with the lighter oils. The dephlegmator is maintained at a high vacuum, and condensed oil is removed by pumps from the bottom of the column. The vapours are condensed by water condensers under vacuum. Tarry matter may be removed in the first column of a series, and lighter oils in the succeeding columns. The exits from the condensers and the flow of returned oils are controlled by siphonic barometric columns. Pitch may be collected in a vacuum tank while still hot.

H. MOORE.

Purification of petroleum, benzine and benzol hydrocarbons, their homologues, etc. GES. FÜR WÄRMETECHNIK, and A. UFER (E.P. 251,117, 21.5.25).—Treatment of petroleum spirit etc. with sulphuric acid is followed by the addition of water or a salt solution before the waste acid is run off. The advantages gained thereby are a more complete separation of the acid from the refined product and also the separation of resinous substances from the acid. If ammonium sulphate solution be used, the acid liquor can be returned to an ammonia saturator and the separated resins mixed with crude tar for distillation. An economy in neutralising reagents is effected by the more complete separation of the acid.

S. BOWMAN.

Refining [hydrocarbon] oils. R. WILES, Assr. to STANDARD OIL CO. (U.S.P. 1,579,799, 6.4.26. Appl., 11.7.21).—Gases containing gasoline constituents are passed through an absorber containing reduced crude oil which is then mixed with ordinary crude oil and redistilled. The liquid constituents of the gas are thus recovered.

S. BOWMAN.

Process for making a highly-active charcoal in grains. H. MÜLLER-CLEMM and E. SCHMIDT, Assrs. to GES. FÜR CHEM. PRODUKTION (U.S.P. 1,586,106, 25.5.26. Appl., 24.10.24).—See E.P. 231,466; B., 1925, 904.

Manufacture of gas. M. W. TRAVERS and F. W. CLARK, Assrs. to REGENERATIVE COAL GASIFICATION

SYSTEM, LTD. (U.S.P. 1,587,564, 8.6.26. Appl., 12.6.24. Conv., 29.6.23).—See E.P. 210,356; B., 1924, 244.

Manufacture of gas. G. H. KAEMMERLING and H. W. BENNER, ASSTS. to FULLER-LEHIGH CO. (U.S.P. 1,587,588, 8.6.26. Appl., 2.11.20).—See E.P. 171,079; B., 1922, 974 A.

Apparatus for coking coal. R. B. KERNOHAN (U.S.P. 1,587,589, 8.6.26. Appl., 12.8.22).—See E.P. 202,327; B., 1924, 458.

Treatment of gas liquor and other waste liquors for the separation and recovery of phenol therefrom. LeR. W. HEFFNER and W. TIDY (E.P. 244,774, 15.12.25. Conv., 16.12.24).—See U.S.P. 1,566,795-6; B., 1926, 147.

Removal of naphthalene and analogous hydrocarbons from fuel gases. H. WADE. From KOPPERS CO. (E.P. 252,497, 25.3.25).—See U.S.P. 1,578,687; B., 1926, 430.

Treatment of tar water. J. Y. JOHNSON. From BADISCHE ANILIN- & SODA-FABRIK (E.P. 252,982, 5.11.25).—See U.S.P. 1,579,957; B., 1926, 478.

Coal pulverising machines. A. HERBERT, P. V. VERNON, and R. JACKSON (E.P. 252,527, 2.5.25).

Method and apparatus for controlling combustion. A. E. WHITE. From SURFACE COMBUSTION CO. (E.P. 252,450, 25.2.25).

Apparatus for the combustion of elastic and/or liquid fuels. A. L. MOND. From E. H. PEABODY (E.P. 252,868, 12.5.25).

Apparatus for the combustion of gaseous, pulverised or similar fuels. A. L. MOND. From E. H. PEABODY (E.P. 252,869, 12.5.25).

Construction of [closures for] coke ovens. A. BECKERS (E.P. 248,331, 9.12.25. Conv., 25.2.25).

Apparatus for treating [quenching] coke when discharged from retorts and the like. DRAKES, LTD., and J. W. DRAKE (E.P. 253,349, 29.5.25).

Generation and distribution of gas. HUMPHREYS & GLASGOW, Ltd., Assees. of J. A. PERRY (E.P. 246,459, 7.1.26. Conv., 20.1.25).

Mechanically-clinkered gas producers. HUMPHREYS & GLASGOW, LTD., and A. G. GLASGOW (E.P. 253,326, 6.5.25).

Bitumen emulsions (E.P. 252,258 and 252,260).—See IX.

Purification of effluents containing phenols (G.P. 426,422).—See XXIII.

III.—TAR AND TAR PRODUCTS.

Phenolic constituents of producer-gas tar from Bohemian lignite. W. STEINKOPF and T. HÖPNER (J. pr. Chem., 1926, [ii], 113, 137—158).—

The phenols were extracted, purified, and fractionated. The fractions of b.p. 180—190° contain phenol and *o*-cresol, those of b.p. 190—205° contain *o*-, *m*-, and *p*-cresol, whilst the fractions of higher boiling point contain phenols with longer side-chains, the xylenols, and β -naphthol. The phenolic products were identified chiefly by conversion into phenylurethanes and aryloxyacetic acids. The melting points of a series of the phenolic derivatives, and in the case of the phenylurethanes the solubilities in various organic solvents are given. The following new compounds were prepared: *phenylurethanes* of 1:2:3-xylenol, m.p. 176°, of 1:2:4-xylenol, m.p. 120°, of 1:3:2-xylenol, m.p. 133°, of 1:3:4-xylenol, m.p. 112°, of *m*-ethylphenol, m.p. 138.8°, and of *p*-ethylphenol, m.p. 120°; *o*-, *m*-, and *p*-ethylphenoxyacetic acids, m.p. 140—141°, 75—75.5°, and 96—97° respectively; 1:2:3- and 1:3:2-xylenoxyacetic acids, m.p. 187° and 139.5° respectively; *mesitoxyacetic acid*, m.p. 131.5°, and *pseudocumenoxyacetic acid*, m.p. 132°. J. S. H. DAVIES.

Constituents of bituminous tar oils rich in sulphur [ichthyol oils]. IV. H. SCHEIBLER and F. RETIG (Ber., 1926, 59, 1198—1202).—The presence of 2-*n*-butylthiophen in an oil from Achensee and of 3-*n*-propyl- and 2-*isopropyl*-thiophen in a similar product from Seefeld is established by treating the individual fractions of the oils with a deficiency of aluminium chloride and acetyl chloride and identifying the acetyl compounds of the thiophen derivatives thus produced as their *p*-nitrophenylhydrazones. H. WREN.

Low-temperature tar oils. G. P. LEWIS (Fuel Econ., 1926, 1, 365—367).—Low-temperature tar oils have no economic value except as fuel. When certain low-temperature tars including pitch were heated to 500° under pressure the products showed increased and decreased contents of fractions of low and high boiling point respectively. It frequently happened that other tars did not benefit by the same treatment but similar results could be produced even in those cases by the addition of certain catalysts. S. PEXTON.

Determination of phenol in crude cresol. W. QVIST (Z. anal. Chem., 1926, 68, 257—273).—In the determination of *m*-cresol in crude cresol by the method previously described (B., 1925, 164) the bulk of the phenol is found as picric acid in the precipitate of trinitro-*m*-cresol and its weight is obtained by difference after determining the trinitro-*m*-cresol as described. The filtrate from the mixed nitro-products is diluted to 230 c.c. and distilled in steam until 250 c.c. of distillate have collected. The residual solution in the distilling flask is diluted to 250 c.c. and extracted twice with 50 c.c. of toluene. The toluene solution is dried by filtration through thick filter paper and 50 c.c. are shaken with an excess of 0.1*N*-sodium hydroxide solution. The sodium picrate solution is separated and the toluene washed twice with 100 c.c. of water. Finally the excess of alkali in the aqueous layer is determined by titration with 0.1*N*-hydrochloric acid using methyl-red as

indicator, and the picric acid content of the original filtrate is calculated from the alkali consumed. Tests of the method with 10 g. of pure phenol gave an average yield of 20.6 g. of picric acid, of which the filtrate contained 2.0–2.2 g. of the acid; therefore the total picric acid found in the analysis divided by 2.06 gives the phenol content of the cresol.

A. R. POWELL.

PATENTS.

Production of aromatic hydrocarbons (E.P. 250,701).—See II.

Purification of benzol hydrocarbons (E.P. 251,117).—See II.

Purification of effluents containing phenols (G.P. 426,422).—See XXIII.

IV.—DYESTUFFS AND INTERMEDIATES.

Sulphurisation and oxidation products of methylantraquinone. A. SCHAARSCHMIDT and H. LEWYEFF (J. pr. Chem., 1926 [ii], 113, 48).—Analysis of Cibanone Orange R (G.P. 209,232), recrystallised from much nitrobenzene, shows the presence of one atom of sulphur to each mol. of β -methylantraquinone. An attempt to obtain an oxidation product similar to the dye by the action of persulphate on β -methylantraquinone in sulphuric acid gave a dimorphous substance, $C_{15}H_8O_2$, m.p. 172° and 164°, insoluble in alkali, and easily brominated.

C. HOLLINS.

Behaviour of hydrated chromic oxide towards dyestuffs. H. M. BURNS and J. K. WOOD (J. Soc. Dyers and Col., 1926, 42, 187–190).—Hydrated chromic oxide precipitated with excess of ammonia (even after prolonged washing) retains traces of ammonia which decrease the absorptive power of the oxide for acid dyes (Ponceau R, Naphthol Yellow S, Orange II, Fast Red A, and Methyl Orange). The curves obtained are more nearly linear than those obtained with oxides containing a considerable amount of chloride. The latter showed the largest absorptive power and gave curves approaching in character an ordinary adsorption isotherm. In one case the amount of Ponceau R and Fast Red A taken up by the oxide was independent of the concentration of the solution, indicating the formation of definite compounds between the dye and the oxide. The influence of impurities on the dyeing properties of hydrated chromic oxide is given the electrical interpretation already given in the cases of titanous acid, stannous acid, and alumina (B., 1923, 544 A; 1925, 203).

R. BRIGHTMAN.

Use of *m*-chlorophenol for the preparation of intermediates and the positional influence of methylthiol-, methoxy-, and chlorine on the colours of certain azo dyestuffs. H. H. HODGSON (J. Soc. Dyers and Col., 1926, 42, 175–179).—See B., 1925, 702; A., 1926, 515.

PATENTS.

[Vat] dyes and dyeing. J. MORTON, J. I. M. JONES, B. WYLLAM, J. E. G. HARRIS, and MORTON

SUNDOUR FABRICS, LTD. (E.P. 251,491, 1.11.24).—Water-soluble derivatives of vat dyes are obtained by treating anthraquinone or indigoid vat dyes suspended in a tertiary base, such as pyridine or dimethylaniline, in the presence of a metal such as copper or zinc, with chlorosulphonic acid or its salts, fuming sulphuric acid, sulphuric anhydride, or salts of pyrosulphuric acid, small quantities of acids or salts being added to assist the reaction; the resulting products are dyestuffs and are extracted from the reaction mixture by means of a limited quantity of water. For example, a mixture containing 13.6 pts. of chlorosulphonic acid, 30 pts. of dry light pyridine, 5 pts. of Caledon Yellow G (flavanthron), and 3 pts. of finely-divided copper is heated at 40° for 20 min., then cooled, and heated with 100 pts. of water containing 17.6 pts. of ammonia (d 0.880), and filtered. The resulting dark blue-black residue is extracted at 50° with 500 pts. of a 1% solution of caustic soda, and a water-soluble vat dye is isolated from the extract by addition of salt.

A. J. HALL.

Recovery of antimony in the manufacture of flavanthrone. W. A. ADAMSON and P. W. CARLETON, ASSTS. to E. I. DU PONT DE NEMOURS & Co. (U.S.P. 1,582,328, 27.4.26. Appl., 29.2.24).—The filtrate from flavanthrone (prepared by digesting β -aminoanthraquinone with antimony pentachloride in nitrobenzene solution) is distilled *in vacuo* and the distillate consisting of antimony trichloride in nitrobenzene is treated below 50° with a calculated quantity of chlorine to convert all the antimony present into the pentachloride. The solution thus obtained can be used again for the preparation of flavanthrone. About 80% of the antimony and nitrobenzene used is recovered.

R. B. CLARKE.

Vat [benzanthrone] dyestuffs. G. KRÄNZLEIN, H. GREUNE, R. SEDLMAYR, and H. VOLLMANN, ASSTS. to GRASSELLI DYESTUFF CORP. (U.S.P. 1,582,475, 27.4.26. Appl., 27.11.25).—New yellow vat dyestuffs are obtained by fusing a benzanthrone with an anhydride of an aromatic mono- or di-carboxylic acid in the presence of aluminium chloride. Bisbenzpyrenequinones are probably obtained from mono-acids, while phthaloyl- or naphthoyl-benzantrones result from di-acids. The reaction product obtained from benzanthrone and phthalic anhydride is probably 2:3-(Bz)phthaloyl-benzanthrone. For example 68 pts. by weight of benzanthrone, 90 pts. of phthalic anhydride, and 150 pts. of aluminium chloride are intimately mixed and heated to 140–160°. The melt is extracted with water and dilute hydrochloric acid, filtered, and the residue treated with dilute caustic soda to remove unchanged anhydride. The yellow-brown paste obtained gives a green hyposulphite vat which produces brilliant fast yellow shades on cotton.

R. B. CLARKE.

Manufacture of 2:3-diaminoanthraquinone. SOC. OF CHEM. IND. IN BASLE, ASSEES. of W. MOSER (U.S.P. 1,586,911, 1.6.26. Appl., 13.4.23. Conv., 24.5.22).—See E.P. 203,051; B., 1923, 1063 A.

The product dyes cellulose acetate silk weak yellowish-brown tints.

Manufacture of vat-dyestuffs of the perylene series. O. Y. IMRAY. From FARBW. VORM. MEISTER, LUCIUS, & BRÜNING (E.P. 253,311, 28.4.25).—See U.S.P. 1,551,849; B., 1925, 911.

Halogenising perylene. A. ZINKE and A. PONGRATZ, Assrs. to F. BENSA (U.S.P. 1,580,708, 13.4.26. Appl., 7.4.25).—See E.P. 232,266; B., 1925, 911.

Process for manufacturing amino-perylene-quinones. A. ZINKE, Assr. to F. BENSA (U.S.P. 1,586,729, 1.6.26. Appl., 15.6.23. Conv., 7.4.23).—See E.P. 199,721; B., 1924, 781.

Process for manufacturing vat [perylene] dyes. A. ZINKE and F. HANSELMAYER, Assrs. to F. BENSA (U.S.P. 1,586,730, 1.6.26. Appl., 14.2.24. Conv., 7.4.23).—See E.P. 213,889; B., 1925, 537.

Manufacture of vat colouring matters of the benzanthrone series. J. Y. JOHNSON. From BADISCHE ANILIN- & SODA-FABRIK (E.P. 252,903, 11.6.25).—See F.P. 598,752; B., 1926, 311.

Manufacture of polyazo-dyestuffs. A. G. BLOXAM. From CHEM. FABR. GRIESHEIM-ELEKTRON (E.P. 253,377, 20.7.25).—See G.P. 423,092; B., 1926, 312.

Azo dyestuffs. CHEM. FABR. GRIESHEIM-ELEKTRON, Assees. of A. L. LASKA and A. ZITSCHER (U.S.P. 1,587,004, 1.6.26. Appl., 31.3.25. Conv., 7.6.24).—See E.P. 235,169; B., 1925, 666.

Azo dyestuffs. CHEM. FABR. GRIESHEIM-ELEKTRON, Assees. of A. ZITSCHER (U.S.P. 1,587,060, 1.6.26. Appl., 30.11.23. Conv., 12.1.23).—See E.P. 218,568; B., 1924, 824.

Basic dyestuffs of the Malachite-Green series. CHEM. FABR. GRIESHEIM-ELEKTRON, Assees. of R. REYHER (U.S.P. 1,588,052, 8.6.26. Appl., 2.9.25. Conv., 27.9.24).—See E.P. 251,511; B., 1926, 577.

