BRITISH CHEMICAL ABSTRACTS

B.—APPLIED CHEMISTRY

SEPTEMBER 16, 1927.

I.—GENERAL; PLANT; MACHINERY.

Priming of saline waters [in locomotive boilers]. A. F. JOSEPH and J. S. HANCOCK (J.S.C.I., 1927, **46**, 315—321 T).—Quantitative determinations of the percentage of priming were made with an experimental boiler working at 150 lb. pressure, the steam with priming water being trapped and condensed and the total dissolved solids determined. The amount of priming was found to increase with the rate of evaporation, but to decrease with increase of pressure. Sodium sulphate, sodium carbonate, sodium chloride, and calcium chloride in solution were found to promote priming in the order mentioned. No evidence was found of any effect from calcium carbonate or boiler scale in suspension. The water level in the boiler is important. The known action of castor oil in preventing priming was confirmed, a 1 in 6 emulsion in 1% soap solution being used.

C. IRWIN.

Rate of growth of crystals in aqueous solution. G. H. MONTILLON and W. L. BADGER (Ind. Eng. Chem., 1927, **19**, 809—816).—The rate of growth of crystals of sodium sulphate and magnesium sulphate during continuous crystallisation was studied. The hot solution, to which a given weight of sized seed crystals was added at regular intervals, was passed, at a temperature at which crystallisation was just commencing, into a long horizontal tube with stirrer. The crystals made during a run were dried, weighed, and screened. The results showed that growing small crystals do not all increase in size at the same rate, but those somewhat larger increase in weight faster than the smaller ones. Under given conditions there is a definite relation between increase in weight and increase in surface. The greater the time of contact in the crystalliser, the larger were the crystals, an arithmetical relationship being observed. The variation in the rate of growth with temperature (between 27° and 31°) and viscosity was also studied. From the data obtained it is possible to predict the proportion of crystal sizes for given conditions of crystallisation. C. IRWIN.

Protecting the eyes of chemical workers. J. E. HANNUM (Ind. Eng. Chem., 1927, **19**, 817—819).—Features of goggles most suitable for workers of various types of chemical processes are described. A list of a large number of substances injurious to the eyes, with the symptoms produced, is given. Methyl alcohol and lead are considered particularly dangerous, the latter causing atrophy of the optic nerve. C. IRWIN.

Conditions of flow into the vertical capillary tube of the Saybolt thermo-viscosimeter. W. H. HERSCHEL (Ind. Eng. Chem., 1927, **19**, 837—840).—In the Saybolt viscosimeter the time required to fill a vertical capillary tube immersed in the liquid between two given marks is measured. $d^2pgt/32 = [(\mu - \mu_a)(h + c) + \mu_a L] \log_e(b + c)/(a + c) - (b - a)(\mu - \mu_a) = \gamma$, where t = time of flow, μ and μ_a are the viscosities of the liquid and of air, h = height of liquid above the bottom of the capillary in the jar, b and a are the depths of the meniscus below the surface at the beginning and end of the run, d = diameter and L = total length of capillary, and c = capillary rise $= 4\gamma/pgt$, where γ = surface tension. A large number of tests were made with two instruments and compared with viscosity tests by the Bingham viscosimeter. To obtain good agreement it was found necessary to use the figure 29 in place of 32 in the above equation to compensate for the error due to drainage effect from the tube. C. IRWIN.

Technical aerosols and their characteristics. P. BEYERSDORFER (Kolloid-Z., 1927, **42**, 229—233).—A treatment of the technological problems connected with the formation, or prevention of formation, of the air dispersoids dust, smoke, and fog. Examples are given to illustrate the influence of the composition of both the solid and the gaseous phase on the properties of the aerosol. The question of dust explosions is considered in some detail, with special reference to the explosion of mixtures of sulphur and sugar dust, and to coal dust explosions and methods available for their prevention. The removal of noxious fumes and harmful gaseous suspensions is regarded as a problem of sol-gel transformation. A few examples of aerosols in which one phase is fluid are discussed. L. L. BIRCUMSHAW.

Silicic acid gel and its adsorbability. P. MAUTNER (Kolloid-Z., 1927, **42**, 273—275).—The manufacture of silicic acid gel from water-glass is briefly described, and the effect of heating the gel is discussed. Tables are given to show the dependence of the adsorptive power of the gel on the drying temperature, and thus on the water content. From figures showing the percentage of aniline, phenol, and acetic acid adsorbed from various solvents it appears that the adsorption is least when the solvent is water. The various technical uses of the gel as catalyst, catalyst-carrier, adsorber of vapours, refrigerating agent, etc. are reviewed, and a description is given of the method used by the Silica Gel Corporation for the recovery of benzene from coke ovens.

L. L. BIRCUMSHAW.

Adhesives and adhesion: relation of joint strength to tensile strength of films. J. W. MCBAIN and W. B. LEE (J.S.C.I., 1927, **46**, 321—324 T).—The tensile strength of joints between ferrotype or celluloid of different grades of sodium silicate was determined.

The results are affected by the atmospheric humidity but the relative order of strengths was independent of the class of material joined so long as it was smooth. Sodium silicate joints are very brittle, and the quality of brittleness or "deformability" is very important. The tensile strength of the adhesive is no guide to the strength of joint between smooth surfaces. The strength of fibres of gelatin glue diluted with dextrose or glycerin between plates was determined. Dilution weakens the films but increases deformability. "Glue pearls" were found to be inferior to ordinary glue in both respects. Shear tests on walnut joints with diluted glues gave results similar to the strengths of the adhesive, and this was also true for tension tests. Minor variations were found with the direction of the grain and the rate of loading. The mechanical explanation of the adhesion of glued wood joints (*i.e.*, joints between rough surfaces) is supported by the similarity of joint strength with sodium silicate and glue diluted to the same tensile strength. C. IRWIN.

Mathematical methods of frequency analysis of size of particles. R. P. LOVELAND and A. P. H. TRIVELLI (J. Franklin Inst., 1927, **204**, 193—217).

Collapsing strength of thin tubes and pipes in chemical works. W. F. SCHAPHORST (Ind. Eng. Chem., 1927, **19**, 887).

Pipe still. ASHWORTH.—See II.

Recorder for carbon dioxide. ROSENCRANS.—See XVI.

PATENTS.

Furnaces for heating. BRITISH FURNACES, LTD., and E. W. SMITH. From SURFACE COMBUSTION CO. (E.P. 274,003, 23.3.27).—The furnace comprises a trough of refractory material through which the goods to be heated (*e.g.*, steel for cementation in boxes) are pushed. The length of the furnace is divided into two parts. In the cooler or feed section fuel is burnt in passages under the trough, and the products of combustion pass up between the sides of the trough and the outer wall, and then over the goods in contact with them to an outlet or chimney at the feed end. In the other or hotter section fuel is burnt in passages under the trough as before, but the products of combustion pass upwards between the sides of the trough and the outer wall, and are deflected towards the outlet end of the furnace, and then pass the full length of the furnace between an outer and inner roof, the latter forming a muffle, so that when the goods have attained the required temperature they are in a still, inert atmosphere. B. M. VENABLES.

Heat exchanger. J. W. YOUNG, and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. (E.P. 273,886, 16. and 24.6.26).—The apparatus comprises a number of annular spaces, usually horizontal, through half of which the hot fluid, which may be furnace gases after leaving economisers, passes from an external supply trunk round nearly the whole circumference of the spaces to a common, axial outlet flue, which may conveniently be a chimney or the continuation of one. The fluid to be heated (air) passes through the alternate spaces in the other direction, both supply and delivery trunks being external to the cylindrical casing. In the case of dusty gases the whirling motion causes the dust to pass to the outer circumference, and it may be caught by slits with inturned lips situated just before the outlet, but in the outer circumference. B. M. VENABLES.

Method of transforming heat applicable to refrigeration. R. W. DAVENPORT (E.P. 258,847, 12.8.26. Conv., 25.9.25).—The process operates on the facts that an inert gas expanded or bubbled briskly through a volatile liquid will cause evaporation, and that the gas–vapour mixture on compression will deposit liquid. A suitable form of the apparatus is described in which a supply of a substance which is liquid at ordinary atmospheric temperature and pressure, but volatile, circulates in an expansion or refrigerating vessel, heat-exchanging conduits, and gas-lift circulating pump. An insoluble gas such as air is expanded in the first vessel, and passes to the pump, where it is compressed and the liquid produced transferred to the main body of liquid while in the air lift, the last-mentioned being designed to operate gently so as to avoid evaporation as much as possible. B. M. VENABLES.

Adsorption apparatus. SILICA GEL CORP., Assees. of F. B. KRULL (E.P. 255,819, 29.3.26. Conv., 27.7.25).—The absorber is divided into a number of zones, each of which is put into communication with the inlet and outlet for either fluid to be treated or regenerating fluid, each in turn, by means of one or more continuously revolving plate valves. B. M. VENABLES.

Carrying out exothermic chemical reactions under pressure and at a high temperature. L'AIR LIQUIDE SOC. ANON., Assees. of SOC. CHIM. DE LA GRANDE PAROISSE (AZOTE ET PROD. CHIM.) (E.P. 268,721, 25.10.26. Conv., 31.3.26).—The heat from exothermic reactions is prevented from damaging the outer pressure-resisting vessel by passing a current of gas between the outer and catalyst vessels. The gas may be the gases before reaction, or after reaction if they are taken outside and cooled before returning, or a separate gas may be used. B. M. VENABLES.

Apparatus for evaporating liquids. W. WIEGAND (E.P. 272,703, 23.7.26).—An apparatus for evaporating liquids of high viscosity and containing solid matter, such as fruit syrups, comprises a sloping bank of heating tubes and a separate evaporating chamber; a centrifugal pump circulates the liquid from the lower end of the evaporating chamber, through the tubes up the slope, and through an adjustable door to the other end of the evaporating chamber. The adjustable door or valve may be spring-controlled, and is intended to maintain pressure in the heating tubes so that no evaporation takes place there, hence there is less risk of formation of scale. B. M. VENABLES.

Method of working steam-distillation plants. METALLBANK & METALLURGISCHE GES. A.-G., and W. GENSECKE (E.P. 273,092, 23.6.26).—A portion of the liquid is distilled, and the whole is lifted, by bubbles of a gas (*e.g.*, part of the "driving-off" steam), and the liquid thus lifted falls down a series of trays in contact with a con- or counter-current of "driving-off" steam. The driving-off steam may be used several times in

separate vessels, but for the lifts live steam can be used only once. B. M. Venables.

Absorption refrigerating or heating machine. Siemens-Schuckertwerke G.m.b.H. (E.P. [a] 250,593, 7.4.26. Conv., 8.4.25, and [b] 259,985, 15.10.26. Conv., 17.10.25).—(a) The gas evolved in either the boiling-off or the evaporation side of a refrigerating system is caused to circulate the liquid in the other side, by means of bubbles in an ascending pipe. (b) From the boiler a mixture of liquid solvent and gas ascends to a gas-separating chamber, and the gas is finally freed from any vapour of the solvent by heat interchange with the circulating solvent in a vessel at a lower level than the gas-separating chamber. B. M. Venables.

[Cooling attachment for] rotary kilns. J. S. Fasting (E.P. 272,616, 18.3.26).—The clinker or material that has been heated leaves the kiln through ports in the circumference and passes to a number of individual tubular coolers arranged round the kiln and extending beyond the lower end. The further end of every tube is partially closed by an inturned flange, preventing exit of material but allowing entry of cooling air, which passes through the tube into the kiln and is used for combustion. The outlet for material from each tube is in the form of a tangential shoot which delivers the material at about the same height as the axis of the kiln. To aid the transmission of heat from the material to the air, loose chains may be provided which are alternately buried and exposed to the air. Large pieces of clinker which will not enter the coolers are discharged from time to time through swinging doors closing the end of the kiln and surrounding the fuel inlet. B. M. Venables.

[Hydraulically] grading solid substances contained in liquids. Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St.-Gobain, Chauny, et Cirey (E.P. 252,683, 10.4.26. Conv., 28.5.25).—An upward-current classifier wherein the pulp and classifying water are fed together (as thin pulp) into the lower conical or pyramidal part of the apparatus and pass upwards into a portion of uniform cross-section, where the flow is maintained uniform over the whole horizontal cross-section by means of honeycomb or tubular baffles. The oversize is withdrawn from a bottom spigot, and the undersize and the bulk of the water overflow at the top into a regulating weir with a waste flow to maintain a constant level of feed to a similar vessel, where a finer product can be collected, and so on through as many vessels as desired. B. M. Venables.

Mixing machine. M. Nairn (E.P. 273,101, 5.7.26).—The machine is constructed with a series of hook knives running in close proximity to a feed roller which protrudes into the feed passage or hopper on the side to which the material is dragged by the knives. The roller is rotated in the opposite direction to the knives either by gearing or by the drag of the material, and may be made hollow for heating purposes. The roller is mainly to increase the rate of feed; the main part of the mixing action is effected against the stationary casing as usual. B. M. Venables.

Grinding or disintegrating machines. H. J. Denham, and H. Simon, Ltd. (E.P. 473,499, 12.7.26).—Two shafts are rotated in the same direction at exactly the same speed. The beaters on each shaft are alternately long and short, the long beaters on one shaft coming opposite the short beaters on the other. B. M. Venables.

Apparatus for grinding or comminuting rubber or other materials. C. E. Gardner (E.P. 272,572, 19.2.26).—A slab of rubber, wood, bark, or similar material is fed between positively driven feed rollers (at least two above and two below) against the surface of an abrading drum. The latter is perforated between the ridges or teeth, so that air can be drawn through to keep the material cool and remove the powder, and a rotary brush runs against the further side of the abrading drum to keep the perforations clear. At starting or stopping the positive drive may be taken off the feed rollers, so that they may be worked by hand. B. M. Venables.

Centrifugal impact pulveriser. F. E. Agnew, Assr. to M. H. Brotherton (U.S.P. 1,635,453, 12.7.27. Appl., 9.12.25).—The material passes in succession through a funnel-shaped section of the outer casing, on to a horizontally-rotating disc with upstanding radial blades, from which it is flung to a cylindrical impact section of the outer casing, then through another funnel-shaped section, and so on downwards over every disc. B. M. Venables.

Atomising liquid and semi-liquid materials. F. Wreesmann (E.P. 269,774, 21.8.26).—The liquid is sprayed by a centrifugal rotor, the outlets from which are in the form of slots with their long side parallel to the axis, the size of the slots being adjustable. Air or gas is supplied under pressure (produced by the same machine, if desired) through, below, or above the rotor, any or all. B. M. Venables.

Separation and recovery of gases and vapours by solid absorbents. A. Godel (E.P. 267,369, 10.6.26).—The absorbent is contained on a porous plate, and within a sheet metal lining, which provides an annular space between the absorbent and the external wall of the absorber. Gas to be treated is passed through the absorbent until it is saturated with the constituent it is desired to recover. To regenerate the absorbent the absorber is isolated and heated by steam coils or electrical elements disposed between the absorbent container and the external wall of the absorber. During the heating the permanent gas in the absorber is kept in forced circulation by a steam injector situated at the base of the layer of absorbent. The injected steam forms only a small proportion by volume of the gas in circulation, consequently no excessive condensation of water takes place during the heating stage. Heat is efficiently transferred from the heating elements to the absorbent by convection. S. Pexton.

Centrifugal apparatus for dust separation. J. Keith & Blackman Co., Ltd., and G. Keith (E.P. 273,475, 18.6.26 and 9.3.27).—The gas is caused to form a vortex in a cylindrical casing by admitting it tangentially to the circumference but obliquely to the axis. An enlarged separating zone is provided remote (axially) from the inlet end of the casing. The outlet for clean gas is at the axis in the enlarged zone, and is either through a flared end of, or through longitudinal

slits or louvres in the wall of a pipe, so as to remove clean gas from the interior of the vortex over a considerable axial length. In each case internal vanes are provided to destroy the rotational movement of the gas without undue shock. B. M. Venables.