Manufacture of 2-aminonaphthalene-1-carboxylic acid or its nucleal substitution products. O. Y. IMRAY. From FARBW. VORM. MEISTER, LUCIUS & BRÜNING (E.P. 252,820, 12.3.25).—See G.P. 418,009; B., 1926, 355.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Chemical changes in sulphite-cellulose boiling. O. RUTALA and J. SEVÓN (Ann. Acad. Sci. Fennicæ, 1926, 26, [4]. Reprint, 30 pp.).—Analyses of the liquor and pulp have been made at various stages of technical sulphite-cellulose boils, and of laboratory boils controlled so that the temperature at each stage was the same as in a technical boil. The dissolution of incrusting substances begins during the first hour of the boil, and reaches an approximately constant velocity when a temperature of 80–100° is attained. It is therefore desirable to heat to 100°

as rapidly as possible. Towards the end of the boil the rate of dissolution diminishes. The sulphurous acid and calcium contents of the wood increase independently of the temperature, within certain limits, and the end-point is always reached after the same time. Carbohydrates and lignin pass into solution together until 23.2% of the wood has been dissolved; lignin then dissolves alone. The carbohydrates dissolved during the first few hours are mostly pentoses, hexoses dissolving later; the ratio of pentoses to hexoses in the hemicellulose is 1:2. It is probable that lignin and carbohydrates are combined in wood as glucoside-like compounds, and that the principal reactions in the sulphite-boiling process are the hydrolysis of such compounds and the formation of soluble calcium ligninsulphonates. The compound of lignin with cellulose contains the constituents in the ratio 1:2.5, corresponding with 1 mol. of lignin (equivalent weight 360) to 5 glucose residues; the compounds of lignin with hemicelluloses contain 1 mol. of pentose and 2 mols of hexose for each mol. of lignin. During boiling the resin and fat are partially removed, but this is mainly due to mechanical action. A. GEAKE.

Wood pulp. III. Properties of the purified pulp. T. OZAWA (J. Soc. Chem. Ind. Japan, 1926, 29, 78–84).—A comparison of ordinary bleached sulphite wood pulp with pulp purified with lime and sodium sulphite (J. Soc. Chem. Ind. Japan, 1925, 28, 285). On heating at 95–100° for 22–84 hrs. or storing for 47 days in air, the pulp gradually becomes yellowish-brown, the copper number increases, and the content of α -cellulose decreases, these changes being more rapid and marked in the ordinary pulp than in the purified pulp. Viscose made from the purified pulp differs in many respects from viscose made from ordinary pulp, and resembles rather the viscose from cotton cellulose in respect of the changes during ageing and of the properties of the regenerated celluloses. The copper number of the cellulose regenerated from the viscose after ageing for different periods increases with the duration of ageing, whilst the viscosity decreases; here also the effects are more marked with ordinary pulp. These differences are due to the presence of degraded cellulose in the ordinary wood pulp.

K. KASHIMA.

PATENTS.

Conditioning of raw cotton stock. BORNE SCRYMSEER Co., Assees. of R. B. SMITH (E.P. 242,693, 27.7.25. Conv., 8.11.24).—The production of static electricity during the working up of raw cotton stock is minimised by treating the stock, either in bulk or before the completion of the drawing operation, with not more than 4% and preferably not less than 0.5% (on the weight of cotton) of a non-volatile, stable oil. The most satisfactory results are obtained with a pure mineral oil having a viscosity between 25 sec. Saybolt at 21° and 300 sec. Saybolt at 100° and density between 0.8 and 0.966. The oil may be removed from the finished material by the use of suitable emulsifying agents.

D. J. NORMAN.

Treatment of silk. BRIT. SILK RESEARCH ASSOC., W. S. DENHAM, and W. BRASH (E.P. 252,064, 13.2.25).—The mineral content of silk may be considerably reduced, leaving at the same time a substantially neutral product, by immersing the silk in an acid solution of such p_H (approximately 3.8) that the silk is brought to an isoelectric condition. For example, 50 lb. of degummed silk are immersed in 400 litres of water of 3° hardness. Dilute sulphuric acid is then added until a sample of the water just turns bromophenol-blue yellow (p_H slightly below 3.8). The silk is centrifuged and the process repeated three times, the material being finally washed in the centrifuge with tap water until the wash water is neutral to methyl-orange. The ash content of a sample of waste silk treated by this process was 0.71% as against 3.16% when the silk was degummed and washed in the usual way.
D. J. NORMAN.

Production of waterproof textile material, paper, and the like. C. KNOPF (E.P. 251,126, 2.6.25).—The disadvantages associated with the production of waterproof fabric or paper by the action of concentrated solutions of metal chlorides (cf. G.P. 377,659; B., 1923, 971 A) are eliminated by adopting the following procedure. The material is dried before entering the bath, and, on leaving it, is scraped on both sides, squeezed to remove superfluous chemicals, and passed over a heating drum to assist amyloid formation. The material is then immediately cooled and passed into the first of a series of washing baths, after which it is subjected to a number of sprays in such a manner that the sheet is not broken. When completely washed, it is dyed or otherwise treated, and slowly dried.
D. J. NORMAN.

Production of artificial filaments. L. A. LEVY (E.P. 251,680, 30.1.25).—A semi-dry-spinning process is used in which the volatile solvent is removed partly by evaporation and partly by a fixing bath. The filaments are spun in a closed or nearly closed chamber in which air at any desired temperature is circulated; the fixing bath, optionally heated, may be inside or outside this chamber, and by adjusting the temperature of the air and the position of the nozzle relative to the fixing bath, it is possible to control the lustre and appearance of the filaments within fairly wide limits. In general about 80% of the solvent should be removed by evaporation.
D. J. NORMAN.

Production of alkali-cellulose. H. HAWLIK and O. SINDL (E.P. 229,678, 18.2.25. Conv., 18.2.24).—The waste lye from the preparation of alkali-cellulose is used to effect a partial mercerisation and purification of succeeding batches of cellulose, until its caustic soda content falls to about 135–140 g. per litre and its hemicellulose content reaches about 60 g. per litre. The partly mercerised cellulose is in each case finally mercerised with fresh liquor. In general the cellulose should be treated three times with lye from a previous operation and twice with fresh lye. In

this way a considerable economy in the consumption of caustic soda is effected and at the same time an alkali-cellulose of lower hemicellulose content is obtained.
D. J. NORMAN.

Coating of paper, fabrics and other web and sheet material. J. D. and D. MACLAURIN (E.P. 251,681, 2.2.25).—Paper and similar materials are coated with a low-grade material and subsequently, after partial drying, with a high-grade finishing material by means of spraying devices operated by means of compressed air or steam, the paper being drawn in open width beneath the spraying devices.
A. J. HALL.

Manufacture of artificial silk and of artificial threads or filaments. SOC. POUR LA FABR. DE LA SOIE "RHODIASETA" (E.P. 238,842, 24.1.25. Conv., 22.8.24).—See U.S.P. 1,583,475; B., 1926, 580.

Process for rendering nitrocellulose yarns incombustible. J. R. LAVAUD (E.P. 251,227, 14.8.25. Conv., 23.4.25).—See F.P. 600,852; B., 1926, 483.

Apparatus for the recuperation of the lye from dissolved cellular substances. G. MOSEBACH (U.S.P. 1,587,345, 1.6.26. Appl., 5.7.24. Conv., 7.8.23).—See G.P. 398,041; B., 1925, 986.

Stencil sheet. S. HORII (U.S.P. 1,587,954, 8.6.26. Appl., 27.6.25).—See E.P. 250,798; B., 1926, 534.

Method of drying material [paper]. J. E. ALEXANDER (E.P. 243,762, 30.11.24. Conv., 28.11.24).

Recovery of sodium hydroxide or carbonate (E.P. 252,304).—See VII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Contraction [of cellulose fibres] on mercerisation. W. GORDON (Kolloid-Z., 1926, 39, 107–110).—Expressions are developed for the contractive force operating on cellulose fibres during mercerisation. The assumption is made that the fibres consist of cylinders of an amorphous cementing substance in which regularly oriented liquid crystallites are dispersed. By making certain assumptions the contractive force is calculated for cases where the crystallites are parallelepipeds, cylinders, ellipsoids, or cones, and in all but the last (which is held to be an improbable shape) the value obtained is of the order of magnitude of that observed.
N. H. HARTSHORNE.

Chemistry of dyeing processes [with vat dyes]. K. BRASS and M. GAYLED (Rev. gén. Mat. Col., 1926, 30, 130–132, 165–168).—Previous conclusions (B., 1925, 986) concerning the much stronger affinity of cotton for the leuco-anthraquinone vat dyestuff acids than the corresponding alkali salts are confirmed and extended to Hydron and indigoid dyes.
A. J. HALL.

PATENTS.

Dyeing cellulose esters and ethers. FARBW. VORM. MEISTER, LUCIUS, U. BRÜNING (E.P. 243,737, 25.11.25. Conv., 25.11.24).—Slightly basic monoazo dyestuffs containing a sulphamino-group in the diazo-component are particularly suitable for dyeing cellulose esters in intense fast shades. Suitable golden-yellow, orange, and reddish-orange dyes are obtained from diazotised 4-aminobenzene-1-sulphamide and aminocresol ether, diazotised 2-nitro-1-aminobenzene-4-sulphamide and *m*-toluidine, and diazotised 4-aminobenzene-1-sulphamide and α -naphthylamine respectively. A. J. HALL.

Dyeing of cellulose ester artificial silks. C. M. BARNARD, and BRIT. ALIZARINE CO., LTD. (E.P. 252,240, 15.11.24).—Cellulose esters are dyed with substances having the general formula $A \cdot N(Y \cdot CO_2H)R^1$ or $A \cdot N(Y \cdot CO_2H)Z \cdot CO_2H$ in which A is a non-sulphonated aryl dye nucleus, N is an atom of nitrogen, R^1 is an atom of hydrogen or an alkyl-group or other substituent, and Y and Z are the same or different aliphatic chains which may be branched or straight, substituted or unsubstituted. The non-sulphonated aryl dye nucleus may be any of the well-known dye groupings such as anthraquinone or its derivatives, azo compounds, indigo or its derivatives, but it is preferable to maintain the molecular weight as low as possible. One group of especially suitable compounds of this type is formed by the condensation of 1 mol. of an amino- or imino-derivative of a non-sulphonated aryl dye nucleus with at least 1 mol. of an aliphatic polycarboxylic acid. Two general methods for preparing suitable substituted glycine dyes are (1) treatment of 1 mol. of an aromatic amine with 1 mol. of an aldehyde, 1 mol. of sodium bisulphite, and 1 mol. of potassium cyanide, and subsequent hydrolysis with boiling caustic soda or sulphuric acid of the nitrile thereby formed, and (2) condensation of an aromatic amine with a halogenated aliphatic acid other than acetic acid. A. J. HALL.

Dyeing of cellulose ester artificial silks. BRIT. ALIZARINE CO., LTD., and C. M. BARNARD (E.P. 252,646, 15.11.24 and 4.7.25).—Azo and anthraquinone compounds having the general formula $A \cdot X \cdot Y \cdot COOH$, in which A is a non-sulphonated aryl dye nucleus, X is an atom of oxygen or sulphur, and Y is a straight or branched substituted or unsubstituted aliphatic chain, are suitable for dyeing cellulose esters. It is desirable that A has a low molecular weight. One group of such dyes consists of derivatives of glycollic or thioglycollic acid or homologues of these acids in which a hydrogen atom attached to the oxygen or sulphur atom is replaced by a non-sulphonated aryl dye nucleus. A suitable azo dye is prepared by condensing *p*-nitrophenol with chloroacetic acid, then reducing the nitro-group to an amino-group, and afterwards diazotising and coupling with β -naphthol. A bright bluish-red anthraquinone dye is prepared by boiling 2:4-dibromo-1-aminoanthraquinone with sodium sulphide, and condensing the product with chloroacetic acid. A. J. HALL.

Dyeing cellulose esters and ethers. C. E. MÜLLER, ASSR. to GRASSELLI DYESTUFF CORP. (U.S.P. 1,587,669, 8.6.26. Appl., 24.1.25. Conv., 29.1.24).—See E.P. 228,557; B., 1925, 845.

Machines for the dyeing and like treatment of hanks. P. CALDWELL, and BRIT. COTTON & WOOL DYERS' ASSOC., LTD. (E.P. 252,507, 6.4.25).

Vat dyes and dyeing (E.P. 251,491).—See IV.

Coating fabrics etc. (E.P. 251,681).—See V.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Mechanism of the pyrites roasting process. G. F. HÜTTIG and P. LÜRMANN (Z. angew. Chem., 1926, 39, 759—765).—By heating iron pyrites and ferric oxide separately in atmospheres containing mixtures of oxygen, sulphur dioxide, and sulphur trioxide at 700° and analysing the gaseous and solid products, it is shown that the reaction between pyrites and oxygen is reversible and that the final product in all cases is a homogeneous solid solution of oxide and sulphide; on cooling, these interact with the formation of ferrous sulphate and oxide, thus: $4Fe_2O_3 + FeS = FeSO_4 + 8FeO$. The composition of the solid solution is given by the equation $1/n = 13.0 - 6.66 \log(p_{SO_2}/p_{O_2})$, where $1/n$ is the Fe:S atomic ratio. These facts explain the presence of 3—6% of residual sulphur in all samples of commercial burnt pyrites. A. R. POWELL.

Interaction of oxides of nitrogen with arsenious acid and with sulphurous acid in presence of sulphuric acid of varied strength. T. L. BAILEY (62nd. Ann. Rept. on Alkali etc. Works, 1926, 12—25).—Experiments were performed in order to establish the conditions necessary for the successful replacement of sulphuric acid by water in the final washing of the exit gases from the chamber sulphuric acid process. (1) Sodium nitrite solution was added to an excess of sulphuric acid of varying strength, a measured volume of air passed through, and the residual nitrite titrated. The loss increased with the strength of the acid from d 1.0 to d 1.47, and then decreased rapidly. The preliminary increase shows that nitrososulphuric acid cannot produce nitrous acid alone on decomposition with water but a mixture of oxides of nitrogen. (2) The reaction of nitrous acid with arsenious acid was found to be extremely slow in presence of sulphuric acid. A maximum is again found between d 1.39 and d 1.47. (3) Excess of sulphurous acid in presence of water causes evolution of nitrous oxide from nitrous acid with production of hydroxyamido-sulphuric acid $HONH(SO_3H)$. (4) Excess of nitrous acid interacts with sulphurous acid in presence of water with evolution of nitrous oxide. If the water contains sulphuric acid the nitrous oxide is progressively replaced by nitric oxide, no nitrous oxide being formed with a solution of d 1.225 or above. The experiments summarised under (3) and (4)

were carried out with exclusion of oxygen and at air temperature. The rate of reduction to nitrous oxide is slow in case (4). Nitric oxide is similarly slowly reduced to nitrous oxide by sulphurous acid in presence of sulphuric acid of greater dilution than d 1.07. Nitrous oxide may well be produced in this way in the early chambers in the process in the neighbourhood of steam jets or water sprays. These reactions harmonise well with Divers' theory of the chamber process (B., 1911, 10, 594).

C. IRWIN.

Determination of the acidity of ammonium sulphate. H. M. LOWE (Gas World, 1926, 94, Coking Sec., 66—68; cf. B., 1926, 358).—Two solutions of ammonium sulphate were made up, from the commercial and the pure salt respectively. Equal quantities of methyl-red were added to each and the commercial solution was brought to the same state of neutrality as the pure solution with 0.1*N*-caustic soda. To portions of the commercial solution 0.1*N*-sulphuric acid was added to give solutions containing 0.01 and 0.02% of free acid and the colours of these solutions were matched by adding 0.1*N*-sulphuric acid to portions of the pure solution. Much less acid was required in the case of the pure solution, indicating the presence of some "buffer," probably pyridine, in the commercial solution. It is recommended that each works should determine periodically the relation between the acidity of its salt determined by potentiometric and colorimetric methods. Electrometric titration methods offer little advantage over colorimetric titration methods, the only trustworthy method being to determine the electromotive force of a solution against a standard cell potentiometrically.

S. PEXTON.

Rapid method for the analysis of hydrosulphide liquors. K. PAULI (Z. anal. Chem., 1926, 68, 286—299).—Commercial hydrosulphide solutions may contain as impurities sulphide, thiosulphate, sulphite, carbonate, and bicarbonate. Analysis of these solutions by Wöber's method (B., 1920, 625*A*) gives erroneous results owing to the difficulty of completely precipitating the sulphide with zinc carbonate. The following modification based on the same general principles overcomes this difficulty. Two series of tests are made one on the solution (A) as received and the other on the same amount of solution after previous treatment with a definite amount of barium hydroxide (B) and decantation of an aliquot part. The iodine consumption, a and b c.c. respectively, is ascertained by adding an excess of 0.1*N*-iodine and titrating with 0.1*N*-thiosulphate. In the same solutions the amount of hydriodic acid formed in the first titration is determined by adding potassium iodate, again titrating with thiosulphate and deducting the c.c. of thiosulphate first used giving c and d c.c. of thiosulphate corresponding with the "iodine acidity." Two further aliquot parts of (A) and (B) are measured into an excess of saturated mercuric chloride solution, 5 c.c. of saturated ammonium chloride solution and a few drops of methyl-orange are added and the

acidity determined by titration with 0.1*N*-sodium hydroxide (e and f c.c.). Finally a further two aliquot parts of (A) and (B) are titrated directly with 0.1*N* hydrochloric acid allowance being made in (B) for the barium hydroxide added; alkalinity = g and h c.c. of 0.1*N*-acid. Then $(a-b)$ = sulphite, $(f-a)/2$ = thiosulphate, $(2b-f-3d)/2$ = sulphide, $(2b-f+d)/2$ = hydrosulphide, $(3d-2b+f)/4$ = bicarbonate, and $(2b-3d-2e+f)/2$ = carbonate. The results obtained for g ($=\frac{1}{2}$ hydrosulphide + sulphide + $\frac{1}{2}$ sulphite + carbonate) and for h ($=\frac{1}{2}$ hydrosulphide + sulphide) serve simply as checks on the other results. If the value for sulphide is negative bicarbonate is present, if positive, bicarbonate is absent. If free alkali is present, d represents its amount and bicarbonate and hydrosulphide are absent.

A. R. POWELL.

Preparation of pure barium salts. D. RAQUET (Ann. Chim. Analyt., 1926, 8, 161).—Owing to their comparatively low solubility most of the salts of barium are prepared in a pure state by recrystallisation. The chloride may be purified by precipitation as chromate by an acetic acid solution of ammonium dichromate at boiling point. The precipitate of barium chromate is dissolved in dilute hydrochloric acid, hydrogen sulphide passed through, and chromium hydroxide separated by boiling with pure barium carbonate; or, the hydrochloric acid solution of the chromate may be treated with barium peroxide, when the hydrogen peroxide formed reduces the chromic acid and the excess of barium peroxide precipitates the chromium hydroxide. In the filtrate the barium will be present as pure chloride. Other salts are obtained by precipitating the carbonate with ammonium carbonate and dissolving in the appropriate acid.

D. G. HEWER.

Preparation of calcium salts free from barium and strontium. D. RAQUET (Ann. Chim. Analyt., 1926, 8, 161—162).—A 10% solution of the salt to be purified is shaken with calcium sulphate which precipitates the greater part of the barium and strontium. To the filtrate is added a one-tenth of its volume of a 20% solution of ammonium chromate and 1 vol. of 60% alcohol. After keeping for some time the chromates of barium and strontium are filtered off, the liquid is distilled to recover the alcohol, and then poured, little by little, into a cold solution of sodium carbonate, whereby a white precipitate of pure calcium carbonate is formed.

D. G. HEWER.

Preparation of salts of strontium free from barium and calcium. D. RAQUET (Ann. Chim. Analyt., 1926, 8, 162).—To a 10% solution of the strontium chloride to be purified a tenth of its volume of a 3% solution of ammonium chromate is added and after shaking and filtering if necessary, the mixture is left for 24 hrs. To the solution, thus freed from barium, a third of its volume of 20% ammonium chromate is added, and after shaking and filtering the precipitate of strontium chromate is washed by decantation with 60% alcohol, and decomposed cold with a 1% solution of sodium carbonate.

D. G. HEWER.

Utilisation of seaweed and marine plants. M. DESCHIENS (*Chim. et Ind.*, 1926, 15, 675—698).—Descriptions are given of the manufacture from seaweed of iodine and potassium salts, alginates, and agar-agar. The carbonisation of seaweed with production of a fuel gas and ashes from which iodine and potash are recovered, has not yet proved a commercial success, owing to the loss of iodine during the process. B. W. CLARKE.

Determination of iodine in natural waters. H. W. BRUBAKER, H. S. VAN BLARCOM, and N. H. WALKER (*J. Amer. Chem. Soc.*, 1926, 48, 1502—1504).—1—2 litres of water, evaporated to 200 c.c., are boiled with standard sodium hypochlorite solution after addition of 40—60 c.c. of phosphoric acid solution made by diluting 85% acid with an equal volume of water. The iodine is converted into iodate. Potassium iodide solution is added and the liberated iodine, six times as much as that present in the sample, titrated with sodium thiosulphate (cf. Hunter, *J. Biol. Chem.*, 1909, 7, 336). The use of sulphuric acid in place of phosphoric acid gives uncertain results. The iron present must be less than 20 pts. per million. When bromides are present longer boiling is necessary. S. K. TWEEDY.

Action of nitric acid on aluminium. UCHIDA and SASAKI.—See X.

PATENTS.

Manufacture of chemically pure hydrochloric acid. VER. FÜR CHEM. U. METALLURGISCHE PRODUKTION (Addn. 30,237, 9.3.25, to F.P. 564,963, cf. E.P. 196,258; B., 1924, 378 A).—Hydrochloric acid formed by the action of chlorine on organic compounds is purified by passing over mineral gels, e.g., of silica, the rare earths, titanium and zirconium oxides. E. S. KREIS.

Recovery of sodium hydrate [hydroxide] or carbonate [from alkali lyes from treatment of cellulosic materials]. L. N. TAYLOR (E.P. 252,304, 28.12.25).—Residual liquor obtained from the treatment of cellulose material with caustic soda, is treated with magnesium bicarbonate solution, heated to 85°, allowed to settle, the clear liquid siphoned off, and the precipitate passed through a filter. The liquid is further heated to 100° to decompose the sodium bicarbonate and then causticised in the usual manner. The non-cellulose organic compounds are recovered as insoluble organic magnesium compounds which may be incinerated for fuel or distilled for production of acetic acid, acetone, etc. H. ROYAL-DAWSON.

Process of forming sodium compounds. C. SUNDSTROM and G. N. TERZIEV, Assrs. to SOLVAY PROCESS CO. (U.S.P. 1,583,662, 4.5.26. Appl., 8.11.23).—The compound $\text{Na}_2\text{CO}_3 \cdot 3\text{NaHCO}_3$ as prepared by the process described in E.P. 202,678 (B., 1923, 1020 A) contains sodium carbonate as an impurity. A pure product may be obtained by heating dry refined sodium bicarbonate in a loosely-covered, shallow dish for about 8 hrs. at 120°

in a current of steam at a pressure of 13—14 lb. Large needle-shaped crystals are thus obtained.

R. B. CLARKE.

Manufacture of caustic soda. A.-G. FÜR STICKSTOFFDÜNGER (G.P. 427,086, 22.1.24).—Calcium carbide is treated with sodium carbonate solution of *d* 1.1 in a pressure vessel. The temperature needed to complete the reaction is developed by the evolution of acetylene: $\text{CaC}_2 + 2\text{H}_2\text{O} + \text{Na}_2\text{CO}_3 = 2\text{NaOH} + \text{CaCO}_3 + \text{C}_2\text{H}_2$. Calcium carbonate is precipitated in a form readily separated by filtration.

E. S. KREIS.

Manufacture of alkali carbonates or bicarbonates and hydroxides. E. HENE (G.P. 427,087, 11.1.24).—Hydrocyanic acid is made to react with lime, and the resulting calcium cyanide treated with alkali sulphate. The resulting alkali cyanide is decomposed with carbon dioxide, to give hydrocyanic acid, which is used again, and alkali carbonate.

E. S. KREIS.

Manufacture of alumina and aluminium sulphate. L. G. PATROUILLEAU, and SOC. ANON. ALUMINE ET DÉRIVÉS (Addn., 30,170, 13.3.25, to F.P. 586,684; cf. E.P. 240,435, B., 1925, 999 A).—The solution obtained by treating bauxite with sulphuric acid is reduced to convert the ferric salts into ferrous salts and then electrolysed, the precipitation of basic aluminium sulphate being induced by adding a dilute solution of carbonates or hydroxides of the alkalis or alkaline-earths.

E. S. KREIS.

Removing sulphur from technical barium carbonate. RHENANIA VER. CHEM. FABRIKEN, J. MARWEDEL, and J. LOOSER (G.P. 427,223, 5.1.22).—Barium carbonate precipitated from barium sulphide solution by means of carbon dioxide in the presence of alkali carbonate, is purified by heating the reaction mixture to above 100° with alkali hydroxide with the addition of alkali carbonate if desired. On washing the barium carbonate is obtained pure. E. S. KREIS.

Production of mixtures of hydrogen and nitrogen. E. EDWIN (G.P. 427,542, 6.4.25).—In a cyclic process a carbon-containing substance, gaseous, liquid, or solid, is introduced into a high-tension arc together with steam and the resulting carbon monoxide and hydrogen, together with any of the unchanged original substances and any nitrogen from a former cycle, are lead away to a gas producer to which also equivalent proportions of steam and air are supplied. The mixture of gases from the producer, now enriched with the nitrogen from the air, is sprayed with water, a portion is led back to the arc, and the excess caused to react by passing it over a contact material, whereby as a result of the reaction between carbon monoxide and steam, hydrogen and carbon dioxide are formed, the latter being removed in the usual way.

E. S. KREIS.

Production of sulphuric acid from sulphur-dioxide - containing - gases. METAL TRADERS TECHNICAL, LTD. From METALLBANK U. METALLURGISCHE GES. (E.P. 253,344, 21.5.25).—See G.P. 421,786; B., 1926, 319.

Production of phosphorus products. CHEM. FABR. GRIESHEIM-ELEKTRON, Assees. of G. PISTOR and E. BORSBACH (U.S.P. 1,586,115, 25.5.26. Appl., 6.2.25).—See E.P. 229,282; B., 1925, 499.

Separation of hafnium and zirconium. D. COSTER and G. VON HEVESY, Assrs. to N. V. PHILIPS' GLOEILAMPENFABR. (U.S.P. 1,586,241, 25.5.26. Appl., 15.7.24).—See E.P. 219,024; B., 1925, 670.

Base-exchange silicate. H. J. WHEATON, Assr. to AMER. DOUGL. Co. (U.S.P. 1,586,764, 1.6.26. Appl., 28.3.22. Conv., 25.1.22).—See E.P. 177,746; B., 1922, 372 A.

VIII.—GLASS; CERAMICS.

Determination of iron in red lead [for glass manufacture]. J. F. SACHER (Farben-Ztg., 1926, 31, 2131—2132).—Manufacturers of "crystal glass" demand a special quality of red lead containing not more than 0.005% and in some cases 0.004% of iron. While the need for such low percentages is queried, precautions necessary for their determination are outlined. A system of air filtration is required owing to the iron content of dust in works. Discrepancies having been found in analyses of the same red lead by gravimetric, volumetric, and colorimetric methods, a standard method is advisable. The most exact and rapid is the colorimetric one, using potassium thiocyanate, the iron being in sulphuric not hydrochloric acid solution. Excess of the latter acid affects the colour and attempts to evaporate off the excess may lead to the formation of insoluble basic salts. The presence of bismuth is also a disturbing factor in the analysis. S. S. WOOLF.

Mullite refractories formed by calcining cyanite; their industrial application. M. L. FREED (J. Amer. Ceram. Soc., 1926, 9, 249—256).—Crude, Indian cyanite was converted entirely into interlocking mullite crystals and a silicious glass on firing to 1450°. Bricks made either from pure cyanite, pure mullite, various mixtures of cyanite with clay, or mullite with clay were fired to 1500° and tested for refractoriness-under-load, softening point, absorption, spalling, thermal expansion, and resistance to slag attack. The results indicated certain industrial possibilities; whether pure or bonded with clay, mullite produced refractory bricks capable of withstanding the laboratory tests for high-grade refractories. The specimens were highly resistant to deformation under load and to spalling and showed a uniform rate of thermal expansion. F. SALT.

Cyanite-clay refractories. I. H. C. HARRISON (J. Amer. Ceram. Soc., 1926, 9, 257—271).—A study of the dissociation of cyanite into mullite under heat treatment indicated that, with fine material, dissociation begins, and is completed, at lower temperatures

than with coarse material. With the latter, dissociation is rapid at 1300° but is not complete at 1350°, whereas with the former it is less abrupt but is complete below 1350°. Temperature is a more important factor than time in governing the rate of inversion. Trial bricks were made, using different clays as bonding material. With finely ground, uncalcined cyanite, 10% of clay gave sufficient dry strength. The coarser the cyanite, the more bonding clay was required. The physical properties of the bricks varied only slightly with the different bonding clays. Raw cyanite was used successfully in the making of bricks, but the firing expansion varied greatly with the grain-size of the material. Bricks made from calcined cyanite exhibited little change in volume on firing. Microscopical examination revealed little interaction between the cyanite particles, or their dissociation products, and the refractory bond. Better results were obtained by the use of finely ground cyanite, ball clay as bonding material, and magnesia in the form of talc as a flux, considerable development of mullite crystals in non-parallel orientation being observed. F. SALT.

Equilibrium considerations of cyanite-clay refractories. II. W. J. McCAUGHEY and H. C. HARRISON (J. Amer. Ceram. Soc., 1926, 9, 271—278).—Experiments with fired mixtures of cyanite and diaspore indicated that the amount of mullite produced was increased both by fine grinding of the materials and by the addition of magnesia. The mullite crystals form at the edges of the cyanite particles and grow in all directions into the interstitial spaces. F. SALT.

Effect of atmospheric conditions on the load test for refractories. L. F. Sheerar (J. Amer. Ceram. Soc., 1926, 9, 279—289).—The effect of oxidising, neutral, and reducing furnace atmospheres on two refractory clays in the under-load test for refractoriness was determined. Varying percentages of iron pyrites were added to the clays. Nitrogen was used for the neutral atmosphere, and air which had previously been passed over charcoal at 600—750° for the reducing atmosphere. The results showed that in fireclays having a given iron content, the contraction at high temperatures was greater, and took place earlier, in a reducing atmosphere. In a given atmosphere, an increase in iron content caused an increase in expansion as the temperature was raised, and a contraction at lower temperatures. The literature of the subject is reviewed (cf. also Vickers and Theobald, B., 1925, 716, 849). F. SALT.

Determination of the bulk and pore volumes of refractory materials. M. L. HARTMANN, O. B. WESTMONT, and S. F. MORGAN (J. Amer. Ceram. Soc., 1926, 9, 298—310).—The bulk volume of refractory materials was determined by a sand displacement method, and the pore volume by a gas porosimeter having a vertical U-tube manometer. The error in determining the porosity by these methods was less than 0.1%. A comparative series of tests showed that, on the whole, slightly higher figures for porosity were

obtained as compared with the water absorption test.

F. SALT.

Mercury balance for measuring the bulk volume of bricks. A. E. R. WESTMAN (J. Amer. Ceram. Soc., 1926, 9, 311—318).—The apparatus consists of a mercury trough, over which is a saddle arrangement to which weights can be applied. Whole bricks are immersed in the mercury by applying weights to a pan attached to the saddle. The bulk volume is calculated from the weight required to balance the upward thrust of the mercury and the density of the mercury.

F. SALT.

Investigation of checker bricks for [water-gas] carburettors. C. W. PARMELEE and A. E. R. WESTMAN (J. Amer. Ceram. Soc., 1926, 9, 290—297).—With the object of determining the best type of brick for use in carburettors in the manufacture of water-gas, and of developing suitable laboratory tests, a series of industrial and laboratory tests was carried out on a number of commercial bricks of different types. Data are presented for criticism, definite conclusions being reserved for a final report.