Indicating the exhaustion of substances used for cleaning gases. Deuts. Gasglühlicht Auer-Ges.m.b.H. (E.P. [A] 272,855, [B] 272,858, 1.3.27. Conv., 17.6.26).—(A) An easily recognisable substance is added to the gas which will be removed by the cleaning filter in a similar manner to the noxious impurities that must not be allowed to pass; *e.g.*, air containing unrecognisable but dangerous nitrous gases may have an addition of easily smelt acetic acid. (B) A substance is added to the filter itself (or just before) of such a nature that on combining with the first traces of noxious substance passing the filter a third easily recognisable substance will be formed; *e.g.*, moisture which will inhibit the action of some filters may be recognised by admixture of calcium carbide, or nicotine may be used to indicate the presence of hydrocyanic acid. B. M. Venables.

Apparatus for hydrogenation of liquids. G. R. Schueler (E.P. 273,045, 31.12.26).—The apparatus comprises a number of cages containing the catalyst assembled on one or more perforated tubes through which the hydrogen is supplied. B. M. Venables.

Polarimeters. E. Leitz (E.P. 271,824, 9.3.27. Conv., 31.5.26).—A polarimeter with half-shade device is provided with one or more glass plates of which the inclination can be varied to neutralise the rotation produced by the substance to be measured. The plane of incidence on the glass plates should make an angle of 45° or 135° with the bisecting line of the half-shade device. A quartz wedge may also be incorporated. B. M. Venables.

[Multiple-tier gas] ovens for baking, drying, and other heating operations. T. & T. Vicars, Ltd., and E. M. Crosland (E.P. 273,861, 4.1.26).

Observation window for furnaces. Vastine Engineering Products Corp. (E.P. 257,266, 17.8.26. Conv., 24.8.25).

Absorption refrigerating apparatus. Electrolux, Ltd., Assees. of Platen-Munters Refrigerating System Akt. (E.P. 255,119, 13.7.26. Conv., 13.7.25).

Method and apparatus for refrigeration. Silica Gel Corp., Assees. of E. B. Miller and W. L. Edel (E.P. 249,109, 4.3.26. Conv., 11.3.25).

Extinguishing fires by foam. W. Graaff (E.P. 274,574, 24.4.26).

Screens of the rotary type for separating various sizes of granular material such as ore, coal, etc. M. C. Dunsmore and D. W. Ritchie (E.P. 274,270, 6.7.26).

Separation of condensate from steam. R. F. Chevalier (E.P. 274,531, 20.2.26).

Wet separating apparatus. J. Sproul (E.P. 274,595, 8.2.27).

Drying apparatus (E.P. 267,784).—See II.

Filtering apparatus (E.P. 273,364).—See II.

Continuous distillation (G.P. 439,712).—See II.

Fractional distillation (Austr. P. 104,137).—See III.

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

Colloid chemistry of coal and related problems. H. Winter (Kolloid-Z., 1927, **42**, 233—242).—An account is given of evidence obtained by numerous investigators for the colloidal nature of coal, with special reference to previous microscopical studies of the author (cf. *ibid.*, 1916, 8; B., 1925, 194, 605), and to the work of Duparque (cf. A., 1926, 380). The relation of dopplerite to mineral coal is fully discussed. L. L. Bircumshaw.

Displacement of moisture in lignite by oils. E. Berl and A. Immel (Koll. Chem. Beih., 1927, **24**, 181—267).—The hydrophilic properties of fuels depend on the degree of carbonisation undergone during their formation. Mineral coal (in which most of the hydroxyl groups present in the original cellulose have disappeared) has a pronounced hydrophobic character, whilst peat has a high capacity for combining with water. Lignite occupies an intermediate position in this respect. Attempts to obtain a fuel of high value by removing water in the liquid form from raw lignite are reviewed. Experiments were carried out on the displacement of the water by oil. The raw lignite mixed with an oil immiscible with water was subjected to a pressure of about 150 kg./cm.^{2} At room temperature it was possible to remove about 27—30% of the bound water in one operation, but 41% could be removed by working at 75°. By repetition of the process a large number of times the water content can be reduced to 6%. The presence of alkali causes the lignite to become more hydrophilic, owing to the formation of humates, and thus affects the displacement adversely. Conversely, the presence of acid favours the displacement of water by oil. Neutral salts have little effect. Similar effects were observed in flotation experiments, using benzene and water as the pair of liquids. The displacing capacity of the light oil used may be increased by addition of a liquid slightly miscible with water, such as aniline. No relation could be found between the displacing power of the oil and its surface tension or viscosity. The basic character of aniline and its homologues is not the cause of the good displacing power, for a typical acidic oil, *m*-cresol, is an excellent displacing agent. It appears that in the best displacing agents a hydrophilic radical (amino, hydroxyl, etc.) is combined with a hydrophobic residue. The facts are discussed in the light of the theories of Hardy, Langmuir, and Harkins. E. S. Hedges.

Microstructure of typical New Zealand lignites. W. P. Evans (Fuel, 1927, **6**, 368—373).—The 28 photomicrographs of etchings and sections of lignites show the predominance of coniferous wood and the comparatively rare occurrence of spores. There is evidence that some of the coal-forming trees were of araucarian type, whilst other etchings show structures similar to those of the kauri pine. The influence of igneous intru-

sions on the structure is illustrated, the coal in one case being half coked and full of pores.

H. D. Greenwood.

Decomposition of vegetable matter under soils containing calcium and sodium as replaceable bases. E. M. Taylor (Fuel, 1927, **6**, 359—367).—The possibility of the formation of fusain by the bacterial decomposition of organic matter under alkaline anaerobic conditions is demonstrated experimentally. Sugars, starch, cellulose, wood, and beech leaves were allowed to decompose under soil containing sodium aluminosilicic complex. The decomposition products of the sugars and starch were entirely gaseous, being mainly methane and carbon dioxide, the latter being absorbed by the alkaline soil. Thus the presence of alkaline strata over coal seams may explain the absence of carbon dioxide from coal seam gases. The decomposition of cellulose does not yield a solid carbonaceous residue, but during peat formation it may give rise indirectly to "humic" substances which are decomposed under alkaline anaerobic conditions. The lignified cell walls of the beech leaves are, however, converted into a black material with the typical fusain structure, and as this artificial fusain resembles that found in peat under an alkaline roof in Egypt (B., 1926, 568) it may be concluded that bituminous coal has been produced by the decomposition of plant residues under alkaline anaerobic conditions.

H. D. Greenwood.

Improvement of coke by grinding the coal. Schweder (Gas- u. Wasserfach, 1927, **70**, 710—712).—A large-scale comparison of the coke produced from unground and ground coal shows that, in the latter case, the proportion of small coke and breeze is greatly reduced, the gas yield remaining unchanged. Suitable blending of the coals leads to a similar improvement in the coke.

W. T. K. Braunholtz.

Properties and uses of coke. S. Qvarfort (Gas- u. Wasserfach, 1927, **70**, 646—651).—Coke for firing purposes should be strong and carefully graded to suit the various uses to which it is put, and its ash should have a high m.p. Chemical and physical properties of coke vary with the size of the coke, the more important factors being the content of ash and moisture, the weight per unit bulk volume, and the m.p. of the ash, all of which tend to increase with diminishing coke size, whilst there is a corresponding decrease in the calorific value. The formation of clinker from coke depends on the quantity and m.p. of the ash, the intensity of firing, the size of the coke, and its weight per unit bulk volume.

W. T. K. Braunholtz.

Removal of phenol from waste water from coking plants. F. Raschig (Z. angew. Chem., 1927, **40**, 897—898).—The phenol and pyridine contained in waste water from coking plants are extracted, before distilling off the ammonia, by treating the warmed water continuously with at least 30% of its volume of warm benzol in a special extraction tower. The benzol is then freed from all but 0·3% of phenol by distilling in a still with a column having Raschig rings and cooling dome of total height of 5 m.

A. Cousen.

Lancashire coalfield. Ravine seam. II. Carbonisation in continuous vertical retorts. (Fuel Research Bd., Phys. and Chem. Survey of National Coal Resources, No. 9, 1927, 37 pp.).—Details are given of three large-scale carbonising tests (30—50 tons) carried out in Glover–West vertical retorts on coal from the Ravine seam (B., 1925, 305), using (1) 5% of steam for 120 hrs., (2) 5% of steam for 72 hrs., (3) 20% of steam for 120 hrs., the combustion chamber temperature averaging 1250—1260°. The coal contained 2·7% of moisture, 34·8% of volatile matter, and 11·2% of ash, and on carbonisation without steam gave a yield of 59·8 therms/ton. The yields/ton obtained with steaming were:—Test (1), gas (501 B.Th.U./cub. ft.) 69·1 therms, tar 12·6 gals., coke 13·4 cwt. Test (2), gas (488 B.Th.U.) 70·9 therms, tar 12·15 gals., coke 13·25 cwt. Test (3), gas (450 B.Th.U.) 85·3 therms, tar 12·75 gals., coke 12·8 cwt., showing practically no increase in tar yield, but an increase in gas yield of 23·4% when steaming is increased from 5 to 20%. The coke had the appearance of normal vertical-retort coke, but contained 14—18% of breeze. Its suitability for use in boilers and water-gas and suction-gas producers was examined by means of large-scale tests. Satisfactory results were obtained, but there was excessive clinker formation owing to the low fusion point of the ash (1280°).

H. D. Greenwood.

Formation of naphthalene during high-temperature carbonisation. Y. Kosaka and Y. Oshima (Proc. Intern. Conf. Bituminous Coal, 1926, 463—468).—Cracking experiments at 850° indicate that the naphthalene of high-temperature tar is largely produced by decomposition and recombination of phenolic compounds.

Chemical Abstracts.

Influence of oxygen, hydrogen, and nitrogen present in coke and of the admixture of distillation gases in the representation of producer gas by a gasification diagram. M. Ruhland (Gas- u. Wasserfach, 1927, **70**, 642—646, 664—667, 688—692, 712—716).—The relation between the analysis of producer gas, the details of its manufacture (*e.g.*, quantities of air and steam used, efficiency of gasification), and its properties (*e.g.*, calorific value, quantity of air required for combustion) can be represented graphically by a gasification diagram. The simplest case, in which pure carbon alone is gasified, *i.e.*, in which no methane is formed and all the oxygen, hydrogen, and nitrogen are derived from the air and steam ("primary gas"), may be represented by Ostwald's trapezoidal diagram or on a system of rectangular co-ordinates. Ordinary producer gas, of known composition, may be considered as comprising the "primary gas," together with methane and other gases derived from the oxygen, hydrogen, and nitrogen of the coke, and its properties may be deduced by the aid of the gasification diagram, or, more directly, knowing the analysis of the coke used, from a gasification equation for ordinary producer gas. Factors such as pressure, temperature, reaction velocity, etc. cannot be included in the gasification diagram. Numerous graphs and equations are given.

W. T. K. Braunholtz.

Illuminating gas from lignite. K. Schmidt (Gas- u. Wasserfach, 1927, **70**, 657—661, 680—684).—Difficulties in the way of producing towns' gas from lignite include the powdery nature of lignite, its high water content

(50—55%), its low heat conductivity, the variability of its composition, and the high proportion of carbon dioxide evolved when it is carbonised. Of the German low-temperature carbonisation processes that of the Kohleveredlungs-A.-G. alone has found large-scale application for lignite. The crude gas obtained in this process has d 0·94, gross calorific value 5333, and contains roughly 29% CO_2, 12% CO, 16% H_2, 21% CH_4, 7% N_2, and 4% of heavy hydrocarbons (C_nH_m). The carbon dioxide is best removed by washing with water under pressure, whilst, in order to raise the hydrogen content and diminish that of heavy hydrocarbons, the gas could be subjected to subsequent cracking. Gas mixtures of roughly equal volumes of the low-temperature carbonisation gas with water-gas or with the gas obtained by further heating the lignite semi-coke to 1130° are very poisonous, owing to their high content of carbon monoxide (22—27%), but a mixture of 60% of the low-temperature gas and 40% of hydrogen has a composition, density, and calorific value approximating fairly closely to that of the usual mixture of coal gas and water-gas. Costs are given for the production of illuminating gas by this method. W. T. K. Braunholtz.

Effect of cooling on the naphthalene content of gas. E. Ott and F. Hinden (Gas- u. Wasserfach, 1927, **70**, 661—664).—The naphthalene content of the gas before the naphthalene scrubbers is decreased by cooling the gas. It is also reduced in the gas after the scrubbers, provided the naphthalene content of the anthracene oil in the final scrubber remains the same. By cooling the gas more gas can be passed through the scrubbers between two changes of oil. Rapid cooling is probably more effective than gradual cooling, as the tar fog formed will help to remove naphthalene, but cooling the gas below 23° before the naphthalene scrubbers may lead to a loss of heavy hydrocarbons.
W. T. K. Braunholtz.

Metaldehyde. C. Lew (Mon. pétrole roumain, 1925, **25**, 2002—2004).—A discussion of the production of metaldehyde, with a view to its use as a motor fuel, by the polymerisation of acetaldehyde below 0°.
Chemical Abstracts.

Effects of *X*-rays in photochemical oxidation, catalyst activation, and the ionisation of gaseous mixtures containing detonation inducers and suppressors. G. L. Clark (Brit. J. Radiol., Roentgen Soc. Sec., 1927, **23**, 112—124).—Irradiation with *X*-rays does not affect the rate of oxidation, and therefore the ageing, of rubber or oils. Irradiation with *X*-rays of the platinum catalyst in the manufacture of sulphuric acid produces an initial increase in activity, followed by a decrease to subnormal activity, an increase to normal activity, and a slow decrease. In a mixture of air and benzene irradiated with *X*-rays butyl nitrate (a knock inducer) slightly increased, and lead tetraethyl (a knock suppressor) markedly increased the ionisation; the action of such substances cannot therefore be attributed to decrease and increase, respectively, in the rate of recombination of ions. Chemical Abstracts.

Autoxidation of treated combustible liquids and its modification by other reagents, applied to "knock" in motors. C. Moureu, C. Dufraisse, and R. Chaux (Chim. et Ind., 1927, **18**, 3—12).—The authors consider that a spray of fuel in the liquid phase entering the cylinder of a motor forms peroxides, that the explosion of the latter is the cause of knock, and that anti-knock compounds impede and knock promoters favour the formation of peroxides. The experiments on which this theory is based were conducted with manometer tubes containing the fuel to be tested in a sealed bulb and immersed in an oil bath. The rise of the mercury in the manometer tube was a measure of the oxygen absorption. Curves showing the progressive rise of the mercury with the fuel alone and with 1·0% or 0·1% of various catalysts added enabled a comparison to be made. In this way it was shown that the absorption of oxygen by paraffin wax (b.p. 250—260°) was reduced by triphenylamine, lead tetraethyl, iodine, phenyl disulphide, and various other anti-knock compounds, but promoted by arsenic and thiourea. With some substances variations with time and dilution were observed. Other fuels studied were tetralin and decalin with generally similar results. Quinol, however, acted as an oxidation promoter for the first and retarder for the second. A sample of petrol showed only very slight oxygen absorption, although redistilled fractions gave much higher figures. These fractions, after oxidation, gave a coloration with potassium iodide. Bromine and nitric acid, well known knock promoters, promoted oxygen absorption by the higher-boiling fraction of the petrol at 160°; others such as sodium nitrate were inert. It was reduced by lead tetraethyl, phenyl disulphide, sulphur, iodine, etc. Marine animal and vegetable oils also show varying amounts of oxygen absoption at 160°. C. Irwin.

Factors affecting internal combustion. C. I. Kelly (J. Inst. Petrol. Tech., 1927, **13**, 101—123).—The history of the internal-combustion engine and the phenomena of flame propagation and detonation are reviewed. The pulsatory nature of the flame wave is shown in photographic reproductions. H. Moore.