F. SALT.

Laboratory muffle kiln [for testing ceramic products]. L. M. MERRITT (J. Amer. Ceram. Soc., 1926, 9, 324—325).—A muffle, having walls about 1 in. thick, is made in one piece over a form similar to a saggar form. The kiln is so constructed that the gases of combustion pass almost completely around the muffle. Hence, a uniform temperature is easily maintained within the muffle, and the difference in temperature between the outside and the inside is small.

F. SALT.

Use of eutectics as glazes. H. M. KRANER (J. Amer. Ceram. Soc., 1926, 9, 319—323).—The possibilities are discussed of utilising the high-silica eutectics of ternary systems such as $\text{MgO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ as glazes on ceramic bodies. Old plaster moulds were successfully used in a glaze of the eutectic type in which calcium oxide was the only flux. This glaze was compounded as follows: old moulds 46.6%, clay 24.2%, flint 29.2%.

F. SALT.

PATENTS.

Manufacture of burnt building materials or the like from clay. H. GRONROOS (E.P. 238,229, 4.8.25. Conv., 6.8.24).—About 10 kg. of a mixture consisting of about 200 kg. of pulverised clay, 100 kg. of pulverised cryolite (previously annealed in a furnace at 600—700°), 10 kg. of iron oxide, and 400 kg. of water are kneaded with 1000 kg. of raw clay. The mixture is cut into blocks and burnt in a tunnel kiln at about 800° for 4 hrs. The burnt blocks are crushed and about 50 pts. by weight of the crushed material are mixed with 50 pts. by weight of clay, and the mixture is rolled, crushed, and mixed again before being moulded into bricks which are passed through a tunnel kiln and burnt at about 900°.

H. ROYAL-DAWSON.

Refractory acid-resisting materials. A. WOLFSHOLZ (F.P. 602,475, 25.8.25).—Thoria or zirconia,

preferably in a colloidal form, is mixed with a solution of calcium, aluminium, or magnesium phosphate in phosphoric acid and the mixture is shaped and fired at a red heat.

A. R. POWELL.

Smoke consumption in round pottery kilns. INGENIEURGES. FÜR WÄRMEWIRTSCHAFT A.-G. (G.P. 424,717, 8.5.23).—Provision is made for admitting warm secondary air at a number of points behind the glost oven. The greater the carbon monoxide content and the rise in temperature of the gases of combustion, the further the air inlet is made to recede toward the chimney. Complete combustion of the carbon monoxide is attained by the time the gases reach the chimney, a sufficiently high firing temperature being maintained at the same time.

F. SALT.

IX.—BUILDING MATERIALS.

High-alumina hydraulic cements. P. H. BATES (Ind. Eng. Chem., 1926, 18, 554—559).—A brief review is given of the composition and properties of aluminous cement, compared with those of Portland cement, with especial reference to its rapid-hardening properties and resistance to attack by salt and sulphate waters.

B. W. CLARKE.

Asphalt emulsions. DE KADT.—See II.

PATENTS.

Preserving wood. N. A. ALEXANDERSON (E.P. 229,296, 10.2.25. Conv., 15.2.24).—Wood is impregnated with the liquid resin obtained as a by-product in alkali-cellulose manufacture, which may be mixed with peat-tar or wood-tar and is dissolved in petroleum burning oil (d 0.850—0.900, flash point 75—100°), to which is added siccatives, such as oleates and resinates of lead, manganese, or cobalt, and disinfecting agents, e.g., cresols, xyleneols, phenol ethers, etc.

H. ROYAL-DAWSON.

Bitumen emulsions. H. W. HUTTON and C. W. FULTON (E.P. 252,258, 23.2 and 3.4.25).—Bituminous materials are heated in an apparatus provided with a stirrer and incorporated with a small proportion (1—5%) of a sulphonated oil or fat in the acid state before neutralisation. The mixture is then incorporated with a sufficient quantity of a hot solution of caustic soda or ammonia to neutralise the sulphonated oil, and hot water added in such proportion that the finished product contains about 50% of water.

H. ROYAL-DAWSON.

Bituminous emulsions. G. S. HAY (E.P. 252,260, 24.2.25).—A proportion up to about 10% (by weight on the bitumen) of an emulsifying agent comprising a resin, resin acid, or resin oil, is added, with agitation, to molten bitumen. After thorough incorporation, a hot solution of caustic soda is added and the agitation of the mixture continued until emulsification has been effected. In a modification of the process the resin is dissolved in turpentine and the solution mixed with the molten bitumen, the alkali being omitted.

H. ROYAL-DAWSON.

Wood preservation. A. M. HOWALD, Assr. to GRASSELLI CHEMICAL Co. (U.S.P. 1,585,860, 25.5.26. Appl., 23.1.24).—See E.P. 228,119; B., 1925, 284.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Equilibrium relations between iron, oxygen, and carbon. R. SCHENCK (Stahl u. Eisen, 1926, 46, 665—682).—It is established from data on indirect reduction of iron oxides by carbon monoxide, that in addition to magnetic iron oxide and ferrous oxide, solid solutions of these in one another and in iron take part in the equilibria as oxygen-containing phases. The probable presence of an iron suboxide, stable only below 720°, is deduced from these equilibria. The equilibria for the system iron, iron carbide, carbon monoxide, carbon dioxide cannot be determined experimentally owing to simultaneous oxidation, but data for the system iron, iron carbide, methane, hydrogen are given, and from these the constants for the first-named system are calculated. The results are used to deduce the conditions for indirect cementation of iron by carbon monoxide and methane as well as for direct cementation processes. From the equilibrium between iron and carbon monoxide below 600°, the existence of a percarbide of iron, with a considerably higher carbon vapour pressure than cementite or elementary carbon, is rendered probable. The equilibrium isotherms for carbon monoxide-carbon dioxide in the presence of iron are determined, and from them a space model showing the relation between temperature, pressure, and concentration in the gaseous phase is constructed; from this is derived a curve for the relation of gas composition to temperature which is very similar to curves experimentally obtained from observations on blast furnaces. Information on the equilibria in ore-roasting processes is derived from these isotherms.

L. M. CLARK.

Metallic cementation and the coating of ferrous alloys with aluminium. J. COURNOT (Rev. Mét., 1926, 23, 219—232; cf. B., 1926, 365).—After 5 or 6 normal cementations (4 hrs. at 900—950°) the efficiency of the powdered ferro-aluminium becomes impaired and the coatings produced become thinner and poorer in quality. The inner layer produced in cementing steel of eutectoid composition is quite regular and continuous but very thin (0.03 mm.) and the outer layer is 0.08 mm. thick. The thickness of the layers produced in grey cast iron are thinner than those in eutectoid steel and on subsequent heating in an oxidising atmosphere there is no marked increase in thickness. Coatings formed on ferrous alloys by this method of cementation seem to be limited to uses below 1050—1100°.

M. COOK.

Cementation of ferrous alloys by tungsten. J. LAISSUS (Rev. Mét., 1926, 23, 233—242; cf. B., 1926, 278).—The bright outer layer on steel cemented with ferrotungsten contains tungsten carbide, and

is formed at a lower temperature (800°) than is the corresponding layer containing chromium carbide when cementing with ferrochrome, which necessitates a temperature of 1100°. The layer produced on a steel by cementing with ferrotungsten for 10 hrs. at 1100° is destroyed by scaling after exposure for 5 hrs. at 950° in an oxidising atmosphere. Cementation by tungsten is not so effective as cementation by chromium in increasing the resistance of steel surfaces to oxidation.

M. COOK.

Cementation of copper and its alloys by aluminium. L. GUILLET (Compt. rend., 1926, 182, 1447—1449; cf. B., 1926, 588).—Copper, brasses, bronzes, German silver, and copper-nickel alloys were cemented at 700° and 800°, using a powdered aluminium-copper alloy (20% Al) mixed with 5% of ammonium chloride as the cementing material. With copper the penetration is 0.25 mm. after 24 hrs. at 700°, the cemented layer consisting of the α Cu-Al solid solution, but at 800° the penetration is greater and both α and β solid solutions are formed. The surface layer is harder than the copper, and in the specimen cemented at 800° it can be further hardened by quenching, when the martensitic structure is produced. With brasses (60 and 67% Cu) the penetration is greater, and the surface layer containing the α and β brass constituents is harder than the original metal, but little affected by quenching. With a bronze containing 84% Cu, and a German silver (Cu 60%, Ni 20%) the cemented layer is softer than the original metal, but with cupro-nickel (20% Ni) and a bronze containing 90% Cu the cemented layer is the harder. With the bronzes the surface layer consists of the $\alpha + \beta$ or martensitic structure, but special constituents are formed with the nickel alloys. The presence of the ammonium chloride is essential for good penetration.

W. HUME-ROTHERY.

Determination of small amounts of bismuth in copper. C. O. JONES and E. C. FROST (Ind. Eng. Chem., 1926, 18, 596).—Good results were obtained by the method in which potassium iodide and sulphurous acid are added to a sulphuric acid solution of bismuth sulphide and the colour compared with that of a standard bismuth solution similarly treated. The bismuth sulphide, previously separated from copper sulphide, is first dissolved in nitric acid, the solution evaporated with sulphuric acid, and any lead sulphate which separates is removed.

B. W. CLARKE.

Action of nitric acid on aluminium. S. UCHIDA and K. SASAKI (J. Soc. Chem. Ind. Japan, 1926, 29, 93—94).—The action of pure nitric acid on aluminium (99.51%) is of a purely chemical nature, not being influenced by diffusion, especially at low temperature. The solution velocity is doubled for a rise of 10°. The optimum solution velocity is obtained with 5—6 N-acid and at higher concentrations, e.g., above 20N, the velocity is almost zero. Addition of a small amount of carbamide has no influence on the solution velocity, showing that nitric acid acts as an acid

toward aluminium, and that the nitrogen oxides have no effect on the solution velocity. The oxide film formed on aluminium has no acid-proof character. There is a close relation between the hydrogen-ion concentration and the solution velocity. Addition of sulphuric acid, ammonium nitrate, chlorine, etc. has no special effect on the action. K. KASHIMA.

Mechanism of ageing process in aluminium alloys. W. FRAENKEL (Z. Metallk., 1926, 18, 189—192).—To endeavour to elucidate the mechanism of the ageing process in aluminium alloys the change of electrical resistance of quenched alloys with time of ageing has been investigated. In the case of aludur (aluminium with magnesium and only small amounts of iron and silicon) the resistance rises during a short period, then falls much more rapidly over several days; the resistance-time curves for 20° and 167° are practically parallel. Aeron (containing copper and a little silicon but no magnesium) behaves differently in that the resistance falls rapidly at first, then more slowly. The resistance of Al_2Zn_3 (21% Al, 79% Zn) increases by 10—12% in the first few minutes after quenching, then falls rapidly at first, finally more slowly until it is only 66% of that of the quenched alloy; these phenomena are greatly retarded by the presence of even small quantities of magnesium, 0.1% Mg extending the time required for completion of the change from a few days to more than 3 months. In view of these results it is suggested that two changes take place during the ageing of aluminium alloys, one associated with an increase of electrical resistance and the other (retarded by the presence of magnesium) with a decrease in the resistance. In the case of duralumin, which contains magnesium, only the first change takes place at the ordinary temperature within a measurable time, whereas in alloys free from magnesium this change takes place spontaneously on quenching and the second change only after ageing at 100—200°. This theory is in accord with the fact that alloys free from magnesium are stronger immediately after quenching than those containing magnesium, e.g., the tensile strength of quenched duralumin is 16—18 kg. per sq. mm., whilst that of aeron is 28—30 kg. On the other hand the 8% zinc-aluminium alloy without magnesium is no harder after quenching than the same alloy containing magnesium, so that the theory does not appear to explain all the known facts.

A. R. POWELL.

Analysis of boron alloys. N. TSCHISCHESWSKI (Ind. Eng. Chem., 1926, 18, 607—608).—The alloy is dissolved in sulphuric acid, oxidised by hydrogen peroxide, and the metals present are precipitated by electrolysis. The boric acid in the resulting solution is determined by titration with caustic soda free from carbon dioxide, using phenolphthalein as indicator, after neutralising the residual sulphuric acid with caustic soda, using methyl-orange as an indicator, which is not affected by boric acid. The results are accurate.

B. W. CLARKE.

Contribution to the study of ternary alloys. [Aluminium-magnesium-cadmium and system potassium chloride-barium chloride-magnesium chloride]. J. VALENTIN (Rev. Mét., 1926, 23, 209—218, 295—314; cf. B., 1925, 135).—The ternary eutectic of the aluminium-magnesium-cadmium system, m.p. 395°, contains in atomic per cent., 45 of magnesium, 17.5 of aluminium, and 37.5 of cadmium. In alloys rich in aluminium, the replacement of small percentages of magnesium by equivalent amounts of cadmium does not appreciably affect the mechanical properties, and in magnesium-rich alloys the replacement of small amounts of aluminium by cadmium is also without effect. The constitution of the system, potassium chloride-barium chloride-magnesium chloride, which contains three ternary eutectics, has been studied by thermal analysis and the ternary diagram as well as sectional diagrams are given.

M. COOK.

Removal of iron from copper and nickel mattes. B. BOGITCH (Compt. rend., 1926, 182, 1473—1475).—Since the heat of formation of ferrous oxide is greater than that of cuprous oxide, it is usually thought that the loss of copper or nickel from the mattes during removal of iron is due to mechanical entanglement in the slag. To test this, samples of copper and nickel mattes were powdered, mixed with sand and sodium sulphate, and then fused, the sodium sulphate acting as oxidiser. The resulting slag was then analysed for entangled globules of matte, and for copper or nickel present as oxide in the slag. Both copper and nickel are oxidised, and in increasing proportions as the removal of iron becomes more complete. For the greater part of the process the loss of nickel is less than that of copper, in spite of the fact that nickel oxide has a higher heat of formation than copper oxide; this is because of the difference in the heats of decomposition of cuprous and nickel sulphides, as a result of which the molten nickel decomposes sulphur dioxide whilst copper does not. On the other hand, the removal of the last traces of iron is more difficult from nickel than from copper mattes. The more acid (and hence more viscous) the slag, the greater is the loss by mechanical entanglement, but this does not affect the relative amounts lost by oxidation. In practice not more than 4—5% of the copper should be lost in this way.

W. HUME-ROTHERY.

Pyrites roasting. HÜTTIG and LÜRMANN.—See VII.

Theory of electric arc furnace. DE LOISY.—See XI.

Corrosion of metals by insulating pastes. REINER.—See XI.

PATENTS.

Refining crude iron. F. BURGERS (U.S.P. 1,578,009, 23.3.26. Appl. 12.3.25).—Crude iron is melted and conveyed to a refining furnace into which it is introduced at a point near the vertical axis and below the upper limit of incandescence.

The fuel supplied to the furnace is preheated by waste gases and is charged through a shoot. M. COOK.

Producing iron coke. H. E. WETHERBEE (U.S.P. 1,581,898, 20.4.26. Appl., 13.6.24).—Ferrous or ferric hydroxides, prepared by treating an iron solution with caustic soda, are washed and mixed with a reducing agent, *e.g.*, finely-powdered coal or charcoal, or crude oil having an asphaltic base, and heated gradually to expel moisture. When all the combined moisture has been driven off and the residue consists of iron oxides and the reducing agent, the mass is heated more strongly in a reducing atmosphere, in which it must also be cooled. Reduction starts at 200° and is complete at 550°.

E. S. KREIS.

Producing iron directly out of iron ore. H. G. FLODIN and E. G. T. GUSTAFSON, Assrs. to H. G. E. CORNELIUS (U.S.P. 1,585,240, 18.5.26. Appl., 7.4.25).—A charge of oxide ore and carbon in a proportion necessary to effect reduction and carbonisation of the metal is fed into a furnace together with another charge of higher carbon content, the carbon in the resulting metal being controlled by suitably proportioning the two charges.

W. COOK.

Manufacture of uranium. WESTINGHOUSE LAMP Co., Assees. of J. W. NEARDEN (E.P. 246,147, 13.1.26. Conv., 13.1.25).—Uranium powder is produced by reducing a uranium salt, *e.g.*, a halide, or potassium uranium fluoride, by means of calcium in the presence of calcium chloride. The powder is then pressed into the desired shape and heated in an inert atmosphere until homogeneous and ductile.