Origin of petroleum: Berginisation of fish-liver oils and other materials. W. R. Ormandy, E. C. Craven, I. M. Heilbron, and H. J. Channon (J. Inst. Petrol. Tech., 1927, **13**, 1—20).—The literature by Tsujimoto, Chapman, and others on the hydrocarbon oil (squalene) present in the liver oils of the *Squalidæ* sharks is reviewed, and its possible connexion with the origin of petroleum is indicated. Samples of squalene having d^{20} 0·8559 and ignition temperature (Moore) 259° were Berginised in a small bomb. The resultant liquid had d^{20} 0·8256, and yielded on distillation 57% of spirit up to 200°, 23% of kerosene at 200—300°, and residual heavy oil. The spirit fraction contained 10% of unsaturated, 26% of aromatic compounds, 24% of open- and 40% of closed-chain paraffins. In a further Berginisation test at 470° for 1 hr. with initial pressure of hydrogen of 80 atm., falling to 63 atm. on cooling, the liquid yield was 75%, the absorption of hydrogen 3·45%, and the product had d^{20} 0·8129 and yielded 59·3% of spirit up to 180° and 28·2% of kerosene up to 300°, no wax being found in the residue. It contained 6·8% of unsaturated and 17·9% of aromatic compounds and 75·3% of paraffins. The presence of *iso*pentane was well marked. A sample of *d*-pinene when Berginised

gave very similar results to squalene, as was the case with some lignite oils, but the latter yield some 20% of phenols. The higher phenols when Berginised are converted into paraffins and lower phenols; the lower the phenol the more soluble it is in water.

H. MOORE.

Extraction of amorphous wax from laboratory specimens of oil [petroleum]. S. BOWREY (J.S.C.I., 1927, **46**, 228 T).—The large-scale centrifugal process for the separation of amorphous paraffin wax from oil, after the addition of petroleum naphtha, is imitated in the laboratory in a short time by cold-settling in a vacuum flask, the jacket of which is half filled with liquid sulphur dioxide. By evaporating the latter under a partial vacuum the oil mixture can be cooled at any desired rate without causing sufficient convection to hinder the settling of the wax. Settling at —20° F. produces an oil of cold test 25—30° F. W. J. POWELL.

Pipe still for continuous distillation in the laboratory. A. A. ASHWORTH (J. Inst. Petrol. Tech., 1927, **13**, 91—100).—The temperature at which light oils are vaporised in a pipe still is 80—100° lower than that in usual continuous crude stills. In the laboratory pipe still the crude oil is fed at 7—10 c.c./min. into an inclined tube of $\frac{5}{8}$ in. internal diam., through which passes an electric heater consisting of a coil of nichrome wire wrapped round a tube of $\frac{1}{4}$ in. outside diam. A temperature of about 300° is attainable. The oil vapours from the inclined tube enter a chamber filled with glass beads nearly up to the level of a thermometer which registers the vapour temperature. The inclined tube and chamber are heat-insulated. A thermometer in reversed position enters the bottom of the chamber, and indicates the oil temperature, and the residue leaves the chamber at this point and passes through a cooler to a receiver, while the vapours from the chamber leave at the top, passing through a condenser to a receiver. The vapours are kept in intimate contact with the oil, the temperatures being measured immediately after the separation of vapour and oil. The temperatures shown for percentage of distillate, though starting at the same initial point, are considerably lower than those in a flask distillation, as shown in graphs. The variations in temperature may be kept within 2°. The still may be used for observing the equilibrium temperatures of light distillates. H. MOORE.

Corrosive influence of sulphur and sulphur compounds in naphtha solutions. H. SCHMIDT (Petroleum, 1927, **23**, 646—648).—Strips of aluminium, zinc, steel, copper, brass, and silver were immersed in a closed test tube at 50° for 3 hrs. in a petroleum fraction of d^{20} 0·769, flash point 41°, initial b.p. 151°, containing 0·010—0·360% of sulphur in the form of *iso*amyl mercaptan, hydrogen sulphide, carbon disulphide, methyl sulphate, *p*-toluenesulphonic acid, butyl sulphide, thiophen, etc. Iron and aluminium were not attacked, zinc and brass were feebly corroded, copper and silver were energetically attacked by free sulphur. In five-day tests with the addition of water, aluminium showed corrosion in many cases. In trials in a copper dish free sulphur, carbon disulphide, and mercaptan gave deposits of copper sulphide. In thirty-day tests at room temperature chromium and zinc were most resistant; most metals were attacked, and especially manganese. Mercaptans had the greatest corrosive influence. The corrosive action of the sulphur compounds corresponded to their capacity for ionisation. Heat promoted corrosion.

H. MOORE.

Methods of testing oils. I. Viscosity determinations with the Engler apparatus. H. SCHLÜTER (Chem.-Ztg., 1927, **51**, 565—566).—In the usual Engler test the thermometer shows a slow fall in temperature as the oil flows through the capillary owing to the gradual exposure of the bulb of the thermometer. This error may be avoided by using a thermometer with the bulb bent round at right angles to the stem, so that it lies in a horizontal position just above the floor of the oil container. A second thermometer with the bulb in the normal position serves as a means of closing the capillary entrance before and after the desired amount of oil has flowed out. When working at 50° the temperature of the water bath should not exceed 50·3° for maintaining the oil at a constant temperature of 50°. A. R. POWELL.

Aerosols. BEYERSDORFER.—See I.

Behaviour of cellulose on heating. BAIN and others. —See V.

Phenols from ammonium sulphate still effluents. PARKES.—See VII.

Chequer bricks for oil-gas manufacture. KNOLLMAN.—See VIII.

Penetrance of oily fluids in wood. HOWALD.—See IX.

PATENTS.

Treatment of pulverised vegetable fuels. S. SHIMAMOTO (E.P. 273,556, 30.10.26).—Sawdust or other vegetable matter is steeped in hot slaked lime until the tissues are soft and sticky, powdered coal is added, and the mixture briquetted. The dry briquettes may be allowed to absorb oil or other liquid fuel.

A. B. MANNING.

Drying apparatus for briquettes and other agglomerates. F. M. CROSSMAN (E.P. 267,784, 4.8.26). —A vertical shaft carrying a series of radial arms rotates in a vertical drum consisting of a number of superimposed chambers. Each chamber has a floor opening, the several openings being staggered with respect to one another. The drum has its curved surface perforated, and is surrounded by a hot chamber provided with means for supplying hot furnace gases to and withdrawing them from the drum. Briquettes to be dried are fed into the uppermost compartment of the drum, from whence they are transferred by the action of the rotor to successively lower compartments. The briquettes are dried by contact with the hot furnace gases. S. PEXTON.

Froth-flotation concentration of coal. P. T. WILLIAMS, and MINERALS SEPARATION LTD. (E.P. 272,301, 12.3.26).—A salt of an organic derivative of a thiocarbonic acid (*e.g.*, an alkali xanthate) is used as a flotation reagent. It may be admixed with the coal prior to charging it to the separator, or used with a soluble and readily disseminable frothing agent. Use

of an organic protective colloid (*e.g.*, starch) is suggested to retard the flotation of high-ash fractions; the flotation circuit may also be rendered alkaline by lime, which, by flocculating gangue-slimes, assists the separation of water from the tailings. R. A. A. Taylor.

Coke ovens. H. Schröder (E.P. 266,996, 20.8.26).—A separately controlled gas feed is provided for the end pair of heating flues in an oven with vertical flues. The regenerators are built in two horizontal sections, so that the air which enters the battery from outside reverses its passage in the upper half of each regenerator and passes to the combustion chambers through a conduit immediately adjacent to the end walls of the battery and enters the distribution flue immediately below the ports for supplying the end two combustion flues. The main damper controlling the secondary air is disposed in the distributing flue beyond the nostrils to the end combustion flues, in such a way that there is always a relatively larger proportion of air passing to each of the end combustion flues than to the remainder. Radiation losses from the end walls are therefore neutralised by burning an increased proportion of gas in the end two flues. S. Pexton.

Coking or carbonising ovens. Stettiner Chamotte-Fabrik A.-G. vorm. Didier (E.P. 263,801, 21.12.26. Conv., 24.12.25).—An inclined carbonising oven has its sole so inclined that the discharging mechanism can be mounted on the carriage of the charging truck. The producer, which is built into the setting, can be charged from the same stage as the ovens. S. Pexton.

Gasification of caking coals in a gas producer. K. Koller (E.P. 257,633, 31.8.26. Conv., 31.8.25).—Within the upper part of, and in the axis of, a gas producer is arranged a water-cooled distillation bell which can be rotated. The section of the bell is not circular, and therefore the expanding coal undergoing caking is sheared against the stationary mass of fuel undergoing gasification in the main part of the producer. S. Pexton.

Distillation or heat treatment of carbonaceous or like materials. Salermo, Ltd., and E. M. Salerni (E.P. 273,528, 15.9.26. Cf. E.P. 247,300; B., 1926, 308).—The material, crushed to pass a ⅜-in. sieve, is conveyed in a thin layer over flat metal plates in a drying chamber above the distillation chamber, into which it then passes through a gas-tight seal. In the distillation chamber it passes laterally through a series of horizontal, semi-cylindrical troughs arranged side by side, each trough being provided with a combined scraper and stirrer. The spent material is discharged into a coke-cooling chamber or may be fed directly to the furnace of a steam generator. The combustion chamber is divided from the distillation chamber below by a series of brickwork arches which leave a channel between the two chambers through which the hot combustion gases flow in a direction opposed to the motion of the material in the retort. The hot gases flow thence to the drying chamber, through which they again pass counter-current to the material. The products of distillation pass from the retort through a dust extractor to a condenser. The temperature of carbonisation is 500—550°; an installation consisting of a single retort with 12 troughs each 10 ft. long and 8 in. radius can deal with 75 tons of coal per 24 hrs. A. B. Manning.

Treatment of coal. Internat. Combustion Engineering Corp., Assees. of W. Runge and E. A. Packhard (E.P. 249,086, 4.2.26. Conv., 12.3.25).—Coal is pulverised in the presence of a hot gaseous medium and the mixture is conducted to a cyclone separator from which the powdered fuel is transferred to the distributing hopper of a carbonising unit. The hot gas, usually air, is utilised for burning part of the purified gas yielded by carbonisation in order to preheat the air to the pulveriser. The remaining gas from carbonisation may be burnt in the retort down which the powdered fuel to be carbonised is showered, or it may be used to preheat some gaseous distillation medium supplied to the retort. S. Pexton.

Vertical retort settings for the destructive distillation of coal and the like. F. J. West, E. West, and West's Gas Improvement Co., Ltd. (E.P. 273,474, 18.6.26).—A large volume of gas of low calorific value is produced by steaming in vertical retorts, the gas being raised to the desired calorific value by admixture with oil-gas from a generator which forms part of the vertical-retort setting, and is heated by the waste gases therefrom. The oil-gas generators may be of the vertical or horizontal type, and are provided with doors through which the carbon or other deposit may be periodically removed. A. B. Manning.

Method and apparatus [electric furnace] for treatment of carbonaceous material. J. J. Naugle (E.P. 267,240—1, 14.12.25).—(A) Comminuted carbonaceous material, *e.g.*, leached carbonised lignin residue derived in the production of wood pulp, is washed with acidified water and filter-pressed. The product is carbonised in an electric furnace with or without the addition of sodium fluoride or fluxes which render the silica volatile and slag the impurities respectively. Further purification is effected by allowing the impurities to settle from a suspension of the carbonised product in water. The carbon has a high electrical conductivity and a high absorptive power. The furnace consists of a rotary kiln carrying mixing members from its internal periphery. The mixing members are insulated from the casing and support the electrodes for heating. Material under treatment is fed from a hopper to a spiral device which ensures long and uniform heating. The necessary oxidising medium (steam or air) facilitates transference of the material to the outlet. (B) The electric furnace is a horizontal cylindrical casing carrying a central revolving electrode built up in sections to enable the heating to be carried out in stages of varying intensity; *e.g.*, the material may be heated at 1500—800° in the first stage, 800—600° in the second stage, and 600—400° in the third stage. S. Pexton.

Producing high-grade combustible gases from bituminous fuel. A. H. Lymn (E.P. 271,173, 23.2.26).—The apparatus comprises a combined generator and retort together with an external retort. The retort superimposed on the generator is heated internally by the "up-run" gases admixed, if necessary, with super-

heated steam. The separate retort is heated externally by the blow gases from the generator after admixture with air and internally by the "down-run" gases. The distillation gases from both retorts pass to a common seal pot. In one design the coke from the separate retort is fed to the hopper of the combined retort and generator. The temperature of carbonisation of the separate retort is controlled by admixing cool gases with the hot blow gases. A. C. Monkhouse.

Drying of fuel gas. C. Cooper, D. M. Henshaw, and W. C. Holmes & Co., Ltd. (E.P. 266,825, 5.12.25).—Hot producer, generator, or blast-furnace gas is washed with a solution of a hygroscopic salt immediately before its combustion in a furnace. The process efficiently removes mechanically carried water and can be conducted without reducing the temperature of the gas. The absorbed water is evaporated from the desiccating solution by spraying it over a series of steam-heated pipes. S. Pexton.

Manufacture of hydrocarbons and derivatives thereof from natural oils and other bitumens. I. G. Farbenind. A.-G. (E.P. 249,493 and 273,228, 26.2.26. Conv., [A], 19.3.25, [B], 26.2.26. Addns. [A, B] to E.P. 247,584; B., 1927, 595).—Modifications of the process described in the main patent are claimed whereby, instead of solid carbonaceous materials, (A) mineral oils or other bitumens or distillation or extraction products thereof, or (B) conversion products or hydrogenation products of mineral oils or bitumens, are employed. A. B. Manning.

Manufacture of liquid or other hydrocarbons and derivatives thereof from coal, tars, mineral oils, etc. I. G. Farbenind. A.-G. (E.P. 251,264, 14.4.26. Conv., 25.4.25. Cf. E.P. 247,583 (B., 1927, 595), 247,586, 249,501).—Tars, oils, etc. are treated with hydrogen or reducing gases containing combined hydrogen at a high temperature (450—550°), under a pressure of at least 50 atm., in the presence of contact masses containing tungsten, chromium, or their compounds. By this process, for example, cresols may be reduced to aromatic and hydroaromatic hydrocarbons, and high-boiling oils cracked to produce a high percentage of benzines without any coke formation. A. B. Manning.

Refining and desulphuring light oils, especially low-temperature benzines. A. Riebeck'sche Montanwerke A.-G. (G.P. 439,608, 11.6.25).—Aldehydes, aldehyde polymerides, or substances which produce aldehyde in the presence of polymerising agents such as acids or alkalis, are used as refining agents; the impurities containing sulphur are precipitated in an insoluble form and can be separated from the oil. A. B. Manning.

Purification of low-temperature benzines. Zeche M. Stinnes, Assees. of F. Müller and P. Hützen (G.P. 439,006, 8.11.23. Addn. to G.P. 437,048; B., 1927, 468).—The procedure of the main patent is modified by the use of acetone in place of alcohol as washing liquid. The purified benzine is equal in quality to that obtained when alcohol is used. A. B. Manning.

Apparatus for cracking mineral oils. Werschen-Weissenfelser Braunkohlen A.-G., and A. Fürth (G.P. 439,010, 12.12.22).—In the method of cracking oils, especially high-boiling paraffin hydrocarbons, by pressure distillation with a catalyst in the vapour space, the higher-boiling condensate being refluxed in such a manner that it does not come into contact with the catalyst, the latter is arranged in an annular space between two cylinders in a decomposition chamber affixed to an autoclave. A. B. Manning.

Continuous distillation of mineral oils etc. E. Blümner (G.P. 439,712, 31.7.21. Addn. to G.P. 338,846; B., 1922, 496 A).—The liquid mixed with a gas, *e.g.*, hydrogen, is passed in a finely-divided form through an externally heated bath of molten metal, and so brought into contact with catalysts contained as a finely-divided filling or other suitable form in the melt. The process is especially suitable for bringing about chemical reactions between liquids and vapours or gases. A. B. Manning.

Production of paraffin hydrocarbons with more than one carbon atom. F. Fischer and H. Tropsch (E.P. 255,818, 26.3.26. Conv., 21.7.25).—Oxides of carbon, mixed with hydrogen, are reduced to paraffins higher than methane by heating the gases at about the ordinary pressure in presence of a catalyst at temperatures between that at which the catalyst begins to act and that at which methane is the main product. The temperature employed is generally 80—100° below that at which methane only is formed. *E.g.*, using as catalyst a mixture of zinc oxide and finely-divided iron, at 300° the product contains 10% of methane and 90% of higher paraffins, whilst at 430° methane is the only hydrocarbon. A. Davidson.

Improving mineral oils and tar products. Siemens & Halske A.-G. (E.P. 263,186, 17.12.26. Conv., 19.12.25).—Oils or tar products are freed from easily oxidisable constituents by treatment with ozone in the presence of inorganic adsorbents, *e.g.*, silica gel or iron oxide, preferably mixed with a basic substance such as calcium oxide. Fatty acids may be recovered from the adsorbing material by subsequent treatment with steam. A. B. Manning.

Production of lubricants containing water. M. J. Heitmann (E.P. 250,562, 29.3.26. Conv., 11.4.25).—Emulsified lubricating oils containing water are prepared by passing saturated or superheated steam, or a gas, under pressure into the lubricating oil, and then adding the requisite amount of water through distributing nozzles to the finely divided oil, continuing the passage of steam or gas until a stable emulsion is produced. Emulsified solid greases are similarly produced by adding materials containing higher alcohols, or other agents for increasing viscosity, to the lubricating oil before proceeding as above. A. B. Manning.

Filtering apparatus [for lubricating oil]. C. S. Garland, T. E. Beacham, and J. A. Pickard (E.P. 273,364, 1.3.26, 8.4.26, and 15.4.26).—The patent deals with the construction and methods of heating edge filters for cleaning the lubricating oil of internal-combustion engines. The filtering medium may be made of commercial asbestos sheets purified by incineration after assembly. B. M. Venables.

Motor fuel. H. Herzog and W. Hüssy-Bühler (G.P. 439,550, 11.3.26).—A 9 : 1 mixture of crude or

illuminating petroleum and alcohol, either pure or containing water, is passed under pressure and at higher temperatures over or through a catalyst (*e.g.*, molten lead, to which bismuth or cadmium has been added to lower the m.p.), and the resulting liquid, after removal of the solid hydrocarbons, mixed with 20—50% of benzine.
A. B. Manning.

Obtaining light hydrocarbons from heavy cyclic hydrocarbons or derivatives. A. J. Kling and J. M. F. D. Florentin (E.P. 253,507, 26.5.26. Conv., 12.6.25).—See F.P. 607,155; B., 1927, 548.

Coal pulverisers. A. S. Cachemaille. From S. A. S. Bunting (E.P. 274,278, 20.7.26).

Screen for separating or sorting coals, minerals, etc. H. Lowson, and H. Lowson, Ltd. (E.P. 274,582, 26.1.27).

Gasworks retort settings. H. J. Toogood, and R. Dempster & Sons, Ltd. (E.P. 274,154, 15.3.26).

Powdered fuel furnaces. A. B. Helbig (E.P. 266,827, 5.12.25).

Separation of gases (E.P. 267,369).—See I.

Acetic acid (F.P. 601,156).—See VII.

Carbon disulphide (G.P. 439,766).—See VII.

III.—TAR AND TAR PRODUCTS.

Basic nitrogen compounds from Fushun shale tar. T. Eguchi (Bull. Chem. Soc. Japan, 1927, **2**, 176—186).—The tar obtained by distilling Fushun shale in vertical Oakbank retorts contains 2—4% of bases. The fraction of the crude tar of b.p. 220—250° yields bases containing no primary or secondary amines, and only traces of pyrroles. The following pyridine derivatives (cf. Garrett and Smythe, J.C.S., 1903, **83**, 763; Oshima and Ishibashi, B., 1926, 1006) were isolated by repeated fractional distillation, purified through the mercurichlorides, and identified by oxidation to the corresponding carboxylic acids: 2-methyl-, n_D^{25} 1·4983; 2 : 6-dimethyl- n_D^{25} 1·4953; 2 : 4-dimethyl-, n_D^{25} 1·4984; 2-methyl-6-ethyl-, b.p., 160—161°; d_4^{25} 0·9207, n_D^{25} 1·4950; 2 : 4 : 6-trimethyl-, d_4^{25} 0·9101, n_D^{25} 1·4959. Displacement of a methyl group from the 4- to the 2-position increases the mol. refraction by 0·13 to 0·18.
H. E. F. Notton.

Phenol from coking plants. Raschig.—See II.

Phenols from ammonium sulphate still effluents. Parkes.—See VII.

Patents.

Decomposition of tars or tar oils into pitch and oil without distillation. H. Waibel (G.P. 439,804, 1.7.26).—The tar is treated with a non-aromatic organic solvent subsequently to being heated in a vessel provided with a reflux condenser. Steam may be passed through the tar while it is being refluxed, any tar oils in the escaping vapours being recovered in a known manner. The oils obtained do not thicken on keeping in the air.
A. B. Manning.

Fractional distillation. V. Freund (Austr. P. 104,137, 6.5.24).—To separate liquid mixtures into their constituents of definite b.p., as for example tar light-oils into benzene, toluene, and xylene, the mixed vapours issuing from the distillation column are lead through dephlegmators provided with reflux condensers in which the cooling liquids used have b.p. coinciding with those of the respective fractions to be condensed.
A. B. Manning.

Production of benzene by reaction between phenolic vapours and a reducing gas. A. Irinyi (E.P. 273,493, 7.7.27).—In the reduction of phenol to benzene at 750° by hydrogen or gases containing it, efficient temperature control is obtained by separately heating the phenol vapours and the reducing gases to the reaction temperature before mixing. Each component is heated by passing part of the gas or vapour through a superheater in which it is raised above the reaction temperature, by-passing the remainder, and mixing the superheated part with the remainder as required to obtain the necessary temperature. A. Davidson.

Hydrocarbons etc. (E.P. 251,264).—See II.

Tar products (E.P. 263,186).—See II.

IV.—DYESTUFFS AND INTERMEDIATES.

Cold oxidation (decolorisation) of colouring matters by sodium hypochlorite in acid solution. II. Oxidation of azo dyes. A. Seyewetz and E. Chaise (Bull. Soc. chim., 1927, [iv], **41**, 332—351; cf. A., 1927, 353).—The decolorising (oxidising) action of sodium hypochlorite on 2% aqueous solutions or suspensions of a number of representative azo dyestuffs in the presence of hydrochloric acid has been studied at 0—5°. Azo compounds, such as azobenzene or azotoluene, which contain no auxochromic group are not attacked under these conditions. All other azo compounds examined are decomposed at the azo group nearest to the auxochrome group, affording the original diazonium compound together with an oxidation or chlorination product of the amine or phenol residue. Thus aminoazobenzene affords benzenediazonium chloride together with a tarry product containing chloranil. Orange III is more readily attacked, and about 70% is converted into diazobenzene-*p*-sulphonic acid, dimethylamine, benzoquinone, and chloranil. With Orange IV oxidation of the diphenylamine occurs, and only traces of diphenyl were isolated besides the diazobenzene-*p*-sulphonic acid. Dyes such as Chrysoidine CR, containing a *m*-diamine group, probably afford, in addition to the diazo compound, an aminoquinone or a triazole derivative. Dyes containing a phenolic group afford a chlorinated quinone in addition to the diazonium salt. Thus Tropæoline Y affords 60% of the diazobenzene-*p*-sulphonic acid and chloranil whilst Chrysoine yields the same diazo compound and an unidentified chlorinated hydroxyquinone. Orange I and Orange II behave similarly, the diazobenzene-*p*-sulphonic acid being accompanied by 2-chloro-1 : 4-naphthaquinone in the former case and 3 : 4-dichloro-3 : 4-dihydro-1 : 2-naphthaquinone, m.p. 86°, together with a little *iso*naphthazarin, m.p. 275°, from oxidation of the dichlorodihydronaphthaquinone in the latter case. Side-chains are not attacked, Orange GT affording *p*-toluenediazonium chloride, whilst the presence of sulphonic groups in the phenol or naphthol nucleus leads to the formation of sulphonated quinones. Thus Ponceau 6R crystals affords α-naphthalene-

diazonium chloride and 1 : 2-naphthaquinone-6 : 8-disulphonic acid. Mordant azo dyestuffs behave normally; Anthracene Yellow RN, for instance, yields *p*-nitrobenzenediazonium chloride andtrichloro-*p*-benzoquinonecarboxylic acid, m.p. 61—62°. Brilliant Croceine M and Naphthol Black WB are typical of the behaviour of polyazo colours, the former affording azobenzene-*p*-diazonium chloride and 1 : 2-naphthaquinone-6 : 8-disulphonic acid, and the latter benzenediazonium chloride, *p*-nitrobenzenediazonium chloride, and (probably) 1 : 2 : 7 : 8-naphthadiquinone-4 : 6-disulphonic acid. Polyazo dyestuffs derived from diamines behave analogously to the monoazo colours. Thus Congo Red affords diphenyl-4 : 4′-tetrazonium chloride and 1 : 2-naphthaquinone-4-sulphonic acid, Chrysamine K yields the same tetrazo compound and trichlorobenzoquinonecarboxylic acid, m.p. 61—62°. Brilliant Yellow F affords benzoquinone, chloranil, and the tetrazo derivative of diaminostilbenedisulphonic acid, but the corresponding dihydroxystilbenedisulphonic acid could not be obtained from the tetrazo compound on account of its instability. With carbamide derivatives, such as solid Diamine Yellow 3G (Cassella), carbon dioxide is first liberated, with formation of a hydrazine derivative, which is then oxidised to the corresponding azo derivative. The original azo groups are attacked in the usual way with formation of the diazonium salt and production of the chlorinated quinone. Pyrazolone derivatives such as Tartrazine afford the diazonium salt and the pyrazolone, the latter resisting oxidation. 1-*p*-Sulphophenyl-5-pyrazolone-3-carboxylic acid is not oxidised under these conditions, but loses carbon dioxide. R. BRIGHTMAN.

Coloration of beeswax. JAUBERT.—See XII.

Determination of methylhexalin. LINDNER and ZICKERMANN.—See XX.

PATENTS.

Production of azo dyes and lakes insoluble in water. I. G. FARBENIND. A.-G., Assees. of CHEM. FABR. GRIESHEIM-ELEKTRON (E.P. 250,909, 19.2.26. Conv., 18.4.25).—Azo pigments suitable for lakes and for dyeing rubber are obtained by coupling 2 : 3-hydroxynaphthoic β-naphthylamide with a diazotised arylamine containing substituents (at least one being a chlorine atom) in positions 2 and 5 (cf. E.P. 235,169; B., 1925, 666, for corresponding ice-colours). Examples of diazo components are 4-chloro-*m*-toluidine (red), 4-chloro-*o*-toluidine (bluish-red), 4-chloro-*o*-anisidine (bordeaux), 4-chloro-*m*-anisidine (red), 4-chloro-*o*-phenetidine (bluish-bordeaux), 2 : 5-dichloroaniline (red), 4-chloro-2-aminodiphenyl ether (bluish-red), 4-chloro-2-aminophenyl benzyl ether (bluish-red). C. HOLLINS.

Intermediate products for dyes. H. FRITZSCHE, E. KRUMMENACHER, H. GUBLER, and O. KAISER, ASSRS. to SOC. CHEM. IND. IN BASLE (U.S.P. 1,625,530—3, 19.4.27. Appl., 20.7.23. Conv., 7.9.22).—See E.P. 221,843; B., 1924, 937. The *products* obtained by the condensation of cyanuric chloride (1 mol.) with *m*-aminobenzoic acid (1 mol.), and with *p*-aminosalicylic acid (1 mol.), have m.p. 220° and above 360°, respectively. T. S. WHEELER.

Preparation of indanthronedisulphonic acid and indanthrone. BRITISH DYESTUFFS CORP., LTD., A. SHEPHERDSON, and A. J. HAILWOOD (E.P. 274,226, 26.4.26).—1-Nitroanthraquinone-8-sulphonic acid is reduced in neutral or alkaline solution, *e.g.*, with zinc dust and ammonium chloride or sodium sulphide insufficient for complete reduction of the nitro-group, giving 1-*hydroxylaminoanthraquinone-8-sulphonic acid*, which when boiled with caustic alkali is converted into indanthronedisulphonic acid, a greenish-blue acid dye. Electrolytic desulphonation of the product yields leuco-indanthrone. C. HOLLINS.

Dyes and dyeing. [Sulphuric esters of leuco-vat dyes.] H. A. E. DRESCHER, J. E. G. HARRIS, B. WYLAM, J. THOMAS, and SCOTTISH DYES, LTD. (E.P. 274,156, 15.3.26).—A vat dye is reduced with the aid of a metal (zinc, copper) to its leuco-derivative in presence of a tertiary base (pyridine) and an alkyl halide or a quaternary ammonium halide, together with the sulphur trioxide derivative of the tertiary base (made, *e.g.*, by treating pyridine with chlorosulphonic acid, an alkyl chlorosulphonate, oleum, or sulphur trioxide). The soluble sulphuric ester of the leuco-vat dye is isolated and applied in the usual manner. The vat dyes specified in the examples are indigo, thioindigo, and dimethoxydibenzanthrone. C. HOLLINS.

Dyes and dyeing. [Sulphuric esters of leuco-vat dyes.] B. WYLAM, J. E. G. HARRIS, J. THOMAS, and SCOTTISH DYES, LTD. (E.P. 274,303, 1.3.26; cf. E.P. 247,787 and 260,638; B., 1926, 403; 1927, 39).—Leucoflavanthrone is treated with chlorosulphonic acid in presence of a tertiary base (pyridine) at 45°. Addition of alkali (ammonia solution) precipitates a reddish derivative, which is purified by solution in dilute aqueous sodium carbonate and aeration; from the filtrate the reddish-yellow compound may be salted out, and used directly for dyeing and printing without vatting, the colour being developed by hydrolysis and oxidation. C. HOLLINS.

Greenish-blue to green vat dyestuffs of the thioindigo series. R. HERZ and J. MÜLLER, ASSRS. to GRASSELLI DYESTUFF CORP. (U.S.P. 1,623,410, 5.4.27. Appl., 23.3.26. Conv., 25.10.24).—2-Amino*peri*naphthoxypenthiophens are condensed with substituted or unsubstituted 3-oxythionaphthens, to give thioindigo vat dyes, which yield fast greenish-blue to green shades on wool and cotton. 2-Acylamido*peri*naphthoxypenthiophens can also be employed, the acylamido-group being hydrolysed before or after condensation. *E.g.*, 2-acetamido*peri*naphthoxypenthiophen (cf. U.S.P. 1,498,913; B., 1924, 781) is hydrolysed with aqueous-alcoholic hydrogen chloride, and the product is condensed in boiling glacial acetic acid containing sodium acetate with 6-chloro-2-(*p*-dimethylaminoanilo)-4 : 5-benzo-3-oxythionaphthen to yield a *dye*, which gives strong yellowish-green shades on cotton and wool in a hyposulphite vat. T. S. WHEELER.

Preparation of perylenequinones. COMP. NAT. MAT. COL. ET MANUF. PROD. CHIM. DU NORD RÉUNIS, ÉTABL. KUHLMANN, and H. PEREIRA (F.P. 592,272, 13.1.25. Conv., 16.4.24).—Halogenated perylenes are oxidised with hot concentrated sulphuric acid. Dibromoperylene of m.p. 278° when heated with sulphuric acid loses bromine and hydrogen bromide at 95—100°;

after being heated to 130—140° and poured into water it gives a *product*, m.p. above 360°. Dibromoperylene of m.p. 189° in similar manner yields 3 : 10-perylenequinone.

C. Hollins.

Preparation of vat dyes and intermediates from diacylperylenes. Comp. Nat. Mat. Col. et Manuf. Prod. Chim. du Nord Réunis, Établ. Kuhlmann (F.P. 612,338, 5.3.26).—Dibenzoylperylene is oxidised in 100% sulphuric acid with manganese sulphate or dioxide at 10—15° in presence of boric acid to a red-violet vat *dye*, which is improved in fastness by chlorination in nitrobenzene at 60°. With less oxidising agent the *product* dyes cotton in olive shades changing to blue on acidification, and may be methylated to a fast bluish-green vat dye. Ditoluoylperylene behaves similarly.