C. A. KING.

Separating antimony and lead. E. C. R. MARKS. From AMER. SMELTING AND REFINING Co. (E.P. 251,736, 17.3.25).—Lead containing antimony in substantial quantity, *e.g.*, above 7%, is heated at 650–930° under oxidising conditions, antimony oxide being recovered as a fume. A layer of lead oxide may be maintained on the surface of the bath during the operation. Any tin present may be removed first as a slag and after volatilisation of antimony, copper separates as a slag on the surface of the cooling lead.

C. A. KING.

Copper[magnesium-cadmium] alloys. O. VON ROSTHORN (E.P. 251,906, 19.1.26).—In the preparation of alloys of copper, magnesium, and cadmium, molten copper is deoxidised by adding a small quantity of an alloy containing Cu 90%, Cd 10%, and a desired amount of a previously prepared auxiliary alloy (Cu 16.5, Mg 3.25, Cd 5 pts.) encased in a copper container is pushed to the bottom of the molten bath and allowed to alloy with the deoxidised copper. The proportion of magnesium may be varied by introducing magnesium before the auxiliary alloy.

C. A. KING.

Manufacture of alloys containing tungsten carbide. GEN. ELECTRIC Co., Assees. of PATENT TREUHAUD GES. FÜR ELEKTRISCHE GLÜHLAMPEN M.B.H. (E.P. 251,929, 2.9.25. Conv., 7.5.25. Addn.

to 213,524; B., 1924, 752).—A sintered hard alloy for tools consisting principally of tungsten monocarbide contains 10–20% of an auxiliary metal of lower melting point, such as iron, cobalt, or nickel. During the preparation of the tungsten carbide, the temperature is regulated so that the small particles adhere only loosely.

C. A. KING.

[Alloy for] thermocouple casing. R. P. BROWN, Assr. to BROWN INSTRUMENT Co. (U.S.P. 1,581,380, 20.4.26. Appl., 30.11.25).—A thermocouple casing resistant to the corrosive action of molten lead and zinc is made from an iron-chromium alloy, containing, for example, C 0.10, Si 0.20, Mn 0.30, Cr 13.00, Fe 86.40%.

E. S. KREIS.

Manufacture of ferrochromium alloy. R. WILD, Assr. to RUSTLESS IRON CORP. OF AMERICA (U.S.P. 1,586,590, 1.6.26. Appl., 5.2.23).—See E.P. 197,733; B., 1923, 662 A.

Manufacture of ferro-alloys, particularly ferrochromium alloys. R. WILD, Assr. to RUSTLESS IRON CORP. OF AMERICA (U.S.P. 1,586,591, 1.6.26. Appl., 5.2.23. Conv., 1.3.22).—See E.P. 198,423; B., 1923, 781 A.

Manufacture of unstainable irons and steels. R. WILD, Assr. to RUSTLESS IRON CORP. OF AMERICA (U.S.P. 1,586,592, 1.6.26. Appl., 4.5.23).—See E.P. 198,633; B., 1923, 782 A.

Casting metals [nickel-iron alloys]. J. H. WHITE, Assr. to WESTERN ELECTRIC Co. (U.S.P. 1,586,871, 1.6.26. Appl., 29.12.24).—See E.P. 241,756; B., 1926, 17.

Steel alloy. B. STRAUSS, Assr. to F. KRUPP A.-G. (U.S.P. 1,587,614, 8.6.26. Appl., 17.6.23. Conv., 2.8.22).—See E.P. 201,915; B., 1924, 60.

Recuperation of metals contained, in the form of silicates, in waste products [slags]. LE CUIVRE NATIF (E.P. 230,471, 5.3.25. Conv., 7.3.24).—See U.S.P. 1,544,493; B., 1925, 678.

Process of treating metals and composition therefor. E. C. R. MARKS. From CHICAGO CRUCIBLE Co. (E.P. 253,402, 14.10.25).—See U.S.P. 1,568,271; B., 1926, 283.

[Incorporating graphite with] bearing material [metal]. A. A. CRIMP (E.P. 253,022, 19.1.26).

XI.—ELECTROTECHNICS.

Theory of the electric arc furnace according to recent work. E. DE LOISY (Rev. Mét., 1926, 23, 253–268). The subject is treated mathematically and the recent work by P. Bergeon (IVe Congrès Chim. Ind., Bordeaux, Juin, 1924; Soc. Franç. Electriciens, Oct., 1925) and E. Riecke (Ber. No. 102, Fachausschüsse Ver. Deuts. Eisenhüttenleute) is reviewed in detail, the latter dealing with furnaces as used for steel melting.

M. COOK.

Corrosion of metals by insulating pastes. S. REINER (Z. angew. Chem., 1926, 39, 588—591).—Insulating oil heated in absence of air is partially dehydrated, with no change in the acid value. The insulating properties are thereby improved. Mineral oils alone have no solvent action on copper, lead, or iron, but the resins with which they are mixed to form insulating pastes, dissolve at 100° up to 0.38% of copper, 1.0% of lead, and 2.0% of iron; in the last case, an increase in the acid value ascribed to polymerisation of the resin is observed. Deterioration of insulating pastes is ascribed to the solvent action of the resinous constituent upon metals, and to water, the presence of which facilitates oxidation of the oils. L. M. CLARKE.

Preparation of luminescent discharge tubes of helium. J. RISLER (Compt. rend., 1926, 182, 1457—1459).—Particulars are given of the removal of all impurities in the filling of discharge tubes with helium. When the absorbed gases have been removed from the glass and electrodes, impurities may still be introduced with the helium, but this may be prevented by passing the gases over absorptive wood charcoal at -78° (solid carbon dioxide and acetone). An alternative method consists in connecting the discharge tube to a vacuum pump and providing an additional electrode consisting of a small metal crucible containing an alkali or alkaline-earth metal. The tube is evacuated, a discharge passed, and the helium admitted, when all the impurities are absorbed by the metal vapour which is liberated. The following figures are given for the volumes of gases absorbed by 1 g. of wood charcoal at -78°, and by 1 g. of sodium and of calcium under the above conditions. Hydrogen 55, 125, and 130 c.c.; nitrogen 95, 135, and 140 c.c.; carbon dioxide 145, 175, and 165 c.c.; helium, 5, 4, and 4 c.c.; neon, 6, 6, and 5 c.c. respectively. Charcoal absorbs 130 c.c. of oxygen at -78°.

W. HUME-ROTHERY.

PATENTS.

High-frequency electric induction furnace. C. R. BURCH, N. R. DAVIS, and METROPOLITAN-VICKERS ELECTRICAL CO. (E.P. 251,758, 18.4.25).—In a high-frequency electric induction furnace in which the inductor consists of a tube and has a cooling fluid circulated through it, the inlet and outlet for the cooling liquid are arranged at equipotential points. This may be done by winding a doubled tube to form a spiral. Electrical connexions are made to the two ends of the spiral and fluid connexions to the tube ends. Other methods consist in winding a number of turns on a tube and then winding in the reverse direction, or by providing a high-frequency choke coil made of tubing and connected electrically in parallel with the inductor tube. Arrangements for automatically regulating the current energy may be incorporated such as the insertion of a Venturi tube and mercury gauge which makes or breaks contact with a controlling battery, or by means of a thermostat in the cooling fluid. C. A. KING.

Method of growing crystals [with piezo-electric properties]. A. M. NICOLSON, Assr. to WESTERN ELECTRIC CO. (U.S.P. 1,578,677, 30.3.26. Appl., 30.9.24).—The patent relates in general to the production of crystals possessing piezo-electric properties and an "hour-glass" structure, and, in particular, to the formation of such crystals of Rochelle salt. Seed crystals are used having three axes "*a*," "*b*," and "*c*" (the principal axis) mutually perpendicular. An "hour-glass" structure is produced when crystals are grown from such seed crystals placed with the axes "*c*" and "*b*" in a horizontal plane; growth proceeds laterally but is arrested upwards along the axis "*a*" The thickness of a seed crystal along its "*a*" axis should be 4/10 of that along its "*b*" axis. The crystals are grown as follows: Powdered Rochelle salt is placed in contact with water at a temperature not exceeding 40° (38—40°) until a constant density of d_{38-50}^{20} 1.39 is obtained. Water at the same temperature is stirred into the saturated mother liquor until the density is d_{38-50}^{20} 1.37—1.38, after which the solution is filtered into glass crystallising dishes maintained at 38—40°. Seed crystals are added as described above to the dishes which are then kept at 20° for 10—12 hrs. R. B. CLARKE.

Alumina or aluminium sulphate. (Addn. to F.P. 586,684).—See VII.

Mixtures of hydrogen and nitrogen (G.P. 427,542).—See VII.

Electrodeposition of organic materials (U.S.P. 1,580,795).—See XIV.

XII.—FATS; OILS; WAXES.

Marine animal oils. M. TSUJIMOTO (J. Soc. Chem. Ind. Japan, 1926, 29, 71—75).—The author has examined the following oils: three samples of lamprey oil, sturgeon (*Acipenser mikadoi*) liver oil, "tora-fugu" ("tiger globe fish," *Spheroides rubripes*) liver oil, dolphin (*Delphinus longirostris*) liver oil, and "hotaru-ika" ("luminous cuttle-fish," *Watasenia scintillaus*) oil. The densities, acid, saponification, and iodine values, index of refraction, amount of unsaponifiable matter and of ether-insoluble bromides of mixed fatty acids, and colour reactions of unsaponifiable matter with sulphuric acid in carbon disulphide and acid earth in benzol are given in a table. The "tora-fugu" liver oil deposited a considerable quantity of solid fat. The unsaponifiable matter of lamprey and dolphin oils contains a large amount of a resinous substance, which gives the colour reactions very distinctly. The unsaponifiable matter of "hotaru-ika" oil consists chiefly of cholesterol. K. KASHIMA.

Constitution of the unsaturated acid $C_{14}H_{26}O_2$ from sperm oil. M. TSUJIMOTO (J. Soc. Chem. Ind. Japan, 1926, 29, 102—104).—The author has examined the oxidation products of the tetradecenoic acid, $C_{14}H_{26}O_2$, from sperm oil (B., 1923, 276 A), by the method of Armstrong and Hilditch (J.S.C.I.,

1925, 45 τ and 108 τ). Nononic acid and an acid, probably glutaric acid (though the m.p. is somewhat low) were isolated; valeric and azelaic acids were not detected. The constitution of the decenoic acid, $\text{CH}_3[\text{CH}_2]_7\text{CH}:\text{CH}[\text{CH}_2]_3\text{CO}_2\text{H}$, determined by the ozone method (B., 1925, 856), is thus confirmed.

K. KASHIMA.

Lower acids of the oleic series in "tsuzu" and "kuromoji" seed oils. M. TSUJIMOTO (J. Soc. Chem. Ind. Japan, 1926, 29, 105—108).—Oils from seeds of "tsuzu" (*Tetradenia glauca*) and "kuromoji" (*Lindera hypoglauca*) had the following characteristics: orange-yellow, dark greenish-yellow, d_4^{15} 0.9452, 0.9394; acid value 13.4, 38.8; saponif. value 238.3, 222.5; iodine value 79.4, 69.1; n_D^{20} 1.4670, 1.4727; Reichert-Meissl value 1.30, 1.49; and unsaponifiable matter 2.45%, 4.12%. A dodecenoic acid (probably identical with Iwamoto's linderic acid, B., 1921, 856 A) is present in large amount in the oils, and a tetradecenoic acid is present in small amount—in very small amount in the "kuromoji" seed oil. The tetradecenoic acid isolated from tsuzu oil is different from the acid obtained from sperm, dolphin, and tōhaku oils (cf. preceding abstract), being distinguished by its higher m.p. (about 20°). It is a crystalline solid at the ordinary temperature.

K. KASHIMA.

Formation of unsaturated solid *iso*-acids during the hydrogenation of fatty oils. II. Presence of *iso*-acids in hardened chrysalis oil. S. UENO and N. KUZE (J. Soc. Chem. Ind. Japan, 1926, 29, 75—77).—Chrysalis oil (d_4^{100} 0.8683, n_D^{50} 1.4649, acid value 6.3, saponif. value 191.2, iodine value 128.5) was hardened at 140°, 160°, and 180° respectively, using a nickel catalyst. The fatty acids of the hardened oils were separated into solid and liquid acids by the lead salt-ether method. Chrysalis oil appears to contain originally a small amount of unsaturated *iso*-acids. Solid unsaturated *iso*-acids are formed during the hydrogenation, the amount increasing with rise of hydrogenating temperature.

K. KASHIMA.

Influence of saturated fatty acids on the value of the Boemer number for lard. F. J. F. MUSCHTER and R. SMIT (Chem. Weekblad, 1926, 23, 284—285).—The case is quoted of a crude lard found to have a Boemer value (cf. B., 1922, 431 A) greater than 71, but which yielded by refining a neutral lard having a value below 71. Addition of free fatty acids to the neutral lard gave products having values up to 72.2.

S. I. LEVY.

Polymerised linseed oil. K. H. BAUER (Farben-Ztg., 1926, 31, 2130—2131).—A sample of polymerised linseed oil was heated until it attained the consistency of rubber, when it gave the following figures: saponif. value 206, acetone-soluble matter 37.7%, chloroform-soluble matter 44.7%. Fatty acids obtained by saponification had acid value 200, iodine value 98.7, and hexabromide value 0. The mol. wt. of the fatty acids was determined cryoscopically in benzene and by Rast's camphor method. Mol. wt.

in benzene 685.0, in camphor 321.0. Fatty acids obtained from the acetone-soluble portion had acid value 197, iodine value 100.6, mol. wt. in benzene 453.0, and in camphor 244.0. Fatty acids obtained from the chloroform-soluble portion had acid value 193.7, iodine value 93.3, mol. wt. in benzene 447.0, and in camphor 241.0. The values in camphor are mono- and those in benzene bi-molecular, a fact which throws light on discrepancies among investigators dealing with polymerisation of oils. S. S. WOOLF.

Polymerisation of tung oil. H. WOLFF (Z. angew. Chem., 1926, 39, 767—770; Farben-Ztg., 1926, 31, 2235, 2292—2294; cf. B., 1925, 556).—Further evidence is adduced from the author's own researches and from those of other investigators to show that polymerisation is not the sole cause of the thickening of tung oil by heating. Thus, agitation of the oil with a very small proportion of hydrochloric acid (d 1.125) at 30—40° induces thickening at a rate comparable with that caused by heating at 200°, whilst no appreciable change takes place in the iodine value. This appears to indicate that certain colloidal constituents of the oil are polymerised by this treatment and that the thickening caused by heat is due to two independent phenomena, namely, coagulation of colloids and chemical change comprising polymerisation, decomposition of some of the glycerides, and changes in the configuration of the elaeostearin glycerides.

A. R. POWELL.

Properties of sodium naphthenate used in soap industry. Y. KAWAKAMI (J. Soc. Chem. Ind. Japan, 1926, 29, 64—67).—The naphthenic acid used had b.p. 195—200°/10 mm., n_D^{22} 1.4812, d_{15}^{22} 0.9605, neutralisation value 228.0, mean mol. wt. 246.5. The detergent action and lathering power of the sodium salt of the acid were slightly inferior to those of sodium palmitate and mixed toilet soap. The gelation capacity of sodium naphthenate was extraordinarily large. The sodium salt of a lower naphthenic acid required more salt than coconut oil soap in the salting-out process, but 100 g. of a 1% solution of a sodium salt of a higher naphthenic acid salted out with 4 g. of salt at 100°, whereas in the same conditions, coconut oil soap required 11 g. of salt and sodium palmitate 6 g. Sodium naphthenate is hygroscopic in moist air.

K. KASHIMA.

PATENT.