C. Hollins.

Preparation of vat dyes of the perylene series. F. Bensa (Austr. P. 104,385, 3.11.24).—Dihalogenated diacylperylenes are heated with alkalis or alkaline earths in presence or absence of an organic solvent (aniline, quinoline, etc.). Dibromo- or dichloro-dibenzoylperylene, obtainable from dihalogenoperylenes, benzoyl chloride, and aluminium chloride, gives fast violet vat *dyes*. *Dichlorodi-α-chlorobenzoylperylene*, m.p. 355°, gives a violet-blue; *dichlorodi-*p*-toluoylperylene*, m.p. 325°, a violet; *dichlorodi-*m*-toluoylperylene*, m.p. 334°, a violet; *dichlorodi-*o*-toluoylperylene*, m.p. 351°, a blue; *dichlorodi-α-naphthoylperylene*, m.p. 275°, a blue. C. Hollins.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Use of hydrocyanic acid gas for the fumigation of American cotton on import into India. A. J. Turner and D. L. Sen (Agric. J. India, 1927, **22**, 173—175).—Hydrocyanic acid gas can be used successfully to destroy the Mexican boll weevil (*Anthonomus grandis*) in baled cotton. Cotton absorbs hydrocyanic acid whether it be loose or baled, damp or dry, but there is no evidence of any chemical combination. The moisture content of the cotton affects the extent of the absorption of gas, but temperature has little effect. In generating gas, sodium cyanide in an amount equal to 0·05% of the weight of cotton is sufficient in a gas-tight vessel. In barge-holds, where there is some leakage, 0·075% of the weight of cotton is recommended. In laboratory experiments the best results were obtained with a gas concentration of 450 parts per 100,000 for 6 hrs., followed by a period of 14 hrs. at a concentration of 200 parts per 100,000. A. G. Pollard.

Decomposition of straw and nutritive value of the decomposed straw. F. Honcamp (Cellulosechem., 1927, **8**, 81—91).—Of the factors involved in the valuation of vegetable foodstuffs, only the nitrogen-free extract and the "crude fibre" are of importance from the point of view of the decomposition of straw. By "crude fibre" is understood all the nitrogen-free substances undissolved after heating with 1¼% sulphuric acid and potassium hydroxide for ½ hr., and washing with water, alcohol, and ether. The nitrogen-free extract comprises all the organic plant substances insoluble in ether, and not belonging to the nitrogenous and ash constituents, which, however, dissolve in the reagents used in the determination of crude fibre. This extract is a complicated mixture of carbohydrates (including sugars and pentosans), substances not belonging to the carbohydrate groups (*e.g.*, organic acids, lignins, aromatic substances, etc.), and unchanged and modified cellulose. Similarly, the crude fibre includes cellulose, pentosans, and incrusting substances such as lignin. These two groups form about 90% of the material of all the straws examined, including grain, rape, beet, and leguminous straws (nitrogen-free extract 33—45%, and crude fibre 42—57% by wt. of dry material). Only one sixth to one seventh of the total pentosan is contained in the crude fibre, the remainder being in the nitrogen-free extract. For various straws examined, the crude fibre was found to contain 64—81% of pure cellulose, 2—3% of cutin, and 16—32% of lignin. The digestible part of the crude fibre has the same percentage composition as pure cellulose, the following mean values being given by three different methods for a number of different straws C 44·70, 44·46, and 44·11%, and H 7·22, 6·49, and 6·63% (pure cellulose $C_6H_{10}O_5$ requires C 44·4%, H 6·2%, and O 49·4%); the somewhat higher values for hydrogen are attributed to the hydrating action of the reagents used. Further, for the ash and protein-free digestible part a calorific value of 4219·6 was found, that for pure cellulose being 4185·4. Hence there appears no doubt that the cellulose of the crude fibre is to a considerable extent decomposed and absorbed in the intestinal canal of animals. The pentosan also present in the digestible part of the crude fibre appears to have the same calorific value as the carbohydrates, starch, and sugar. Experiments show that cellulose is the substance which, in ruminants, is split up by fission fungi into carbon dioxide, methane, acetaldehyde, acetic and butyric acids. The digestible crude fibre, freed from incrusting substances, possesses a nutritive value similar to that of the digestible part of starch flour. The smaller food value of straws is conditioned not by the inferior nature of their nutritive material, but by the fact that the latter is covered with incrusting substances which permit only limited access to the digestive juice or intestinal bacteria, a higher value being obtained when these are removed or loosened. The latter is achieved mechanically by finely grinding the straw, or better, by treatment of the material with caustic alkalis with or without heat and increased pressure. Decomposition with hydrochloric acid is unsuitable. By use of 4% sodium hydroxide in an autoclave, the digestibility of wheat chaff was increased from 26 to 56%, and of the crude fibre from 37 to 83%. The extent and nature of the decomposition depend upon the temperature, pressure, and concentration of liquor as well as upon the duration of cooking, and not only different varieties but different growths of the same kind of straw give different results. Rape and leguminous straws are much more resistant to the action of alkali than grain straws, and sodium hydroxide gives better results than lime or sodium carbonate. By suitable treatment, a food material may be obtained which compares satisfactorily with hay or bran, grain straws giving the best results.

B. P. Ridge.

Size of bamboo fibre and its variation with certain constituents. K. Nishida and K. Wakamiya (Cellulose Ind. Tokyo, 1927, **3**, 181—191).—The length of the

bamboo fibre increases as the stem is ascended to a maximum at about the 18th node and then decreases to the top, whilst the breadth of the fibre decreases continuously, though above the 18th node the change is small. Interior fibres are longer, broader, and contain less lignin than those in the exterior portion of the stem.

W. J. POWELL.

Behaviour of cellulose on heating. J. W. BAIN [with J. E. T. MUSGRAVE, G. F. KAY, G. M. CHUTE, and S. A. ROWLAND] (J.S.C.I., 1927, **46**, 193—195 T).—A study of the behaviour of cellulose when subjected to heat at temperatures well below that of exothermic decomposition. Cellulose (100 g.) heated at 210° for a long period underwent slow, progressive decomposition yielding, chiefly, carbon dioxide and monoxide, but after 34 days, when 2350 c.c. of gas had been obtained, the evolution became negligible and the residual dark brown brittle fibres were apparently stable towards heat. At 265° the evolution of gas (4100 c.c.) ceased after 376 hrs. Surgical cotton after extraction with hot water was heated for 3 hrs. at 200°, and the heated cotton extracted with 6 litres of boiling water; the straw-coloured extract on concentration yielded 0·2% of formic acid (calc. on the cotton), a small quantity of acetic acid, and 2·38% of a syrup which when freed from formic and other acids gave none of the usual colour reactions of pentoses or methylpentoses, but a fermentation test indicated the presence of a hexose. Phenylglucosazone and *p*-nitrophenylglucosazone were prepared from the syrup, whilst with *o*-nitrophenylhydrazine orange needles similar to lævulose-*o*-nitrophenylhydrazone were obtained. Mannose was not detected. The extracted cotton yielded further amounts of syrup on re-heating at 200°, the yield being almost as high as in the first extraction.

W. J. POWELL.

Value of p_H determination in the paper industry. R. ESCOURROU and P. CARPENTIER (Chim. et Ind., 1927, **18**, 13—23).—A scale of desirable p_H values for the different solutions used in the manufacture of sulphite pulp is given. The calcium bisulphite solution as it comes from the towers has p_H about 2·0. After saturation with sulphur dioxide from the process the value is about 1·6. The proposed addition of salts such as chlorides or the use of sea water, which are stated to give better penetration of the wood, act only by modifying the p_H of the liquor. Chlorides increase hydrogen-ion concentration, sulphates diminish it. For any wood there is an optimum value. For resinous pinewood this is 2·1, which may be attained by addition of neutral sodium sulphite. The p_H value of the aqueous extracts of a number of kinds of wood is given. The variation of p_H during the process of cooking was systematically studied. It shows a rise to about 3·0 (period of impregnation), followed by a fall (dissolution of incrustants), and then by another rise (second impregnation). In the case of pulp for bleaching the last stage is omitted and the second is conducted slowly to as low a p_H value as possible, short of the point at which the liquor "turns." The measurement of p_H is, therefore, of great value in control. It is also of value in the washing of the pulp. In a particular case the fresh water used (p_H 8·1) was saturated with resins at p_H 6·1. A guide is thus furnished to the quantity of replacement water necessary, and to the possibility of the loss of soluble matter owing to faulty batches.

C. IRWIN.

Decomposition of vegetable matter under soils. TAYLOR.—See II.

Finnish "fluid resin." PYHÄLÄ.—See XIII.

Fermentation of pectin substances. OMELIANSKII and KONONOVA.—See XVIII.

PATENTS.

Increasing the electric insulating properties of cotton fibre and like insulating materials. LONDON ELECTRIC WIRE CO. & SMITHS, LTD., and E. L. WILDY (E.P. 272,587, 12.3.26).—The material, in the form of fibre, yarn, cloth, or tape, is impregnated under pressure first with a solution which precipitates protein (*e.g.*, 1% tannic acid), then with a solution containing protein (*e.g.*, 1% gelatin or glue), and finally dried.

B. P. RIDGE.

Production of artificial silk from cellulose or cellulose compounds. WOLLF & CO., E. CZAPEK, and R. WEINGAND (E.P. 257,925, 27.8.26. Conv., 1.9.25).—Rapid precipitation of aqueous cellulose solutions (viscose, cuprammonium, etc.) is obtained by the use of a bath consisting of a solution of an inorganic salt (magnesium chloride or sulphate) and/or an inorganic acid in methyl alcohol. Alternatively, a bath of pure methyl alcohol is first used, followed by the above. Filaments of extreme fineness can thus be produced owing to their high resistance to tearing.

B. P. RIDGE.

[Mechanically] cleaning plant fibres. F. KRUPP GRUSONWERK A.-G. (E.P. 262,761 and 274,716, 2. and 21.12.26. Conv., 12.12.25 and 6.8.26).

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Dyeing of silks, viscose silk, and acetate silk. R. P. FREYSSINGEAS, R. E. E. WEILL, and M. H. DREGE (F.P. 606,487, 18.11.25).—A solution of 13·5 g. of cellulose octanitrate in a mixture of 67 c.c. of 95% alcohol and 67 c.c. of ether is added to a mixture of 54 c.c. of a vegetable oil, the dye, and 10 c.c. of paraffin oil, and diluted with alcohol–ether to the desired thinness.

C. HOLLINS.

Preparation of a printing paste for calico printing with cylinders. CHEM. FABR. VORM. SANDOZ (Swiss P. 115,536, 25.9.25).—To the printing colour is added an inert, highly viscous oil (mineral oil or tar oil), with or without paraffin wax etc. to increase the viscosity. These may be dissolved in hydrocarbons (heavy benzine oil), which minimise frothing. Acid printing pastes which contain basic dyes and starch thickening may further be mixed with high-molecular fatty acids (œnanthylic acid etc.) in addition to the viscous oils.

C. HOLLINS.

Sizing for textiles. TEINTURERIE DE LA RIZE (F.P. 607,223, 1.12.25).—Air is blown through a mixture of castor oil, linseed oil, and manganese acetate or resinate at 100—105°. The yarn is impregnated with the product either in a vacuum or with addition of carbon tetrachloride. Oxidation on the fibre is prevented by rinsing with a dilute alcoholic solution of quinol or similar agent.

C. HOLLINS.

Treatment of vegetable fibrous materials with mercerising and like liquids. E. GMINDER (E.P.

262,154 and 267,470, [A] 30.11.26, [B] 14.12.26. Conv., [A] 30.11.25, [B] 13.3.26. [B] Addn. to [A]).—(A) Fabric saturated with the mercerising liquid is cooled in the stretching zone by being passed between pairs of rollers consisting alternately of stretching and cooling rollers. The material is subsequently fixed by washing in the stretched condition with hot water or dilute sodium hydroxide solution. (B) Instead of being washed with hot liquids in the stretching zone the stretched material is passed over heated rollers or surfaces, and then, if desired, again over cooled surfaces, the stretching in this case being partially or wholly dispensed with.

B. P. Ridge.

Machines for washing or otherwise treating fabrics with liquids. J. E. and A. Shaw (E.P. 274,703, 1.12.26).

Dyeing or like machines [for loose stock, rags, etc.]. I. Mitchell (E.P. 274,651, 31.7.26).

Dyes and dyeing (E.P. 274,156 and 274,303).—See IV.

Dyeing wood (E.P. 439,226).—See IX.

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

Influence of reaction rate on operating conditions in contact sulphuric acid manufacture. II. W. K. Lewis and E. D. Ries (Ind. Eng. Chem., 1927, **19**, 830—837).—A series of determinations of the rate of conversion of sulphur dioxide in a platinised asbestos converter was made under isothermal conditions and using dried gases. Owing to the exothermic character of the reaction such conditions can only be obtained with a low concentration of sulphur dioxide (up to 0·5 mol. %). This volume was diluted with either air, air and nitrogen, or air and sulphur trioxide, the latter being produced in a preliminary converter. With low concentrations of both sulphur dioxide and sulphur trioxide neither Knietsch's equation, based on the law of mass action, nor Bodenstein's equation was found to hold good, the results agreeing with the simple equation $dC/dt = K(SO_2)$. In other words, the effects of alterations in the concentration of oxygen or sulphur trioxide are negligible. This is a particular case of a general relationship of the form $-dx/dt = xf(r)$, where x is the number of sulphur dioxide molecules at time t and r is the ratio of sulphur trioxide to sulphur dioxide. The experimental results were in agreement with the relation $-dx/dt = bx(\log_e r_e - \log_e r)$, where r_e is the gas ratio at equilibrium. In this the only term influenced by the oxygen concentration is r_e which varies with $(O_2)^{0\cdot5}$. This agrees with the small effect of oxygen variations. For given initial concentrations and given percentage conversion, there will be a temperature at which $-dx/dt$ will be a maximum. These have been calculated and agree with plant practice. The equation, unlike Bodenstein's, does not demand stoichiometric proportions of sulphur dioxide and oxygen since an increase in the former is accompanied by a decrease in r_e, and this also accords with general experience.

C. Irwin.

Analysis of mixed acid. Loriette and Jovinet (Mém. poudres, 1927, **22**, 174—179).—The usual method of analysing mixed acids can be shortened by determining the sum of nitrous and nitric acids by the Devarda method instead of by the nitrometer. By this modification it is possible to determine the sum on the same sample that was used in determining the total acidity. This application of the Devarda method has been made possible by the design of a special pipette, a description of which is given, which enables the mixed acid to be weighed out with the requisite accuracy. The weighed sample is run into water and the total acidity is determined, followed by a determination of the nitrogen in the neutralised liquid by the Devarda method. The values obtained agree well with those obtained by the nitrometer.

S. Binning.

Volumetric relationships in the burning of hydrogen sulphide to sulphurous acid. R. Nitzschmann and E. Vogel (Chem.-Ztg., 1927, **51**, 557—558).—The volumetric relationships in the equation $2H_2S + 3O_2 = 2SO_2 + 2H_2O + Q$ have been calculated. The results are expressed graphically.

L. M. Clark.

Removal and recovery of phenols from ammonium sulphate still effluents. D. W. Parkes (J.S.C.I., 1927, **46**, 186—193 T).—If the effluent from the distillation of ammoniacal liquor is saturated with carbon dioxide and allowed to settle, the phenols, present to the extent of 0·1—0·6%, may be removed by treatment with activated carbon. At first the phenols adsorbed decompose on the carbon, but this action ceases with time. The proportion adsorbed gradually falls, and thus the total phenols recovered, at first low, rise to a maximum and then fall off. Recovery is best effected with superheated steam and extraneous heating at 380—600°. Different types of activated carbon gave very varying results. Both coke and wood charcoal were used with fair success. The sample should be granulated, and should not only have a high saturation value, but should reach it quickly. Water is always adsorbed as well. The thiocyanate content of the liquor was found to show some reduction. The likelihood of success of this process depends on the securing of a suitable carbon. The best results obtained in laboratory experiments corresponded to a treatment rate of 2700 gals. per ton of carbon per hr., one ton of carbon being removed for separation of phenols every 4 hrs.