Recovery of oils and fats from finely divided bleaching materials or the like. HARBURGER EISEN- U. BRONZEWERKE A.-G. (G.P. 426,712, 7.7.21).—The oil or fat contained in used decolorising carbon or fuller's earth may be recovered by heating the mass with a dilute solution of alkali hydroxide at 100° in an autoclave fitted with a stirring device, then raising the temperature and pressure after addition of a dilute salt solution, and finally allowing the mixture to cool without agitation. The alkali and salt treatments cause the surface tension between the solid particles and the oil or fat to be so far reduced that the two separate, the carbon or fuller's earth settling to the bottom of the vessel

and the oil or fat forming a layer on the surface of the solution. A. R. POWELL.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

So-called black and white content of pigments in the Ostwald colour-system. C. SCHAEFER (Physikal. Z., 1926, 27, 347—353).—Ostwald's absolute system of colours (A., 1916, ii, 205; 1917, ii, 281) is criticised (see also Kohlrusch, Physikal. Z., 1920, 21, 423, 473). It is shown experimentally that insertion of dark sectors in a colour-circle merely reduces brightness in a manner which is exactly counterbalanced by increased intensity of illumination. This result is in opposition to Ostwald's theory. Further theoretical and experimental arguments are adduced against the theory that the three terms pure colour, white, and black can express colour quantitatively. R. A. MORTON.

Relation between the number and size of the particles and the light absorption of graphite suspensions. F. HEBLER (Z. angew. Chem., 1926, 39, 741—744).—The light absorption of colloidal suspensions of graphite in water or water-glycerin mixtures increases at first with the degree of dispersion in a ratio approximately proportional to the increase in the number of particles corresponding with the greater dispersion. The absorption by colloidal suspensions containing particles of an average size of 2.5μ is, however, about 50% less than the theoretical calculated from the linear law, but the maximum absorption of light is not reached at this grain size. A. R. POWELL.

Evaluation of [water-]paint adhesives. H. WAGNER (Farben-Ztg., 1926, 31, 2132).—Two types of test are indicated. The first, mainly economic, deals with adhesive strength and effective cost. Trial mixtures are made up with calcium carbonate as pigment, and the quantities used for satisfactory binding are substituted in empirical formulæ giving comparison figures. Mixtures are then made up using pigments of acid properties and their behaviour on painting gives information as to adsorption, peptisation, reversibility, alkalinity, refractive power, etc., properties which bear on applicability, adhesion, permanence, water-resistance, opacity, etc. Glass plates coated for this second test may be used as negatives to obtain permanent records for comparison of various tested products. S. S. WOOLF.

Micrography of oil and varnish films. E. STERN (Farben-Ztg., 1926, 31, 2129—2130).—The examination of the microstructure of films of varnish and paint-media is recommended as a simple form of accelerated testing, information as to quality and durability being afforded by the alteration of the original microstructure during the drying and hardening period, and the ageing and deterioration of the dried film. The development of suitable etching technique should reveal characteristic behaviour in films containing reversible and irreversible emulsions, linseed and tung oils, cellulose esters, etc. S. S. WOOLF.

American colophony. P. LEVY and H. RAALF (Ber., 1926, 59, 1302—1310).—Oxidation of crude American colophony in cold, aqueous alkaline solution by potassium permanganate gives formic, acetic, propionic, and isobutyric acids, together with *r-tetrahydroxyabiatic acid*, m.p. 207.5—209°, and *l-tetrahydroxyabiatic acid*, m.p. 251—252°, $[\alpha]_D^{15}$ —41.64° in alcohol. The presence of two ethylenic linkings in abiatic acid is therefore established. H. WREN.

Polymerised linseed oil. BAUER.—See XII.

Polymerisation of tung oil. WOLFF.—See XII.

PATENTS.

Colours capable of being fixed by heat. O. VAN CUYCK (E.P. 251,866, 29.10.25. Conv., 8.5.25).—Pigments are incorporated with nitre and gum-resin, and the ground products are used in the form of pastels or as liquid fresco-paints. The colours are so easily fusible that they can be glazed or vitrified by the application of a temperature insufficient to cause deterioration of the paper, textile, etc., on which they are applied. For example, Venetian red is obtained by drying a watery paste of 10 pts. of iron oxide, 2 pts. of nitre, 1 pt. of glycerol, and 4 pts. of flowers of sulphur. The ground residue is fused with 10 pts. of kauri gum and 2 pts. of nitre, and the cooled mass ground and pressed into crayons or tablets. Other resins such as white mastic gum may replace the kauri gum.

S. S. WOOLF.

Resinous compositions. BRIT. THOMSON-HOUSTON Co., LTD., Assees. of L. V. ADAMS (E.P. 235,595, 13.6.25. Conv., 13.6.24).—A condensation product of glycerol and phthalic anhydride (referred to as a "glyptal") is incorporated with a drying oil in any proportions by heating to about 200° in contact with a solvent of high b.p., e.g., benzyl benzoate (b.p. 323—325°). The glyptal is used in its initial soluble form and during the heating process it becomes converted into the intermediate less fusible and less soluble form. The high-boiling solvent may be removed from the product by distillation, leaving a viscous mass which dissolves in solvent naphtha etc. to produce a varnish. The glyptal in the product is readily converted into the final insoluble and infusible form, and a tough, flexible, infusible film, of good adhesive properties and resistance to heat is obtained. Semi- and non-drying oils may be substituted for the drying oil, while other solvents of only moderately high b.p. may be used as dispersing agents, reflux condensation being adopted in such cases to avoid excessive loss. S. S. WOOLF.

Process of manufacturing acid-proof and water-proof black ink. J. INOUE (E.P. 253,368, 30.6.25).—See F.P. 600,390; B., 1926, 596.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Origin of the [X-ray] interferences in the stretching of rubber. E. A. HAUSER (with H. MARK) (Gummi-Ztg., 1926, 40, 2090—2092).—

Further investigation of the X-ray interferences exhibited by stretched rubber indicates that the phenomena at high extension are due in part to nuclei of the magnitude $(C_5H_8)_8$. At lower extensions the phenomena are produced by clusters containing approximately 2000 (C_5H_8) groups; whether these are to be regarded as crystals or as aggregates will be dependent on the amplitude of vibrations of the particles. These aggregates are already existent in a swollen condition in the unstretched rubber, but give no definite interference phenomena because they have a vibration amplitude too large to give rise to interference phenomena, the state of their "crystal lattice" being comparable with that of strongly heated salt. Under stress, however, part of the distending medium is reversibly squeezed from the aggregates so that these then exhibit distinct interference behaviour. This explanation accords with the observation that the position of the interferences is independent of the degree of extension while their intensity increases almost dropportionately with this factor. D. F. TWISS.

Determination of sulphur in vulcanised rubber. E. KAHANE (Caoutchouc et Gutta-percha, 1926, 23, 13,154—13,155).—For determination of its total sulphur content, vulcanised rubber is commonly oxidised with brominated nitric acid followed by fusion (cf. Tuttle and Isaacs, B., 1915, 436). In the absence of such mineral ingredients as barium carbonate, the subsequent fusion may conveniently be omitted. By adopting similar procedure for the determination of the total sulphur and mineral sulphur, the difference between the two results (necessary for calculation of the degree of vulcanisation) is the same as would be obtained by the longer method. It may be necessary to wash the barium sulphate precipitate with aqueous ammonia to remove oxidation products of the rubber. D. F. TWISS.

PATENT.

Electrodeposition of organic materials [rubber]. S. E. SHEPPARD and L. W. EBERLIN, Assrs. to EASTMAN KODAK Co. (U.S.P. 1,580,795, 13.4.26. Appl., 8.6.25).—When organic materials are electrolytically deposited from emulsions or suspensions, the deposition may be hastened by the use of a high current density, but this causes the evolution at the anode, of gases, particularly oxygen, which interfere with the formation of an even deposit and cause pits and weak spots. This can be avoided by having in solution a reducing agent which is indifferent to the material deposited, for instance, alkali sulphite, hyposulphite, or thiosulphate with rubber emulsions. Organic reducing agents may be used; if a substance which will oxidise to a coloured substance is used the deposit will be coloured.

E. S. KREIS.

XV.—LEATHER; GLUE.

Nature of vegetable tannage: Tanning with mixtures of gallotannin and quinone. A. W. THOMAS and M. W. KELLY (Ind. Eng. Chem., 1926,

18, 625—626).—The fixation of tannin by hide powder from solutions of gallotannic acid and benzoquinone respectively was determined in solutions of varying p_H value. The quinone curve showed a maximum at p_H 10.5. The curves for mixtures of gallotannic acid and benzoquinone in different proportions were also determined and show increasing amounts of fixation in the alkaline range of p_H 8 to 12, similar to the typical curve for vegetable tanning (cf. B., 1923, 1235 A). In the region of p_H 8 to 5 the quinone retards the tanning, thus acting like a non-tan. The results support the view that the tanning action of vegetable tanning extracts in the range p_H 8 to 12 is due to substances of the nature of quinones. D. WOODROFFE.

Processes in chrome tanning. S. HILPERT and E. SCHLUMBERGER (Z. angew. Chem., 1926, 39, 637—640).—Samples of gelatin were shaken for 3 hrs. with a large excess of solutions of basic chrome tanning liquors of different concentrations. The product was analysed in each case for unchanged gelatin. When this was nil the tannage was counted as 100%. The p_H value and concentration of those liquors which gave 100% tannage were determined and the results plotted. The logarithm of the chromium concentration was inversely proportional to the p_H value whether the liquors were clear or turbid or whether green or violet. A mixture of a molten 16% gelatin jelly and a 20% solution of chromium sulphate, which was almost at the precipitation point, set to a mass from which a large amount of water could be decanted. Chrome tanning is influenced more by the condition of the pelt than by the chrome liquor. Swelling is due to the hydration of the primary amino-groups. The lower the p_H value, the greater the amount of hydration and consequently the less possibility for the tannin molecules to link up with the amino-groups. The optimum speed of tanning is therefore at the isoelectric point. It is impossible to produce normal chrome liquors with a p_H equal to that of the isoelectric point since it is on the wrong side of the precipitation point. The isoelectric point of proteins can be changed by additions of acid and by neutral salts. The tanning intensity does not depend on the basicity of the chrome tanning solution but on its p_H value and is at a maximum when the greatest possible degree of dehydration of the hide protein is attained. D. WOODROFFE.

Properties of various glues. T. ARAKI (J. Soc. Chem. Ind. Japan, 1926, 29, 84—92).—The author has compared the properties of various samples of Japanese and foreign glues, and studied the relations between various properties and the quality of the glue. The adhesive strength was found to be generally proportional to the jelly strength except that a few glue solutions of high concentrations gave high values. Solutions of 1 pt. of glue in 2 pts. of water such as are generally used for strong joints showed very high adhesive power, and in the strength test the walnut test-pieces were stripped off whilst the glue surfaces remained un-

affected. The adhesive powers are greater with straight-grained wood than with cross-grained wood.

K. KASHIMA.

Unhairing process. Alteration of keratin by alkalis. II. M. BERGMANN and F. STATHER (Collegium, 1926, 249—256).—See A., 1926, 631.

PATENTS.

Lime treatment of skins. M. BOURGUIGNON, Assr. to SOC. DU FEUTRE (U.S.P. 1,586,062, 25.5.26. Appl., 7.2.22).—See E.P. 175,620; B., 1923, 367 A.

Quick tannage by means of the one-bath method. CHEM. FABR. GRIESHEIM-ELEKTRON, Assees. of F. MERKEL (U.S.P. 1,587,019, 1.6.26. Appl., 18.7.22. Conv., 1.8.21).—See G.P. 414,867; B., 1925, 858.

XVI.—AGRICULTURE.

Properties of humid-tropical and humid-temperate American soils with reference to relations between chemical composition and physical properties. H. H. BENNETT (Soil Sci., 1926, 21, 349—376).—In a study of clay soils occurring in tropical America, two types are distinguished, namely, a friable and a plastic type. The former type is distinguished by a relatively low silica and high sesquioxide content, the molecular ratio $\text{SiO}_2 : \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$ being generally less than 2. In the plastic type this ratio is greater than 2. Similar conclusions are reached from a consideration of certain clays of the South-Eastern United States.

G. W. ROBINSON.

Loss of soluble salts in "run-off" water [from soils]. F. L. DULEY (Soil Sci., 1926, 21, 401—409).—Analyses are given of the water running off the surface of different plots in a series of soil erosion experiments in Missouri. The total annual loss of soluble matter varied from 167 to 380 lb. per acre, and fell chiefly on the calcium and sulphur of the soil. Whilst the losses of potassium were relatively small, in some cases they were equivalent to the amount ordinarily applied in potash fertilisers. The losses of nitrogen and phosphorus were comparatively small.

G. W. ROBINSON.

Determination of incrustated cellulose in soil. N. BENGTSSON (Mitt. 279 der landw. Zentralversuchsanst. [Sweden], 1926, Bakt. Abhandl., 37, 1—13; Chem. Zentr., 1926, I., 3355).—For the determination of the cellulose of straw in soil, 20 g. of soil are digested at 100° for 72 hrs. with a solution of 80 g. of sodium hydrogen sulphite in 100 c.c. of water and 200 c.c. of *N*-hydrochloric acid. With sawdust and moss, longer heating is required. The residue is washed and dried at 50°, shaken for 1—2 hrs. with 100 c.c. of Schweitzer's reagent, and the liquid filtered after keeping overnight. The cellulose in 50 c.c. of the filtrate is then precipitated with 80% alcohol, washed successively with hydrochloric acid, 5% ammonia, 2% hydrochloric acid, water, alcohol, and ether, and dried for $\frac{1}{2}$ hr. at 50° and for 1 hr. at 100°. It is then transferred to a

platinum crucible, weighed, ignited, and re-weighed. The difference between the two weighings gives the cellulose in 10 g. of soil. A correction must be made for the water in the precipitate before treatment with Schweitzer's reagent, if very accurate results are required. The procedure is slightly modified for the determination of cellulose in lignite.

C. T. GIMMINGHAM.

Decomposition of incrustated cellulose in soil I. Straw and sawdust in loamy and sandy soils C. BARTHEL and N. BENGTSSON (Mitt. 300 der landw. Zentralversuchsanst. [Sweden], 1926, Bakt. Abhandl., 40, 1—19; Chem. Zentr., 1926, I., 3354).—Experiments with oat straw and sawdust show that the reaction of the soil has even less influence on the decomposition of incrustated cellulose than it has on that of pure cellulose. Oat straw contains a sufficient amount of suitable nitrogen compounds for the cellulose-decomposing bacteria and, consequently, decomposes more rapidly than pure cellulose in sandy soils poor in nitrogen. This also accounts for the rapid breaking down of roots and stubble in the soil.

C. T. GIMMINGHAM.

Use of oat straw in a system of soil fertility. R. P. THOMAS and H. J. HARPER (Soil Sci., 1926, 21, 393—400).—Addition of oat straw to two types of soil, alone and in combination with red clover, sodium nitrate, and ammonium sulphate, respectively, did not affect the accumulation of nitrates. Straw alone depressed the yield of wheat in pot experiments with one type of soil. No depression occurred with maize on another soil type. It is concluded that large quantities of straw can be returned to soils, if spread on the second growth of clover, without reducing the nitrate content except in the soil which is in immediate contact with the straw.

G. W. ROBINSON.

Influence of form, soil-zone, and fineness of lime and magnesia incorporations upon outgo of calcium and magnesium. W. H. MACINTYRE (Soil Sci., 1926, 21, 377—392).—The author has studied by lysimetric observations the effect of different dressings supplying lime and magnesia and of different modes of application on the loss of these constituents by drainage. The rate of loss of calcium during four years after incorporation of the dressing with the surface zone was not increased by more than 6.8% of the added calcium. Greater losses were observed when the dressings were incorporated with lower zones. Losses of magnesium were only slightly increased by surface incorporation of limestone or dolomite, but incorporation of the latter material with the subsoil resulted in considerably increased losses. Total calcium-magnesium leachings were uniformly greater when the added dressings were incorporated with the subsoil and were approximately the same for additions of calcium hydroxide, 80- to 200-mesh limestone, and 80- to 200-mesh dolomite respectively.

G. W. ROBINSON.

Decomposition of farmyard manure in soil and its utilisation by plants. M. Bach (Landw.

Vers.-Stat., 1926, 104, 245—284).—Samples were taken on cropped and fallowed plots on a variety of soils at intervals after manuring with dung. About 75% of the added carbon is oxidised by the end of a year. The remainder oxidises only slowly. Decomposition is notably slower in chalk soils than in sand, clay, and slatey soils. The whole of the pentosans added with the manure disappear within a year, whereas decomposition of the lignin proceeds much more slowly. The amounts of both total and easily soluble nitrogen show a considerable decrease soon after manuring, due to denitrification and loss by drainage. The percentage of available phosphoric acid remains approximately constant; available potassium shows a gradual decrease. On plots cropped with sugar beet and rye, about 20% of the added nitrogen, about 20% of the phosphoric acid, and about 50% of the potassium were utilised by the plants in the two years following manuring.

C. T. GIMINGHAM.

Solubility of soil potassium and response to potassium fertilisers. O. ENGELS (*Ernährung d. Pflanze*, 1925, 21, 172—178; *Chem. Zentr.*, 1926, I, 213).—The solubility of the potassium compounds of the soil in 10% hydrochloric acid or in 1% citric acid is no trustworthy indication of the need or otherwise for potassium fertilisers.

G. W. ROBINSON.

Vegetation experiments with sericite as a source of potassium. E. BLANCK and F. ALTEN (*Landw. Vers.-Stat.*, 1926, 104, 237—243).—Vegetation experiments with mustard grown in sand give no support to the view that the potassium in sericite, a potash-mica, can be utilised by plants. No significant difference in yield was observed between pots receiving no potassium and those receiving sericite.

C. T. GIMINGHAM.

Promoloid asahi [colloidal magnesium silicate. E. BOTTINI (*Annali Chim. Appl.*, 1926, 16, 29—39).—The "promoloid asahi" used was a milky, alkaline liquid containing 88.82% of water (determined at 100°), 2.09% of water of crystallisation and combination (at red heat), 2.03% of magnesia, 6.94% of silica, and 0.12% of ferric oxide; 1000 c.c. required 2.08 g. of sulphuric acid for neutralisation. Experiments were made with artificial soils of different types. Addition of "promoloid" diminished the permeability, with all kinds of soil. It had little effect on the capillarity of sandy and calcareous soils, but with clay and humic soils it increased the capillarity considerably, favouring the evaporation of water. "Promoloid" had no appreciable effect on the drying of the wet soils except in the case of humic soils where it accelerated evaporation. The absorptive power of the soils for ammonium chloride was increased and for sodium nitrate diminished by treatment with "promoloid."

R. SANSONE.

Denitrification in oxidising media. E. PARISI (*Annali Chim. Appl.*, 1926, 16, 40—45).—The losses of nitrogen taking place in the biological purification of sewage and maturation of manure during aerobic fermentation, are attributed to the interaction of

nitrous acid, formed by oxidation of ammonia, with amino-acids produced by degradation of proteins:

$$R \cdot CH(NH_2) \cdot CO_2H + HNO_2 = R \cdot CH(OH) \cdot CO_2H + H_2O + N_2$$

Ammonium sulphate added to soil submerged in water in a flask in which an atmosphere of oxygen was maintained was decomposed with formation of a considerable quantity of nitrogen. When sufficient sucrose was added to the submerged aerated soil to prevent nitrification the ammoniacal nitrogen remained unchanged. When the quantity of amino-acid present in the soil was not sufficient to destroy the nitrous acid formed nitric acid was produced. By adding sufficient asparagine the whole of the nitrous acid, however, disappeared and the liquid remained free from nitrate.

R. SANSONE.

Problem of a proper nutrient medium. D. N. PRIANISHNIKOV and M. K. DOMONTOVITCH (*Soil Sci.*, 1926, 21, 327—348).—A historical discussion is given of the problem of nutrient solutions for use with sand cultures. In the experimental portion, the authors study the effect of the different ingredients of the Prianishnikov medium in which nitrogen is supplied as ammonium nitrate, in combination with calcium monohydrogen phosphate. In this medium and also in the Hellriegel medium, containing calcium nitrate and potassium dihydrogen phosphate, the greatest buffering effect is at a p_H near the neutral point. Ammonium nitrate is physiologically acid. The effects of different plants on the reaction of complete media containing sodium nitrate, ammonium nitrate, or ammonium chloride with a small amount of potassium dihydrogen phosphate are qualitatively similar. Buckwheat shows the greatest tolerance to the physiological acidity of ammonium chloride.

G. W. ROBINSON.

PATENT.

Artificial drying of crops (E.P. 251,577).—See XIX.

XVII.—SUGARS; STARCHES; GUMS.

Chemistry of [sugar] refining by "Norit." P. HONG (*Int. Sugar J.*, 1926, 28, 302—305).—Examination of washed Cuban sugar melts after treatment with about 1½% (on the weight of sugar) of "Norit" carbon showed the purity to remain practically unaltered, the colour and the surface tension being principally affected, while ash was adsorbed to the extent of 20—25% of that originally present. After a single application of "Norit," the ash adsorption was about 1.8% of the carbon, calcium, magnesium, and phosphoric acid being principally removed. Organic matters (pectins and pentosans, galactans, wax, and nitrogenous substances) are taken up to the extent of 2.2% of the carbon. Surface tension determinations and laboratory experiments show carbon to be superior to kieselguhr as a filtering aid.

J. P. OGILVIE.

Determination of the effect of decolorising carbons on sugar juices by measurement of the surface tension. F. TÖDT (*Z. Ver. deuts. Zucker-Ind.*, 1926, 253—272).—Traube's "stalagmo-

meter" (cf. B., 1888, 42; 1911, 448) is recommended in preference to Du Noüy's apparatus for the determination of the surface tension, especially for practical work in sugar factory control.

J. P. OGILVIE.

Determination of reducing sugars by the picric acid method. F. HERZFELD (Z. Ver. deuts. Zucker-Ind., 1926, 273—292).—In the picric acid method, instead of determining the picramic acid colorimetrically, the extent of the change of colour is estimated by means of a polarisation-photometer, tables giving the extinction coefficients for various sugars having been compiled. In the case of impure factory products, the method is less trustworthy than with fairly pure solutions. J. P. OGILVIE.

Determination of starch by calcium chloride. G. CHABOT (Bull. Soc. chim. Belg., 1926, 35, 130—131).—The author has examined the method of Mannich and Lenz (Z. Unters. Nahr. Genussm., 1920, 40, 1) which is based on the fact that starch dissolves when boiled with concentrated calcium chloride solution, yielding a clear solution which can be polarised. He finds that if the calcium chloride used is alkaline, gelatinisation occurs. Clearer solutions are obtained in porcelain than in glass vessels. E. W. WIGNALL.

PATENTS.

Filtration or decolorisation of sugar and other liquors. M. RUSSELL (E.P. 251,749, 4.4.25).—In revivification of animal charcoal and like filtering media by steam as described in E.P. 210,232 (B., 1924, 271) when the filter and filtering medium have reached the temperature of 100° steam may be drawn from the exit end of the filter, compressed to any desired extent in a compressor, and returned through the filter in a closed circuit, steam from the boilers being required only to make good any leakages in the circuit. Charcoal and dust may be separated from the spent steam by passing it through a 160-mesh monel-metal screen or a layer of sand and gravel. G. T. PEARD.

Extraction of juices by diffusion. A. SOKOLOV (F.P. 597,408, 29.4.25).—The substances from which the juice is to be extracted, e.g., sugar-beet slices, are first treated in a current of the extracting liquid and then exposed between sieves to the action of a current of hot juice, the direction of which can be periodically altered. C. RANKEN.

Manufacture of starch. J. M. WIDMER, Assr. to PENICK & FORD, LTD. (U.S.P. 1,585,452, 18.5.26. Appl., 26.12.24).—Corn (maize) is steeped, and the grain in disintegrated condition and in presence of water is subjected to separating operations for the removal of the starch. Water used in these operations is sterilised by heat derived from the evaporation of the steep water. Wash water from the starch washing operation is acidified and used together with the sterilised water for the separating operations on material treated subsequently. J. P. OGILVIE.

Preparation of starch solutions not precipitated by basic salts. J. PERL & Co.

(Swiss P. 113,725, 19.11.24).—An aqueous starch suspension after warming with very small quantities of acid substances, is heated with caustic alkali in excess until the starch is dissolved, and, finally, the alkali is neutralised by acid.

C. RANKEN.

Treatment of seed of the carob-tree or other plant to extract the gum. Soc. ANON. ETABL. J. F. AUDIBERT (E.P. 241,186, 1.10.25. Conv., 10.10.24).—Carob seeds decorticated by rolling and crushing are heated until of a golden brown colour, and then macerated in 20 times their weight of boiling water, the viscous product obtained being pumped through sieves and cloth filters, and the clear gum dried and pulverised. J. P. OGILVIE.

XVIII.—FERMENTATION INDUSTRIES.

Agave pulp as a source of industrial alcohol. P. BAUD (Compt. rend., 1926, 182, 1631—1634).—Leaves of *Agave rigida*, var. *Sisalana*, two months after cutting, contain up to 6% of fermentable sugars and 3.5% of non-reducing sugars and gums. Juice expressed from agave pulp after removal of the fibre, contains 5.4% of fermentable sugar and 6.6% of non-reducing sugar including pentosans. The dried pulp contains up to 15% of fermentable sugar, as against the expected value of 40—45%. This variation is ascribed to changes in the composition of leaves at different times of the year. Analyses for cellulose and inorganic salts are also given. 22.4 litres of 92% alcohol were produced from 280 kg. of agave stems. It is considered that the production of alcohol is an economic possibility from five-year-old plantations, not less than 400 hectares in area. M. CLARK.

Toxicity, detection, and determination of methyl alcohol. G. REIF (Z. Unters. Lebensm., 1926, 51, 262—267).—A case of poisoning by methyl alcohol in spirits is discussed. The toxicity is ascribed to methyl alcohol itself and not to contained impurities. The method of Pfyl, Reif, and Hanner (B., 1922, 78 A) for detecting methyl alcohol by means of guaiacol is adopted for the detection and determination of small quantities of methyl alcohol in spirits. A. G. POLLARD.

PATENTS.

Preparation of citric acid by fermentation. J. SZÜCS (Austr. P. 101,009, 19.12.23; F.P. 589,936, 3.12.24).—Species of *Citromyces*, *Mucor*, *Aspergillus*, and *Penicillium* chosen after experimental comparison of their power of forming citric acid at relatively low temperatures, are used for the preparation of citric acid by fermentation of molasses. The optimum temperature for *Aspergillus* is 20°, whereby the oxidation of citric acid to oxalic acid is hindered. The molasses may be mixed with phosphates or freed from potassium salts by purification. The citric acid is neutralised by addition of oxide, hydroxide, or carbonate of barium, and the resulting barium citrate decomposed by sulphuric acid. C. RANKEN.

Manufacture of yeast, especially by the aeration process. VER. MAUTNER'SCHE PRESS-HEFEFABR. G.M.B.H., and E. FOULD-SPRINGER (Austr. P. 102,274, 20.9.19).—Yeast and alcohol are prepared from mashies or worts by leading continuously or periodically during fermentation a concentrated solution into the extremely dilute fermenting liquid. The concentration and velocity of the inflowing liquid are such that the consumption of nutriment is not only equalled but exceeded. The fermentation is also carried out so that, in addition to the yeast reproduction, an increasing quantity of alcohol is formed in the fermenting solution.

C. RANKEN.

Obtaining absolute alcohol. J. A. STEFFENS, Assr. to U.S. INDUSTRIAL ALCOHOL Co. (U.S.P. 1,586,717-8, 1.6.26. Appl., 5.4.21).—See E.P. 206,747 and 213,984; B., 1924, 193, 569.

Purification of effluents from breweries, distilleries, etc. (G.P. 426,765).—See XXIII.

XIX.—FOODS.

Relation between the lactic acid content of milk and its loss in dry extract. M. FOUASSIER and G. MAURICE (Bull. Soc. Chim. biol., 1926, 8, 175-177).—The dry extract of milk previously treated with dichromate decreases appreciably from day to day, though much more slowly than that of untreated milk. The lactic acid formed slowly reduces the dichromate, so that the determination of the lactic acid content does not give a reliable correction for the value of the dry extract; some of the lactic acid is also converted by heat into dilactic acid which remains in the extract.

C. P. STEWART.

Milk powders as food. II. Existence of vitamin-E. L. T. ANDEREGG and V. E. NELSON (Ind. Eng. Chem., 1926, 18, 620-622).—Skimmed milk powder, compared with whole milk powder, appears to be deficient in the proteins and vitamins necessary for growth and reproduction of rats and rearing of young; the deficiency cannot be remedied by the addition of butter-fat to the skimmed milk to make the chemical composition similar to that of whole milk. Cod liver oil incorporated with the skimmed milk gives poor results, as decomposition occurs, similar decomposition being observed with cod liver oil and other highly desiccated materials. Ethyl alcohol, wheat oil, or water, however, exert a protective influence. The addition of water to the skimmed milk powder, and administration of cod-liver oil separately, produced very good results, young of the fourth generation being reared successfully. These results are at variance with views previously expressed regarding the existence of vitamin-E (cf. B., 1925, 520).

B. W. CLARKE.

Chemistry of flesh foods. No. 6. Canned meats. A. M. WRIGHT and (Miss) J. F. BEVIS (N.Z. J. Sci. Tech., 1926, 8, 163-167).—A concentration of the food value occurs during the canning

of meats, e.g., tongues, mutton, etc., owing to evaporation of water during the parboiling of the meat previous to the canning process. Detailed analyses of fresh and canned meats are given.

B. W. CLARKE.

Feder number in relation to the examination of meat. H. W. DE KRUIJFF and G. L. VOERMAN (Chem. Weekblad, 1926, 23, 296-299).—The Feder number, i.e., the ratio of moisture to organic material other than fat, has been determined for a great number of different meats, and it is confirmed that the value should always be less than 4. For samples containing flour, e.g., sausage meat, the ratio should be calculated on the content of organic matter not fat, less the flour content, in testing for addition of water. Addition of casein or milk powder may be detected by examining for lactose and calcium compounds.

S. I. LEVY.

Examination of Canadian sprayed apples for arsenic. F. T. SHUTT (Analyst, 1926, 51, 291-293).—Eight samples (each consisting of 6-12 apples) of apples from Nova Scotia, 8 from Quebec, 17 from Ontario, and 10 from irrigated orchards of British Columbia were examined for arsenic in the skin, calyx, and stalk respectively, and it was found that approximately half the samples were free from arsenic, a sixth showed traces less than 1/10,000 of a grain per lb., and a third contained quantities from 1/10,000 to 1/190 of a grain per lb.

D. G. HEWER.

Preparation and colloidal properties of pectin. (Miss) M. A. GRIGGS and (Miss) R. JOHNSTIN (Ind. Eng. Chem., 1926, 18, 623-625).—Pure pectin is prepared from lemon albedo by first extracting with alcohol and subsequent extraction of the residue with 0.01N-hydrochloric acid at 90°. The pectin sol is freed from electrolytes by dialysis, the pectin precipitated by alcohol and flocculated in an electric field. The colloidal properties and conditions of gelation of pure pectin sols and of alcohol-pectin and sugar-acid-pectin sols are described.

B. W. CLARKE.

Food value of different grades of barley as produced by a modern seed purification plant. F. HONCAMP and W. SCHRAMM (Landw. Vers.-Stat., 1926, 104, 285-296).—Digestibility trials with sheep indicate that the digestible protein and starch equivalent of various grades of barley, separated by the Schule system of seed purification, differ little in amount from those of the original grain or from one another. It is suggested, therefore, that all the first-class seed should be reserved for sowing and not used for feeding.

C. T. GIMINGHAM.

Composition and digestibility of barley and its milling offals. F. HONCAMP and W. SCHRAMM (Landw. Vers.-Stat., 1926, 104, 297-312).—The results of microscopical examinations of barley meals and various milling products of barley, and of digestibility trials with the same materials are recorded. A coarse barley meal showed the highest starch equivalent.

C. T. GIMINGHAM.

Influence of degree of maturity on the composition of peas. C. F. MUTTELET (Ann. Falsif., 1926, 19, 283—290; cf. B., 1925, 186).—Ratios previously found to increase with the degree of maturity in the case of the American Marvel pea have now been worked out for the three varieties Caractacus, Serpette, and Express, and a general agreement with former results obtained. It is thus possible from determinations of starch, sugars, soluble and insoluble nitrogen, and cellulose to obtain an indication of the age of the product. D. G. HEWER.