C. Irwin.

Conversion of alkali chlorides into nitrates with simultaneous production of chlorine. V. Dominik (Chim. et Ind., 1927, **18**, 24—32).—The aim of the process is to furnish cheap potassium nitrate for agricultural purposes. Krupp's "thermisilid-extra" (silicon-steel) is found to be practically unacted upon by aqua regia, and is available as constructional material. The reaction $HNO_3 + 3HCl = 2H_2O + Cl_2 + NOCl$ has been studied in detail. (It is reversed on dilution.) The proportions of alkali chloride, nitric acid, and mother-liquor necessary for a maximum evolution of chlorine are worked out. It is proposed to carry on the reaction in a vessel with a reflux condenser, and to separate the chlorine and nitrosyl chloride by liquefaction. The chlorine will be purified by washing with dilute nitric acid: $NOCl + Cl_2 + 2H_2O = HNO_3 + 3HCl$. Nitrosyl chloride will be decomposed by cold dilute nitric acid, $3NOCl + 2H_2O = HNO_3 + 3HCl + 2NO$, and the

nitric oxide oxidised. The 7—8*N*-solution of acids is returned to the process. For each kg. of sodium nitrate 0·54 kg. of water will be introduced into the process, and the direct yield of chlorine will be 60%. Allowing for water formed on the reaction and the use of 50% nitric acid, the total quantity of water to be eliminated will be 1·64 kg. per kg. of sodium nitrate. This will be performed in a concentration column, the liquor from which will be returned to the sodium nitrate ready for crystallisation. With sodium nitrate refrigeration will be necessary. With potassium nitrate the acid concentrate should not be added until after crystallisation.

C. Irwin.

Comparison of colorimetric methods for the determination of perchlorate. Junck and Küpper (Caliche, 1926, **8**, 159—168).—The methods of Hofmann and Höbold (A., 1911, i, 608) and Hahn (B., 1926, 404) are discussed. For the colorimetric determination of perchlorate in crude nitrate a reagent is used consisting of 20 c.c. of zinc sulphate solution (*d* 1·35) and 5 c.c. of a solution of 1·6 g. of Methylene Blue in 5 litres of water; 5 c.c. of the reagent are shaken with 0·2 c.c. of 20% nitrate solution. After at least 1 hr. the colour is compared with those of ten standards prepared from similar nitrate solutions containing 0·1—1·0% of perchlorate. If more than 0·8% of perchlorate is present, a 10% nitrate solution is employed. The determination is accurate to 0·01%. Free iodine must be removed, but other usual impurities do not interfere. New standards are necessary in each new set of determinations.

Chemical Abstracts.

Chlorination of ilmenite. Y. F. Krieger (Contrib. Study Nat. Resources U.S.S.R. [Russia], [56], Titanium, 1926, **1**, 23—33).—A report of the titanium commission on the subjection of briquettes of ilmenite and coal to the action of chlorine not above 750°, and the redistillation and sublimation of the products.

Chemical Abstracts.

Chlorination of titanium carbide. M. S. Maksimenko and A. Eliseev (Contrib. Study Nat. Resources U.S.S.R. [Russia], [56], Titanium, 1926, **1**, 43—47).—The apparatus described requires only 750—1000 watts per 8—9 kg., does not clog, and gives only small quantities of ferric chloride.

Chemical Abstracts.

Production of titanium carbide. M. S. Maksimenko (Contrib. Study Nat. Resources U.S.S.R. [Russia], [56], Titanium, 1926, **1**, 33—43).—After removal of dolomite, ilmenite is fused electrically with carbon; the slag is ground and magnetically separated, whereby the iron content is reduced from 34 to 12%, and the carbon content increased to 1·5%. Slag, coal, sawdust, and sodium chloride are then heated in an electric furnace; the iron content falls to 5% and the carbon content rises to 18%. Calcium carbide, magnesium chloride, and iron are removed by means of hydrochloric acid.

Chemical Abstracts.

Production of titanium dioxide, carbide, and tetrachloride. V. S. Suirokomskii (Contrib. Study Nat. Resources U.S.S.R. [Russia], [56], Titanium, 1926, **1**, 49—53, 53—55, 47—49).—A review.

Chemical Abstracts.

Determination of iodine in mother-liquor and in wash-liquors. C. C. Smith (Caliche, 1926, **8**, 149—150).—To the liquor (10 c.c.) are added water (40 c.c.), 20% sulphuric acid (5 c.c.), and 0·1*N*-sodium hypochlorite in slight excess; the mixture is boiled until it occupies 35—40 c.c., cooled, diluted with water (300 c.c.), mixed with an excess of potassium iodide, and titrated with 0·1*N*-sodium thiosulphate. Chromates, if present, must be eliminated or separately determined.

Chemical Abstracts.

Determination of very small amounts of yellow phosphorus in red phosphorus. R. H. Kray (Ind. Eng. Chem., 1927, **19**, 816).—The colour produced on a copper sulphate test paper by a filtered solution of the red phosphorus in carbon disulphide is matched against those produced by known amounts of yellow phosphorus.

Rate of growth of crystals. Montillon and Badger.—See I.

Silica gel. Mautner.—See I.

Adhesives and adhesion. McBain and Lee.—See I.

Explosive ammonium salts. Kast.—See XXII.

Hydrogen peroxide explosives. Bamberger and Nussbaum.—See XXII.

Patents.

Direct production of acetic acid from crude pyroligneous acid. E. D. Deperrois (F.P. 601,156, 18.10.24).—The crude acid vapours from which the tar has been removed, and at a temperature at which acetic acid is just volatile, are sent through an apparatus in which the acid is condensed in a more or less diluted form in various chambers by suitable arrangement of heating or cooling coils, whilst the lowest-boiling fractions are not condensed and escape. The apparatus can be used for other similar separations.

A. B. Manning.

Manufacture of solid sodium hypochlorite preparations. M. P. Appleby and C. Carter (E.P. [A] 274,197 and [B] 274,196, 16.4.26).—(A) A strong solution or melted crystals of sodium hypochlorite is mixed with anhydrous or partially dehydrated salts of a definite alkaline character capable of forming stable hydrates, *e.g.*, sodium metaborate or tripotassium phosphate. (B) The hypochlorite is admixed with dehydrated trisodium phosphate or its salts, or dehydrated disodium hydrogen phosphate and free caustic soda.

H. Royal-Dawson.

Manufacture of ammonium chloride. J. W. Moore, W. G. Polack, and Castner-Kellner Alkali Co., Ltd. (E.P. 274,263, 25.6.26).—Interaction is effected between synthetic ammonia and a gaseous mixture of hydrogen and hydrogen chloride (obtained by burning chlorine in an excess of free hydrogen) in a reaction chamber, the residual hydrogen being again used in the cyclic process.

H. Royal-Dawson.

Removal of silica from zinc, copper, and vanadium solutions. R. H. Stevens, G. C. Norris, and W. N. Watson (E.P. 274,297, 23.8.26).—The solution from the roasted ore is agitated and heated at 40—65°, in the presence of a basic material, *e.g.*, zinc oxide, zinc dross, lime, producing a granular precipitate of silica, which is filtered off from the resulting pulp, the filter cake being then washed with weak acid and water till free of its metal contents.

H. Royal-Dawson.

Continuous production of pure carbon disulphide, sulphur, and highly concentrated hydrogen sulphide from crude carbon disulphide. I. G. Farbenind. A.-G., Assees. of P. Siedler and E. Schulte (G.P. 439,766, 25.10.25).—Two similar fractionating columns, *A* and *B*, attached to reflux condensers are employed. *A* is maintained above 120° and is fed with crude carbon disulphide from above; down *B*, which is kept just above 47°, the purified carbon disulphide from *A* is allowed to trickle. The vapours may be withdrawn from the lower end of the columns and raised to the level of the upper end before complete condensation. The gases from the exits of the columns may be condensed and returned to column *A*. C. Hollins.

VIII.—GLASS; CERAMICS.

Changes in optical glasses. P. Nicolardot (Rev. gén. Colloid., 1927, **5**, 539—543).—An account is given of the methods used by different investigators for measuring the degree of resistance of glasses to various factors (such as the action of atmospheric moisture or carbon dioxide, the presence of hydrocarbon vapours from lubricants, etc.) causing superficial changes in the glass. The method of Mylius (Ann. Phys. Chem., 1879, **6**, 431) is described in detail; this is based on the determination of the quantity of alkali yielded by the glass, using erythrosin as indicator.

L. L. Bircumshaw.

Behaviour of fluorides in glazes and enamels. G. Agde and H. F. Krause (Z. angew. Chem., 1927, **40**, 886—895).—Examination of the waste gases from a furnace melting fluoride enamels revealed no formation of silicon fluoride. From the analysis of a series of glazes previously studied for opalescence (B., 1927, 483) fluorine losses of 12—34% were found, the chief cause of which was the volatilisation of sodium and aluminium fluorides, whilst the formation of some hydrofluoric acid was also indicated. A. Cousen.

Use of super-refractories as chequer brickwork in [oil-]gas manufacture. H. J. Knollman (J. Amer. Ceram. Soc., 1927, **10**, 299—308).—With the object of increasing gas-generating capacity, carbofrax and diamel (fused magnesia spinel) bricks, possessing superior heat-transfer properties, were tried in the upper chequer brick section of a full-sized, standard, single-shell, oil-gas generator. Although the object was not realised, an analysis of the reasons for this suggests excellent possibilities for such products in oil-gas production. A. T. Green.

Effect of steam on the transverse strength of fireclay bricks. C. W. Parmelee and A. E. R. Westman (J. Amer. Ceram. Soc., 1927, **10**, 292—298).—Transverse strength data on twelve of each of three brands of fireclay bricks, the composition and properties of which are detailed, and which had been subjected to the action of steam at 1100° for 10 hrs. and to an ordinary firing at 1100° for the same period, were obtained and compared with similar data obtained on untreated samples of the same products. The results indicate that steam has no influence on the strength of the fire-bricks investigated. The colour of the steamed and of the reheated samples was much darker than that of the new bricks, the "iron" spots showing up in a much more pronounced manner. Further tests with more varieties of fireclay refractories are suggested.

A. T. Green.

Patents.

Protecting the silvering of glass. Soc. Anon. des Manuf. des Glaces et Prod. Chim. de St. Gobain, Chauny, & Cirey (E.P. 262,824, 13.12.26. Conv., 14.12.25).—A stable and uniform backing for silver layers on glass is prepared from a synthetic resin, such as a phenol–formaldehyde condensation product, of which 40 pts. are dissolved in about 60 pts. of a solvent such as denatured alcohol. The liquid is spread as a thin film on the dried silver coating and the glass gradually heated to, and kept at, about 93° for 2 hrs.

A. Cousen.

Refractory, acid-proof and other ceramically bonded products. Scheidhauer & Giessing A.-G. (E.P. 263,194, 18.12.26. Conv., 19.12.25).—Firebricks, blocks, etc. are made from a mixture of kaolin, liquefied by water and an electrolyte as deflocculator, together with a finely ground non-plastic material such as is usually used for refractories or ceramically bonded articles, the mixture being in such proportions that it can be beaten, stamped, or pressed to shape. After drying, the articles may be burned *in situ*. Mixing may be rapidly effected by first liquefying the kaolin, together with part of the non-plastic material, then adding the remainder. For masses of low plasticity more water than necessary for making the slip is preferably added, the excess being removed subsequently if necessary for moulding purposes. A. Cousen.

IX.—BUILDING MATERIALS.

Temperature developed in high-alumina concrete. T. H. Cutler (Eng. News-Rec., 1927, **99**, 146).—High-alumina concrete laid under cold weather conditions began to increase in temperature about 4 hrs. after mixing and generated enough heat during the hardening period to prevent its freezing, without protection, when air temperatures fell slightly below 0°. Maximum temperatures of 29° and 23°, respectively, for the interior and the surface of the concrete were attained in 9 to 10 hrs. W. T. Lockett.

Penetrance of oily fluids in wood. A. M. Howald (Chem. Met. Eng., 1927, **34**, 413—415).—Petroleum residues (fuel oil), alone or mixed with creosote, in some cases have a much lower penetrance in wood than their viscosities would indicate, which is not the case with petroleum distillates. A similar reduction in the penetrance of a distillate was produced by adding magnesium oleate or stearine pitch. These form colloidal solutions in oil, and it is suggested that the reduction in penetrance caused by the addition of asphaltic residues is similarly caused. The addition of carbon black in each case increased the penetrance, presumably by removing the peptised colloid. C. Irwin.

Patents.

Manufacture of cement. Soc. Anon. des Chaux et Ciments de Lafarge et du Teil (E.P. 250,246, 31.3.26. Conv., 4.4.25).—Aluminous cement is prepared by heating an intimate mixture of ferruginous bauxite

and lime or limestone, each ground so that at least 90% passes the 180-mesh per inch sieve, at a temperature below sintering (*i.e.*, 1000—1100°) for about 6 hrs. The mixture may be such as to give the constituents within the approximate limits, silica 0—5%, iron oxide 10—25%, alumina 40—55%, lime 20—40%.

A. Cousen.

Process of manufacturing acid-proof hydraulic binding agents. Portland-Cementwerk Balingen G.m.b.H. (E.P. 269,549, 12.4.27. Conv., 13.4.26).—Barium sulphate or witherite, mixed with sand, clay, or other materials rich in silicic acid, is burnt to the sintering or fusing point, preferably with an admixture of coal or coke. The process is arranged so that the percentage of barium aluminate is kept low, and a proportion of aluminium silicate or iron oxide is formed. The ground product is highly resistant to acids, sulphates, etc.; the resistance is increased by treatment with a sulphate solution.

B. W. Clarke.

Manufacture of artificial stone. R. H. Abrey (E.P. 273,989, 14.2.27).—Raw or calcined magnesite is heated with a flux, *e.g.*, sodium silicate or borax, to the sintering point, and the ground product is gauged with a solution of magnesium chloride containing aluminium chloride and barium chloride.

B. W. Clarke.

Through dyeing of wood. E. Ambühl (G.P. 439,226, 4.2.25. Conv., 26.9.24).—The wood, sawn into planks, is introduced, moist or oven-dried, into an autoclave containing the colouring solution, and a pressure of 30—40 atm. is applied. The heart-wood and annual rings remain uncoloured. After about 5 hrs. the pressure is released to 5 atm. and the liquid is boiled to soften the wood, after which the pressure is again increased to 20, 30, or 40 atm. for 2 hrs. The contents are then allowed to cool at this pressure for 6—12 hrs. and the pressure is finally released slowly. The wood, now coloured throughout, is piled with good access of air, and after some days is dried in a drying plant. Water-soluble aniline dyes or colours soluble in alcohol or glycerol are employed and give an odourless wood. Greater depths of shade are obtained by evaporation, lighter shades by merely boiling.

C. Hollins.

[Bituminous] material for road surfaces. J. F. Bennett and J. Hadfield (E.P. 274,248, 4.6.26).

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

Deformations accompanying the thermal treatment of steel. A. Portevin and A. Sourdillon (Rev. Mét., 1927, **24**, 215—233).—The test-pieces examined diminished in length and increased in diameter after each anneal, the cross-section tending to become ellipsoidal. The effect of successive anneals was additive and more marked the higher the annealing temperature, but was independent of time. The variations in dimensions increased greatly with the rapidity of cooling above 600°; below this temperature the rate of cooling had no effect. In quenching experiments the deformations depended on the quenching temperature, and might be positive or negative; *e.g.*, a semi-hard steel quenched from 850° showed an increase in length and a decrease in diameter. For each steel there exists a certain quenching temperature such that no variations in length are produced, and another temperature at which there are no variations in diameter. With extra-hard carbon steels oil-quenching produced less deformation than water-quenching. The duration of heating before quenching had a very slight influence, whilst one anneal annuls, from the point of view of the deformations, the effects of all previous heat-treatments.

M. E. Nottage.

Reflecting power of some unoxidisable steels. (Mlle.) J. Clavier (Compt. rend., 1927, **185**, 264—266).—Certain so-called "unoxidisable" steels have excellent reflecting powers which are not impaired on exposure to air. They may also be silvered without being attacked.

J. Grant.

Variations in the mechanical properties of steels and alloys with temperature. A. Michel and M. Matte (Rev. Mét., 1927, **24**, 200—209).—A wire under a constant load and maintained at a constant temperature above that of its surroundings for a sufficiently long period of time undergoes several kinds of elongations, viz.:—(1) an instantaneous elastic elongation, (2) a slow elongation which proceeds with decreasing rapidity, and can be resolved into an elastic elongation with retarded elasticity or reactivity, and a permanent elongation, (3) if the load is sufficient, the foregoing elongation is followed by another which proceeds with constant rapidity and corresponds to a so-called "viscous" deformation, (4) after a certain time the rapidity of elongation increases very rapidly up to the breaking-point of the test-piece; this period corresponds to the striction. Each of these quantities should be evaluated separately when studying the behaviour of metals and alloys under mechanical stretching forces at different temperatures. The influence of the time factor in tests made at high temperatures is of the greatest importance. To determine the viscosity limit a study of the variations of the elastic limit and of the modulus of elasticity as a function of the temperature is necessary.

M. E. Nottage.

Determination of silicon in ferrosilicon. L. Deutsch (Chem.-Ztg., 1927, **51**, 558—559).—Ferrosilicon is best decomposed by fusion with sodium hydroxide and potassium nitrate. The fused mass is acidified with hydrochloric acid and the silicon determined as silica after treatment by the usual methods.

L. M. Clark.

Nickel and nickel-chromium in cast iron. A. B. Everest (Bull. Brit. Cast Iron Res. Assoc., 1927, **16**, 14—19).—Nickel increases the quantity of graphitic carbon similarly to silicon and aluminium. It improves machinability and resistance to wear. Grain growth on heating is about 15% of that of foundry iron. The effect is believed to depend on the silicon and phosphorus content. Graphitisation may be retarded by addition of chromium (0·5%); the iron is then hard and close-grained, but readily machinable.

Chemical Abstracts.

Chromium plating and resistance to corrosion. S. Wernick (Nature, 1927, **120**, 225).—The limitations of chromium as a corrosion preventive are briefly mentioned.

A. A. Eldridge.

[Chromium plating and resistance to corrosion.]

H. C. H. C. (Nature, 1927, **120**, 225—226).—A reply to Wernick (preceding abstract). A. A. ELDRIDGE.

Titanium and its application in the industries. V. S. SUIROKOMSKII (Contrib. Study Nat. Resources U.S.S.R. [Russia], [56], Titanium, 1926, **1**, 76—108).—A comprehensive review. CHEMICAL ABSTRACTS.

Analysis of Babbitt metal. I. B. MINTZ, B. O. LYUBIN, and V. I. ZILBERMAN (Nauch. Zapiski [Russia], 1927, **4**, 196—198).—The filings (1 g.) are evaporated to dryness with water (5 c.c.) and concentrated nitric acid (10 c.c.), copper and lead salts being then extracted from the residue with 7·5*N*-nitric acid. The residue is washed with ammonium nitrate solution, and the filtrate, after addition of 10 c.c. of concentrated nitric acid, is electrolysed for copper and lead. To determine antimony and tin, 0·5—1 g. of the metal is dissolved in 10 c.c. of concentrated sulphuric acid, boiled for 5—7 min., cooled, mixed with water (50 c.c.) and concentrated hydrochloric acid (20 c.c.), boiled for 2 min., quickly cooled, diluted with water (100 c.c.), and the antimony titrated with 0·1*N*-permanganate. The solution is poured into 6*N*-hydrochloric acid (110 c.c.), iron wire (1·5 g.) added, heated slowly in a current of carbon dioxide, and, after dissolution of all the iron, cooled, the tin being titrated with 0·1*N*-iodine solution. CHEMICAL ABSTRACTS.

Separation of chromium, tungsten, molybdenum, and vanadium and application of the method to the analysis of stellite alloys. E. CREMER and B. FETKENHEUER (Wiss. Veröff. Siemens-Konz., 1927, **5**, 199—203).—The substance is fused with 10 g. of a mixture of 12 pts. of sodium carbonate, 7 pts. of potassium carbonate, and 1 pt. of potassium nitrate in a platinum crucible. The product is extracted with water, and the filtered solution boiled with an excess of hydrochloric acid, which precipitates the greater part of the tungstic acid. The remainder of the tungsten is recovered from the filtrate by the usual evaporation to dryness, followed by heating at 120° and extracting the residue with dilute hydrochloric acid. The combined tungstic acid precipitates are weighed, and fused with sodium carbonate, and the solution of the mass is treated with tartaric acid, and saturated with hydrogen sulphide under pressure to recover the trace of molybdenum precipitated with the tungsten. The main portion of the molybdenum is recovered from the hydrochloric acid solution by means of hydrogen sulphide under pressure, and both precipitates are ignited to oxide for weighing. The filtrate from the hydrogen sulphide treatment is boiled to remove excess of the gas, and treated with the minimum amount of sodium hydroxide to precipitate chromic hydroxide, which is collected, washed, ignited, and fused with sodium carbonate in a current of coal gas, whereby the occluded vanadium dissolves as sodium vanadate. The aqueous extract of the fused mass is added to the main vanadium filtrate, which is just acidified with hydrochloric acid and treated in succession with manganous chloride, hydrogen peroxide, and ammonia. The precipitate of manganous vanadate and peroxide is dissolved in hydrochloric acid, the solution evaporated with sulphuric acid, and the vanadium determined volumetrically in the usual way. The chromic oxide residue is fused with sodium peroxide for volumetric determination of the chromium. In applying this method to the analysis of stellite alloys the finely-pulverised alloy may be dissolved by the fusion mixture described above, or better by fusion with potassium hydrogen sulphate. In the latter case the solution of the melt in dilute sulphuric acid is treated with 1 c.c. of bromine, followed by sufficient 5% sodium hydroxide solution to precipitate all the iron, manganese, cobalt, and nickel. The precipitate is collected, washed, dissolved in hydrogen peroxide and sulphuric acid, and the precipitation with bromine and sodium hydroxide is repeated. The filtrates from both precipitations are united, treated with hydrochloric acid and ammonia to separate the silica and alumina, and the analysis is finished as described above. A. R. POWELL.

Practical application of inhibitors in [metal] pickling operations. F. N. SPELLER and E. L. CHAPPELL (Chem. Met. Eng., 1927, **34**, 421—423).—Inhibitors are commonly added to the acid baths in which steel is pickled in order to prevent dissolution of the metal, while allowing that of oxide to continue. Amongst inhibitors used have been nitrogen bases derived from coal-tar, mouldy flour or bran, glue, and vitriol tar sludge from benzol washing. The efficiency of certain of these was determined by measurement of the rate of evolution of hydrogen. To give results of practical value this must be done at the temperature at which treatment is to be actually applied. In general, increase of concentration of inhibitor gives a diminishing effect, so that for a given inhibitor there is a concentration which it does not pay to exceed. Amongst the advantages gained are saving in acid, preservation of metal surface, avoidance of "hydrogen embrittlement," and a reduction in acid fumes. C. IRWIN.

Dispersoid chemistry in metallurgy. F. SAUERWALD (Kolloid-Z., 1927, **42**, 242—253).—A number of subjects are dealt with, including the influence of the state of division on the mechanical properties of solid metals; the differences between the mechanical properties of single crystals and crystal aggregates; general views on the relation between inter- and inner-crystalline cohesions, with special reference to Rosenhain's work on the mode of fracture of metals; the influence of cold rolling (cf. A., 1927, 302); and the connexion between the degree of dispersion and the separation of mixed crystals. L. L. BIRCUMSHAW.

Corrosive effect of sulphur etc. in naphtha solution. SCHMIDT.—See II.

PATENTS.

Blast furnace. J. A. PARKER (U.S.P. 1,629,045, 17.5.27. Appl., 7.7.25).—The lower edge of the furnace wall comprises a series of blocks separated by water spaces. The blocks extend the entire width of the wall, and their lower faces are alined with the lower faces of the water spaces. Air passages extend through each block into the furnace. H. HOLMES.

Age-hardening aluminium-silver alloys. W. KROLL (Metall u. Erz, 1926, **23**, 555—557; Chem. Zentr., 1927, I, 175; cf. B., 1926, 751).—The solubility of silver in solid aluminium rises from 1·3% at 20° to about 9%

at 525°, consequently silver–aluminium alloys within this range exhibit the phenomenon of age-hardening when quenched from above 525° and subsequently aged at 130°. The maximum tensile strength so obtained is less than that of the corresponding copper–aluminium alloys by about 5—8 kg./mm.^{2} A. R. Powell.

Alloy [for hard-chilled castings]. J. N. Early (U.S.P. 1,622,576, 29.3.27. Appl., 21.7.26).—A ferrous metal alloy, suitable for the making of castings such as rolling-mill rolls and capable of forming a controllable chill in a sand mould without the use of chills, contains 0·75—1·50% Si, 0·05—0·35% S, 0·25—0·75% P, 0·20—0·70% Mn, 2·00—3·75% C, 0·05—0·25% Ni, 0·15—0·25% Cr, 0·10—0·30% Mo, and remainder iron. M. E. Nottage.

Plating metals [iron]. B. S. Summers, Assr. to Locomotive Terminal Improvement Co. (U.S.P. 1,619,835, 8.3.27. Appl., 9.2.24).—An alloy of lead and nickel is deposited electrolytically on iron from a bath containing lead acetate, sodium hydroxide, nickel chloride, potassium cyanide, and glue. A dense, resistant coating is obtained. T. S. Wheeler.

Aluminium alloy containing lithium. J. Czochralski, Assr. to Allied Process Corp. (U.S.P. 1,620,082, 8.3.27. Appl., 7.12.23).—A hard alloy of good tensile strength comprises Li up to 0·5%, Zn 1—12%, Cu up to 3%, and aluminium. The properties are improved by heating at 100—500° and cooling. T. S. Wheeler.

Smelting of antimony, arsenic, and mercury ores. Oesterr. Bamag-Büttner-Werke A.-G., and R. Jahn (Austr. P. 104,390, 7.8.25. Addn. to Austr. P. 102,293; B., 1926, 549).—To economise in fuel the ore is heated nearly to the desired roasting temperature during the drying operation, and, when quite dry, subjected to a roasting or chlorination treatment, the resulting oxide or chloride being subsequently reduced as described in the chief patent. A. R. Powell.

[Gold] alloy. Western Electric Norsk A./S. (Dan. P. 34,635, 29.7.24).—A gold alloy suitable for electrical contacts contains 72% Au, 26·2% Ag, and 1·8% Ni. A. R. Powell.

[Platinum–copper] alloy. C. S. Brainin, Assr. to Baker & Co., Inc. (U.S.P. 1,624,857, 12.4.27. Appl., 17.10.22).—An alloy of high electrical resistance contains at least 75% Pt and the remainder copper. F. G. Crosse.

Electrolytic process and apparatus [electrodeposition of metals]. H. C. Harrison (E.P. 274,405, 5.1.26).—Electrolyte flows through the electrolytic bath in two streams, the one flowing with a high velocity through a tunnel-like cathode compartment in contact with the cathode, which is moved through the compartment, and the other stream flowing at a lower speed through a compartment containing the metal to be deposited, *e.g.*, copper, the two streams subsequently mixing. J. S. G. Thomas.

Apparatus for concentrating ores etc. by flotation. F. P. Egeberg, Assee. of J. C. MacIntosh (E.P. 261,395, 11.11.26. Conv., 13.11.25).—See U.S.P. 1,608,896; B., 1927, 115.

[Annealing and like] furnaces. A. Smallwood and J. Fallon (E.P. 274,730, 22.1.27).

Manufacture of converter bottoms. J. Schmidt (E.P. 274,316, 11.10.26).

Electroplating [apparatus]. H. Göthe (E.P. 274,671, 14.9.26).

XI.—ELECTROTECHNICS.

Patents.

Pasted accumulator grid or plate. W. Haddon and J. M. Burnett (E.P. 274,208, 19.4.26).—The pasted plate is coated with a mixture of rubber latex and a salt soluble in water, *e.g.*, magnesium sulphate or ammonium carbonate, then dried, and the soluble salt washed out. J. S. G. Thomas.

Manufacture of oxide cathodes. H. Wade. From N.V. Philips' Gloeilampenfabr. (E.P. 274,233, 30.4.26).—A core of highly refractory metal or alloy, *e.g.*, tungsten or molybdenum, which does not form an alloy with the alkaline-earth metals is coated with a film of readily oxidised metal, *e.g.*, copper, and the film then oxidised and brought into contact with one or more of the alkaline-earth metals, which are finally converted into oxide, and the whole is heated to evaporate any remaining reduced readily oxidised metal contained in the film. J. S. G. Thomas.

Induction furnaces. British Thomson-Houston Co., Ltd., Assees. of M. Unger (E.P. 263,856, 30.12.26. Conv., 31.12.25).—See U.S.P. 1,626,437; B., 1927, 450.

Treating filaments for electric incandescence lamps etc. [by spraying]. British Thomson-Houston Co., Ltd., Assees. of G. E. Inman (E.P. 270,733, 5.5.27. Conv., 10.5.26).

Treating carbonaceous material (E.P. 267,240—1).—See II.

Increasing insulating properties of cotton etc. (E.P. 272,587).—See V.

Electrodeposition of metals (E.P. 274,405).—See X.

XII.—FATS; OILS; WAXES.

Chemistry of the [fat of] edible domestic birds. J. S. Hepburn and A. B. Katz (J. Franklin Inst., 1927, **203**, 835—841).—The constants of the visceral fat of the turkey (*Meleagris gallopavo*) and the goose (*Anser anser*), the subcutaneous fat of the goose, and the egg fat of the duck (*Anas erythrorhynchos*) and the goose were determined. The following results were recorded for goose and duck eggs, respectively:—Average weight, 133·0, 80·3 g., the shell being 12·72, 10·58%, and the edible portion 87·28, 89·42% of the gross weight. The yolk formed 36·86, 38·08%, and the white 63·14, 61·92% by wt. of the edible portion. The gross composition (%) of the edible portion of duck and goose eggs, respectively, is tabulated for (*a*) whole egg, (*b*) white, and (*c*) yolk. Thus, for total solids, (*a*) 31·45, 38·75; (*b*) 12·98, 12·08; (*c*) 56·31, 58·90; ether extract, (*a*) 14·36, 12·20; (*b*) 0·01, 0·06; (*c*) 35·04, 35·74; crude protein, (*a*) 13·64, 14·12; (*b*) 9·88, 10·77; (*c*) 18·42, 18·67. The percentage composition of the abdominal adipose connective tissue of the turkey and goose respectively is:—Total solids, 92·94, 91·46;

moisture, 7·06, 8·54; ether extract, 90·2, 88·12; crude protein, 2·24, 2·57. The following constants are given of the visceral fat of the turkey; the visceral, subcutaneous, and egg-yolk fats of the goose; and the egg-yolk fat of the duck, the respective values being:—Acid value, 6·8, 3·4, 0·5, 4·7, 4·8; saponif. value, 225·1, 211·6, 216·5, 199·2, 205·1; ester value, 218·3, 208·2, 216·0, 194·5, 200·3; Hehner number, 90·87, 89·58, 94·90, 87·10, 87·46; iodine number, Hübl, 65·5, 68·6, 73·4, 63·3, 70·8; soluble acids, 5·48, 4·16, nil, 2·57, 2·66; n^{20}, 1·4663, 1·4647, 1·4659, 1·4651, 1·4674; phosphorus (%), 0·074, 0·165, 0·156, 0·927, 0·628. H. M. LANGTON.

Marine animal oils. Aliphatic unsaturated alcohols in spermaceti oil. E. ANDRÉ and (Mlle.) M. T. FRANÇOIS (Compt. rend., 1927, **185**, 279—281; cf. Toyama, A., 1924, i, 257).—The separation of oleyl alcohol (Bouveault and Blanc, A., 1905, i, 12) from spermaceti oil by Tsujimoto (Chem. Umschau, 1921, **28**, 71) has been repeated. The liquid alcohols in the unsaponifiable matter were converted into the mixed acetates, which were fractionally distilled. After some hexadecyl acetate, the main fraction was *oleyl acetate*, b.p. 200—203°/3 mm., which had iodine and saponification values very near the theoretical. In the higher fractions an *acetate* was found which gave a *tetrabromide*, $C_{22}H_{42}OBr_4$, m.p. 242°. Oleyl phenylurethane had not a sharp m.p. (cf. Bouveault and Blanc, *loc. cit.*), but the β-*naphthylurethane* had m.p. 44—45°. *Oleyl allophanate* was not obtained homogeneous; of two portions, m.p. 135° and 129°, the former saponified to a mixture of oleyl and elaidyl alcohols. Elaidyl alcohol could not easily be separated from the product of the action of nitrous fumes upon oleyl alcohol; prepared by the method of Toyama from elaidic acid (with which it shares the property of an iodine value below the theoretical), it had m.p. 36—37°, *phenylurethane* m.p. 55—56°, β-*naphthylurethane* m.p. 71°. Elaidyl alcohol is more stable than oleyl alcohol, which is apt to isomerise.