Preserved peas in relation to their diameter. E. LASAUSSE (Ann. Falsif., 1926, 19, 290—293; cf. B., 1926, 382).—A criticism of Muttelet's experiments and conclusions. D. G. HEWER.

Determination of sodium; applications. [Determination of sodium in mineral waters and milk.] L. BARTHE and E. DUFILHO (Compt. rend., 1926, 182, 1470—1473).—Sodium may be determined by precipitation as the triple acetate of uranium, magnesium, and sodium (cf. Blanchetière, A., 1923, ii, 579) in the absence of organic matter and phosphates. If organic matter is present it should be destroyed by the nitro-sulphuric acid method without addition of permanganate. Phosphates are best precipitated by a uranium salt using hot solutions. This direct determination of sodium when used for mineral waters gives results differing from those obtained by the usual indirect methods, indicating that the generally accepted figures may be wrong. Thus for a Vichy water the direct and indirect methods gave 1.4064 and 1.5285 g. of sodium per litre respectively. The application of the method to the determination of sodium in milk is described in detail. Normal untreated milk contains from 0.345 to 0.484 g. of sodium per litre, and this method is very suitable for the detection of the addition of sodium bicarbonate to milk. W. HUME-ROTHERY.

Determination of free acid in silage. F. MACH and W. LEPPER (Landw. Vers.-Stat., 1926, 104, 317—320).—The use of phenolphthalein as an indicator for the determination of the total acidity in silage and similar acid food products gives results which are too high. The drop method with a specially sensitive litmus paper is recommended as giving satisfactory results. C. T. GIMINGHAM.

Determination of crude fibre in the presence of products of animal origin. F. MACH and W. LEPPER (Landw. Vers.-Stat., 1926, 104, 313—316).—In the determination of crude fibre in such materials as fish and meat meals, hair, feathers, etc. a determination of the nitrogen in the fibre is essential. If asbestos is used for filtering, the change in weight on ignition should be determined in a blank experiment and allowed for. The amount of 1.25% hydrochloric acid used for the digestion should be increased from 200 c.c. to 400 c.c. if the material contains bone-meal. C. T. GIMINGHAM.

PATENTS.

Artificial drying of crops. B. J. OWEN (E.P. 251,577, 2.4.25. Addn. to 235,273; B., 1925, 648).

—In addition to the central hollow space for the distribution of the heated air, one or more smaller auxiliary spaces are provided which ensure the more rapid and uniform drying of the material.

G. W. ROBINSON.

Process for making a kola preparation. W. J. WULF (E.P. 252,765, 24.11.25).—Raw kola nuts, as distinct from the fresh nuts, are subjected to a preliminary fermentation, which prevents drying or hardening, and are then cut up, soaked in water, fermented in their own juice, dried, roasted, and ground. Alternatively, the raw nuts are steeped in water before fermentation. The product is free from the bitter taste of the natural nut and the free caffeine content is very low. E. H. SHARPLES.

Drying hay and like crops. W. DONALD (E.P. 252,533, 8.5.25).

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Basic [dissociation] constant of morphine and its application in the titration of morphine. C. MORTON (Pharm. J., 1926, 116, 567—570, 593—597).—The hydrolysis constant of morphine hydrochloride at 30° (determined by E.M.F. measurements) is 1.914×10^{-6} , whence the dissociation constant of morphine is 6.27×10^{-9} . On theoretical grounds, the accepted methods of titrating morphine cannot be expected to yield accurate results, but by the back titration of acid solutions, using litmus, cochineal, and methyl-orange as indicators, fairly satisfactory results are obtained, owing to partial compensation of errors. Bromophenol-blue gives satisfactory results as indicator, and for the analysis of fairly pure morphine its use in combination with potassium hydrogen phthalate solution as colorimetric standard is recommended. A system of hydrogen and calomel electrodes devised for the E.M.F. measurements is described. B. FULLMAN.

Yocca, a new caffeine drug. E. PERROT and A. ROUHIER (Compt. rend., 1926, 182, 1494—1496).—From the bark and stems of the *yocca* plant of southern Colombia a crystalline alkaloid, agreeing in composition and properties with caffeine, is readily extracted. B. W. ANDERSON.

Determination of nicotine in tobacco. R. R. T. YOUNG (N.Z. J. Sci. Tech., 1926, 8, 129—142).—Keller's method for the determination of nicotine in tobacco (cf. A., 1899, ii., 194) yields accurate results when slightly modified. Three successive extractions for $\frac{1}{4}$ hr. with an ether-petrol mixture containing only 10% of ether are more satisfactory than one extraction for 3 hrs. with a 50% ether-petrol mixture, whilst cochineal or rosolic acid is to be preferred to iodoquin as indicator. It is unnecessary to pass a current of air through the solution to expel ammonia, since experiments show that no ammonia is liberated by this method.

B. W. CLARKE.

Value of the D.M. index from the point of view of the toxicity of the arsenobenzenes. DE MYTTENAERE (J. Pharm. Chim., 1926, [viii], 3, 497—506). A VALEUR and L. LAUNOY (*Ibid.*; 506—507). Polemical. B. FULLMAN.

Analysis of glacial acetic acid. H. D. RICHMOND and E. H. ENGLAND (Analyst, 1926, 51, 283—287).—A table is given showing the relationship between d , f.p., and percentage composition of glacial acetic acid, as all likely impurities of the acid affect these two physical properties. Propionic acid depresses the value of d on the average 0.0065 for each 1%, and the f.p. 0.485°. The percentage present may be calculated by dividing the difference between the value of d calculated as equivalent to the f.p. found, and that actually found, by 0.00135. Values of d calculated for different values of f.p. at intervals of 0.1° are given in a table. Aldehydes and ketones may be present in too small quantities to affect the d or f.p., but may be detected by Schiff's reagent or Denigès' mercuric chloride test respectively.

D. G. HEWER.

Analysis of acetic anhydride. H. D. RICHMOND and J. A. EGGLESTON (Analyst, 1926, 51, 281—283).—The rise of temperature when 2 c.c. of acetic anhydride are added to 200 c.c. of a mixture of 94% of toluene (diluent) and 6% of aniline, in a vacuum flask, serves as a measure of the percentage of anhydride in the sample. A small and constant rise of temperature is given by acetic acid, but this is practically negligible for acetic anhydride of 90% and over. Trustworthy results may be obtained by multiplying the rise of temperature by a factor and ignoring the small corrections, which, however, are given in a table. Cooling corrections and heat capacity of the apparatus were not determined so that at present a factor must be worked out for each apparatus. The maximum divergence between 2 experiments was 0.037°.

D. G. HEWER.

Anæsthetic gases. W. E. BROWN and V. E. HENDERSON (J. Pharm. Exp. Ther., 1926, 27, 1—8).—Propylene is a better anæsthetic than either butylene or propane, since it does not stimulate the spinal centres, whilst the low concentration required allows the administration of sufficient oxygen to maintain a practically normal metabolism.

H. P. MARKS.

Camphor researches at Naples. A. DE DOMINICIS and C. LA ROTONDA (Annali Chim. Appl., 1926, 16, 7—20).—Some results of experimental steam distillation of camphor (*Laurus camphora*) plants, 6—7 years old, from the Naples Botanic Gardens are given. The younger leaves yielded 0.38% of camphor and 0.19% of essential oil in May, and 1.12% of centrifuged camphor and 0.10% of oil in July. The maximum yield of camphor (1.14%) from full-grown leaves was obtained in May and July. The highest yield of oil was obtained from leaves gathered in September. No camphor and only traces of oil were obtained from the stems of the plants. The roots gave yields of oil ranging

from 0.45 to 1.67%, according to the season, but no camphor. Dry leaves yielded 2.37% of camphor and 0.31% of oil.

R. SANSONE.

Essential oil of *Laurus nobilis*, L. V. MORANI (Annali Chim. Appl., 1926, 16, 21—28).—A study of the essential oil of Italian laurel (*Laurus nobilis*, L.). 20 kg. of leaves on distillation with steam, yielded 256 g. of a canary-yellow oil, having a characteristic smell recalling that of eucalyptus oil. The oil had d_{15}^{25} 0.92073, n_D^{24} 1.4712, solubility at 20° in 70% alcohol 1:10.5 (particles in suspension); in 80% alcohol 1:1.1 (clear); esters as $C_{10}H_{17}OAc$ 13.02%, total alcohols ($C_{10}H_{18}O$) 23.19%, free alcohols 12.95%. Acetylation by the method of Boulez, as modified by Schimmel (cf. B., 1907, 221), gave total alcohols 27.76%, free alcohols 17.52%, indicating the presence of tertiary alcohols. The approximate composition of the oil is 45% of cineole, 18% of terpineol and geraniol, 13% of acetic esters, 0.55% of free eugenol, 1.1% of eugenyl acetate, 3% of methyleugenol, 12% of terpene hydrocarbons, principally β -pinene and phellandrene, and 3—4% of a sesquiterpene. The Italian oil differs from other laurel oils by containing β -pinene in the place of α -pinene and terpineol instead of linalool.

R. SANSONE.

Constituents of ichthyol oils. SCHEIBLER and RETTIG.—See III.

PATENTS.

Manufacture of halogenated alcohols. FARBEN-FABR. VORM. F. BAYER & CO., and H. MEERWEIN (E.P. 251,890, 11.6.25. Addn. to 253,584; B., 1925, 738).—The aluminium alkoxide or halogenated alkoxide, used according to the previous patent for converting a halogenated aldehyde dissolved in a primary alcohol into a halogenated alcohol, is replaced by aluminium alkoxide to which aluminium chloride has been added. The conversion of butyl-chloral into trichloro-*n*-butyl alcohol is described.

B. FULLMAN.

Preparation of soluble salts of substituted phenylarsinic acids. R. W. E. STICKINGS, and MAY AND BAKER, LTD. (E.P. 252,099, 1.7.25).—Soluble piperazine salts of amino- and acylamido-phenylarsinic acids and the hydroxy-derivatives of these are prepared by direct combination of the components in solution in water or alcohol. Examples are given of the preparation of the salts of 3-amino-4-hydroxyphenylarsinic acid, 3-acetamido-4-hydroxy-phenylarsinic acids, 4-aminophenylarsinic acid, and 4-dihydroxypropylaminophenylarsinic acid. The salts have therapeutic application.

B. FULLMAN.

Preparing pentaerythritol tetra-acetate. H. T. CLARKE, ASSR. to EASTMAN KODAK CO. (U.S.P. 1,583,658, 4.5.26. Appl., 1.8.24).—250 pts. of pentaerythritol are refluxed with 1000 pts. of glacial acetic acid and 1 pt. of concentrated sulphuric acid (as catalyst). The temperature of the vapour is maintained at 105° so as to allow water vapour only to escape. When water evolution has ceased acetic

acid is distilled from the ester by raising the temperature of the mixture to 118°. A calculated quantity of anhydrous sodium acetate is then added to neutralise the sulphuric acid, and the pentaerythritol tetraacetate is distilled from the residue of sodium sulphate at a pressure of 9 mm. at 186°. It is recrystallised from benzene. R. B. CLARKE.

Production of amines including the substitution products thereof and nitriles. K. F. SCHMIDT (E.P. 252,460, 27.2.25). — See U.S.P. 1,564,631; B., 1926, 216.

Manufacture of hexamethylenetetramine. H. WADE. From S. KARPEN & BROS. (E.P. 252,609, 23.10.25).—See U.S.P. 1,566,820; B., 1926, 217.

Manufacture of alkyl esters of formic acid. J. Y. JOHNSON. From BADISCHE ANILIN & SODA FABRIK (E.P. 252,848, 22.4.25).—See U.S.P. 1,572,698; B., 1926, 462.

Monoiodo-oxindole and process of making it. CHEM. FABR. AUF ACTIEN (VORM. E. SCHERING), Assees. of W. SCHOELLER and K. SCHMIDT (U.S.P. 1,587,866, 8.6.26. Appl., 24.11.25. Conv., 10.12.24).—See E.P. 244,444; B., 1926, 514.

Preparation of solutions of derivatives of di[hydr]oxydiaminoarsenobenzene. S. R. MAC- EWEN (U.S.P. 1,588,252, 8.6.26. Appl., 7.12.23).—See E.P. 221,565; B., 1924, 966. An alkaline reagent may also be added.

N-Acyl derivatives of 5-amino-3-chloro-4-hydroxybenzene-1-arsonic acid. I.-G. FARBEN-IND. A.-G., Assees. of L. BENDA and W. SCHMIDT (U.S.P. 1,588,382, 8.6.26. Appl., 7.11.25. Conv., 10.3.24).—See E.P. 230,487; B., 1925, 942.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Relation between the colour sensitivity of emulsions of the same kind, but of differing silver iodide content. R. JAHR (Phot. Ind., 1926, 609).—A series of emulsions containing respectively 1, 2, 3, and 4 g. of potassium iodide per 100 g. of silver nitrate, and sensitised with Erythrosin, were prepared in the same way. Sensitisation by the dye takes place most readily when no iodide is present. With more than 2% of silver iodide sensitisation begins to decrease, whilst with 4% of silver iodide there is practically no sensitisation. W. CLARK.

Nitro-compounds as desensitisers. LÜPPO-CRAMER (Phot. Ind., 1926, 629–630).—Contrary to the observations of other workers, it is found that nitrates have no influence on the sensitivity of photographic plates. A desensitising action of aqueous sodium nitrite cannot always be observed. The strong desensitising action of a colourless nitrite solution on the direct blackening of silver chloride-gelatin plates or precipitated silver chloride cannot be due to absorption of the blue part of the spectrum by the nitrite (cf. Perley, Eder's Jahrbuch,

1913, 446). The view that, in general, nitro-compounds are desensitisers is not confirmed. The NO-group in sodium nitroprusside is not responsible for the desensitising action of this salt. W. CLARK.

Photochemical processes with silver halides. H. H. SCHMIDT (Phot. Ind., 1926, 608).—The absorption spectra of dyes adsorbed on silver halides and of the silver salts of the dyes agree with the sensitivity spectrum of the silver halide dyed with the particular dye. It is considered that this explains the discrepancy between the absorption spectrum of a dye and the spectral sensitivity it confers. W. CLARK.

XXII.—EXPLOSIVES; MATCHES.

Chemical stability of [propulsive] explosives as an additive property. M. TONEGUTTI (Z. ges. Schiess- u. Sprengstoffw., 1926, 21, 81–84).—Lenze and Pleus (B., 1920, 468 A) and de Bruin (B., 1921, 903 A) have shown that the behaviour of nitro-cellulose does not support the generally accepted view that the decomposition products of a small quantity of an unstable constituent cause a catalytic decomposition of the remainder of the explosive. The investigation has now been extended to nitroglycerin propulsive powders such as ballistite and cordite by using Taliani's method (B., 1921, 562 A) to measure the rate of decomposition of various batches of either explosive alone and when mixed in various proportions. It is found that the stability of a mixture of 2 ballistites or 2 cordites can be satisfactorily calculated, when the proportions and stabilities of the constituents are known, by assuming that the stability is an additive property. In mixtures of cordite and ballistite the stability is not additive, but remains close to that of cordite, the more stable constituent, the vaseline in the cordite appearing to retard the decomposition of the ballistite. S. BINNING.

XXIII.—SANITATION; WATER PURIFICATION.

Determination of iodine in natural waters. BRUBAKER, VAN BLARCOM, and WALKER.—See VII.

PATENTS.

Biological purification of effluents contaminated with phenols. H. BACH (G.P. 426,422, 11.12.24).—Effluent from gas-works etc. is purified, after a preliminary treatment such as dilution, if required, by mixing with sewage and running into tanks where compressed air is blown in from below, either continuously or discontinuously, to stir up the sludge and subject the effluent to oxidation and the action of the bacteria in the sludge. E. S. KREIS.

Biological purification of effluents contaminated with organic matter, and containing acids, or tending to become acid; e.g., effluents from breweries, distilleries, etc. H. BACH (G.P. 426,765, 20.1.25).—The effluents are purified by adding sufficient sewage, leading into a tank filled with clinker etc., and blowing in air from the bottom. The purification is quick and efficient. E. S. KREIS.