E. W. WIGNALL.

Fatty acids of shark and ray liver oils. V. Fatty acids of Aburatsunozame. Y. TOYAMA and T. TSUCHIYA (J. Soc. Chem. Ind., Japan, 1927, **30**, 207—215).—The oil of Aburatsunozame (*Squalus wakiyae*, Tanaka) contains a considerable amount of unsaponif. matter (16·79% of the oil), which consists essentially of alcohols of the selachyl alcohol group (cf. Toyama; B., 1924, 431, 719; 1927, 82, 83). The fatty acids of the oil contain more than 15% of saturated acids. The unsaturated acids contain a considerable amount of acids more unsaturated than those of the oleic series. The saturated acids consist mainly of palmitic acid with small quantities of myristic, stearic, arachidic, and behenic acids, and an acid $C_{24}H_{48}O_2$. The acids of the oleic series consist of zoömaric and oleic acids, an acid $C_{20}H_{38}O_2$, and cetoleic and selacholeic acids, possibly with an extremely minute amount of an acid $C_{14}H_{26}O_2$. The acids more unsaturated than those of the oleic series consist chiefly of C_{22} and C_{20} acids, and possibly also of a small amount of C_{18} acids. Among the C_{18} acids, $C_{18}H_{28}O_2$ and $C_{18}H_{30}O_2$ seem to be present. $C_{20}H_{32}O_2$ seems to form the main constituent of C_{20} acids. C_{22} acids consist mainly of $C_{22}H_{34}O_2$. K. KASHIMA.

Oils and fats from the seeds of Indian forest plants. VIII. Oil from the seeds of *Thevetia Neriifolia* (Juss.). R. BHATTACHARYA and P. R. AYYAR. **IX—XI. Oils from the seeds of *Cerbera odollam*, *Holarrhena antidysenterica*, and *Anona squamosa* (Linn.).** R. V. GHANEKAR and P. R. AYYAR (J. Indian Inst. Sci., 1927, **10A**, 15—31).—VIII.—Extraction of the decorticated seeds of *Thevetia Neriifolia* yields 57% of a pale yellow oil (d_{15}^{15} 0·903, n_D^{40} 1·4599, acid value 4·3, saponif. value 19·41, unsaponifiable matter 1·4%, acetyl value nil, iodine value 76·0, Polenske value 0·5, Reichert–Polenske value 0·4, Hehner value 95·6) consisting of the glycerides of palmitic (17·1%), stearic (11·8%), arachidic (0·47%), oleic (64·3%), and linoleic (6·3%) acids. The mixed fatty acids have n_D^{40} 1·4531, iodine value 77, solidif. pt. 34°, and mol. wt. 277·5. The unsaponifiable matter contains 15·3% of sitosterol.

IX.—Extraction of the seeds of *Cerberaodollam* (Gaertn.) yields 43·1% of a pale yellow oil (d_{15}^{15} 0·9144, n_D^{60} 1·4578, acid value 0·35, saponif. value 19·1, unsaponifiable matter 0·8%, acetyl value nil, iodine value 73·8, Polenske and Reichert–Polenske values inappreciable, Hehner value 94·8) containing the glycerides of linoleic (16·4%), oleic (4·2%), myristic? (0·4%), palmitic (30%), stearic (9·9%), and lignoceric (0·9%) acids. The mixed fatty acids have n_D^{60} 1·4478, iodine value 75·8, solidif. pt. 33·8°, mol. wt. 277·9. The unsaponifiable matter contains 32·2% of a sterol, probably sitosterol.

X.—Extraction of the ground seeds of *Holarrhena antidysenterica* yields 19% of oil (d_{15}^{15} 0·9354, n_D^{60} 1·4666, acid value 36·1, saponif. value 180·5, unsaponifiable matter 3·5%, acetyl value 22·9, iodine value 149·1, Reichert–Meissl value 1·7, Reichert–Polenske value 0·4, Hehner value 94·3) composed of the glycerides of linolenic (10%), linoleic (54·7%), oleic (21%), palmitic (5·6%), stearic (6·8%), and lignoceric (1·9%) acids. The mixed fatty acids have n_D^{60} 1·4597, iodine value 151·3, solidif. pt. 24·7°, mol. wt. 283·8. The unsaponifiable matter contains 17·4% of phytosterol.

XI.—Extraction of the seeds of *Anona squamosa* (Linn.) dried at 110° (loss in wt. 33·3%) yields 30% of oil (d_{15}^{15} 0·9126, n_D^{60} 1·4558, acid value 0·8, saponif. value 188·3, unsaponifiable matter 0·2%, acetyl value 18·5, iodine value 85·6, Polenske value 0·1, Reichert–Polenske value 0·6, Hehner value 93·8) composed of the glycerides of oleic (18·1%), linoleic (55·2), palmitic (14·7%), stearic (10·7%), and cerotic? (0·9%) acids. The mixed fatty acids have n_D^{60} 1·4470, iodine value 84·8, solidif. pt. 31·8°, mol. wt. 276·3, and contain an unidentified saturated liquid acid (equivalent 126·5). The unsaponifiable matter contains 15% of sitosterol.

E. H. SHARPLES.

Oil from seeds of *Bombax heptaphyllum*. A. C. DA S. TELLES (Bol. Min. Agr. Ind. Com., 1927, **16**, 178—181).—The oil from the seeds of *Bombax heptaphyllum*, Kunth, has *d* 0·920 and m.p. —9°. It is a drying oil. G. W. ROBINSON.

Grape stone oil. L. MARGAILLAN (Compt. rend., 1927, **185**, 306—307).—Oil carefully extracted from fresh grape stones has an acetyl value which may be as low as 4; it is thus, contrary to accepted opinion, unoxidised when extracted. On keeping, ground grape

stones become heated, owing to oxidation of the oil. Oxidation by "blowing" is slower than that of colza oil; the product, a jelly, is a good lubricant.
E. W. Wignall.

Origin of the coloration of beeswax. Composition of propolis. G. F. Jaubert (Compt. rend., 1927, **184**, 1134—1136).—The matter exuded by the wax glands of the bee is a colourless, transparent liquid, and on cooling forms translucent, pearly white scales. Extracted beeswax is, however, of a bright yellow colour, which is derived from the propolis varnish which covers the tops of the cells. The colouring matter of propolis combines with certain salts, such as those of iron, aluminium, copper, titanium, uranium, etc., to form insoluble lakes. From these the pure colouring matter may be isolated and is found to be chrysin. The propolis is the exudate of the buds and green parts of *Populus nigra*, and contains the above compound and melezitose. A. Rayner.

Complete saponification of fats in the manufacture of soap base. J. Davidsohn (Chem. Umschau, 1927, **34**, 160—162).—The development of brown spots and rancidity and the loss of perfume in toilet soaps are said to result if more than 0·1% of unsaponified fat is present. In the ordinary boiling operation, since the mass in the pan is not homogeneous, even with long boiling, it is common to find 0·3—0·8% and even more of unsaponified fats present. If the soap is in the right condition this saponification can be completed when the material is only warm, and for this reason slow cooling in frames is preferred in some cases to the quicker machine-cooling method. It is argued that if saponification can be completed under these conditions, it should be possible to get complete saponification much more rapidly by adopting the semi-cold process of soap-making. Various experiments are given confirming this conclusion, and it is shown that tallow with 15% of coconut oil can be completely saponified at 55—60° on a large scale like cold-made soap, by keeping it over-night after saponification has started.
A. Rayner.

Blank test in glycerin analysis by the acetin method (I.S.M.). O. Berth (Chem. Umschau, 1927, **34**, 129—131).—It is suggested that differences in the results of different operators with the acetin method are due mainly to differences in the blank test, and that 50 c.c. of *N*-alkali should be used instead of 5 c.c. In a particular analysis the percentage of glycerol found using 10 c.c. for the blank was 78%, compared with 77·6% using 50 c.c. A true blank can only be obtained using 50 c.c. as in the actual determination, due probably to the influence of carbon dioxide on the titration, as is shown in an experiment in which 10 c.c. of *N*-sodium hydroxide were added to 25 c.c. of water and 125 c.c. of *N*-hydrochloric acid which had been exactly neutralised with *N*-alkali. After boiling the mixture for 15 min. and titrating back, an absorption of 0·46 and 0·38 c.c. was recorded. It is stated further that whilst the I.S.M. method requires acetic anhydride of purity such as to require only 0·1 to 0·2 c.c. of *N*-alkali, such a material is unobtainable. The purest samples were found to require 0·36 to 0·74 c.c. A. Rayner.

Berginisation of fish-liver oils. Ormandy and others.—See II.

Testing viscosity of oils. Schlüter.—See II.

Drying of linseed oil. Wilborn.—See XIII.

Oxyns. Eibner and Munzert.—See XIII.

Patent.

Apparatus for hydrogenation (E.P. 273,045).—See I.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Basic zinc sulphate liquors in lithopone manufacture. W. N. Hirschel (Chem.-Ztg., 1927, **51**, 599).—In the lithopone industry, zinc sulphate liquor is purified by oxidation and subsequent reduction. In these reactions, typical equations for which are given, excess of zinc hydroxide is formed, giving rise to a basic salt that separates from the zinc sulphate liquor after filtration and cooling. This is shown to be $3ZnO,ZnSO_4,8H_2O$. S. S. Woolf.

"Oxyns." V. Oil films from the colloidal point of view. A. Eibner and H. Munzert (Chem. Umschau, 1927, **34**, 183—189, 206—211; cf. B., 1927, 417).—Mainly a theoretical discussion on the relations between the purely chemical and the colloidal reactions involved in the drying of oil and stand oil films. The reaching of the "free from tack" stage is a pseudo-drying due to autoxidation, preliminary to the drying proper which is dependent on the "gelatinising tendency" of the oil, a function of the nature of the individual oil and of the treatment to which it has been subjected. The solubility in alcohol and ether of various fresh and aged oil films was studied, and the drying and the general qualities of an oil are shown to be improved by conversion into stand oil. The insoluble matter in films 6 months old was as follows:—Linseed oil 36%, linseed stand oil 64·5%, tung oil 60%, tung stand oil 86%. The corresponding figures for films at the "pseudo-dry" stage are 28, 50, 15, and 17%. The gel formation essential to true drying proceeds more rapidly in tung oil films than in others owing to the absence from tung oil of mixed glycerides and to its intense tendency to gelatinise. Its claims to be considered as the standard drying oil, in place of linseed oil as hitherto, are advanced. This gel formation is distinct from the formation of semi-solid "polymerised" masses by heating oils in the absence of air, such irreversible gels being absent in ideal dried oil films. From the constants of the portions of aged oil films soluble in water, alcohol, and ether, respectively, the nature of these soluble substances is discussed for the various oils. In the drying of oil films in enclosed vessels, the reversible nature of the gels is demonstrated, the syneresis occurring constituting a suggested "accelerated test." The differences between the drying of tung, linseed, and poppyseed oils are amplified from the above considerations, whilst suitable "colloidal" nomenclature is introduced. S. S. Woolf.

Influence of copper compounds on the drying of linseed oil. F. Wilborn (Farben-Ztg., 1927, **32**, 2542).—Boiled linseed oil containing copper as drier dries more quickly in winter and more slowly in summer than does linseed oil. From laboratory drying experiments it is deduced that variation in humidity rather

than temperature is responsible for the anomalous behaviour. S. S. Woolf.

Analysis of driers. F. Wilborn (Farben-Ztg., 1927, **32**, 2542).—To avoid the loss of metallic chlorides by volatilisation, when, in the analysis of driers, organic matter is removed by incineration, with subsequent treatment of the ash with hydrochloric acid, also by reduction of the oxides to metal, treatment with strong acid—nitric acid for linoleates, sulphuric acid for resinates—is recommended, especially for lead driers. Experimental details are given. S. S. Woolf.

Composition of Finnish "fluid resin." E. Pyhälä (Chem. Umschau, 1927, **34**, 145—147, 189—195).—If the soft soap layer separating from the black liquor obtained in cellulose manufacture be decomposed with sodium bisulphate or dilute sulphuric acid, a dark brown, viscous oil ("fluid resin") results. On steam distillation *in vacuo*, this yields 75—80% of "tall oil" and resin crystals, leaving 20—25% of residual pitch. By mechanical separation, 12 fractions varying in viscosity from a mobile oil to a black asphaltic material were obtained from a commercial Finnish "fluid resin." The physical and chemical properties of these are tabulated, and the results of examination of the various fractions are described. The composition of the fluid resin is given as follows:—fatty acids 45·3% (mainly oleic, linolenic, and ricinoleic acids), unsaponifiable oil 2·5%, oily resin acids 21·5%, soft resin acids 10·8%, solid resin acids 13·6%, unsaponifiable pitch 6·3%. S. S. Woolf.

Patents.

Fibrous paint material. G. E. Heyl (E.P. 273,848, 21.4. and 18.5.26).—Paper, wood pulp, spent hops, or similar fibrous material is subjected to a preliminary wet disintegration in an ordinary paper beater, and a subsequent disintegration in a high-speed colloidal grinding machine, binding medium, fillers, and colouring material being incorporated prior to or during either stage of disintegration. Aqueous or oily vehicles may be used at both stages, or the material may be dried after the first stage. S. S. Woolf.

Binding medium for dyes. E. Stern (G.P. 438,935, 14.10.24).—To water-insoluble fixing media is added 10% or less of a non-swelling carbohydrate, such as formaldehyde–starch, starch compounds of alkalis or alkaline-earths, cellulose, hydrocellulose, or oxycellulose. C. Hollins.

Binding medium for dyes. E. Stern (G.P. 439,519, 26.6.25. Addn. to G.P. 438,935, preceding).—As water-insoluble fixing media bitumens, *e.g.*, petroleum pitch, stearine pitch, or viscous mineral oil distillate, are used with the non-swelling carbohydrates of the prior patent. C. Hollins.

Method of forming synthetic resinous materials. J. V. Meigs (E.P. 274,146, 9.2.26).—See U.S.P. 1,593,342; B., 1926, 838.

Mills for grinding paints etc. H. Drysdale, and S. Smith & Blyth, Ltd. (E.P. 274,162, 19.3.26).

Azo dyes and lakes (E.P. 250,909).—See IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber–filler systems. Colloid problems of the rubber industry. P. Stamberger (Kolloid-Z., 1927, **42**, 295—300).—It is found that fillers for rubber, of which the size of the particles lies between 0·5 and 1μ, diffuse through the solvation medium partially or completely with the rubber. The rate of diffusion, and the quantity diffusing with the rubber, depend upon the filler. The view that this behaviour is due to the strongly dispersing action of the rubber is considered to be inadmissible, neither will a purely mechanical explanation meet the facts. It is assumed that the filler is adsorbed on the rubber, the rubber–filler complexes moving together. The effect of carbon black on rubber may also be explained by the adsorption theory. L. L. Bircumshaw.

Patents.

Manufacture of an organic selenium compound. Vulcanisation processes. P. I. Murrill, Assr. to R. T. Vanderbilt Co., Inc. (U.S.P. 1,622,534—6, 29.3.27. Appl., [a, b], 30.9.25; [c], 28.8.26).—(a) Compounds of the types $(NRR'\cdot CS\cdot S)_4Se$, $(RO\cdot CS\cdot S)_4Se$, or $(\vdots C\cdot CS\cdot S)_4Se$, *e.g.*, selenium compounds derived from dithiocarbamic, xanthic, dithioacetic, or dithiobenzoic acid, are of value as (b) vulcanisers and (c) accelerators. *Selenium diethyldithiocarbamate*, m.p. 94—95°, is obtained by the interaction of anhydrous sodium selenite (1 mol.), sodium diethyldithiocarbamate (4 mols.), and hydrochloric acid (6 mols.). *Selenium dimethyldithiocarbamate* has m.p. 163—165°. T. S. Wheeler.

Manufacture of a vulcanisation accelerator. H. W. Elley and D. H. Powers, Assrs. to E. I. du Pont de Nemours & Co. (U.S.P. 1,624,723, 12.4.27. Appl., 2.12.24).—*p*-Nitrosoaryldialkylamines (1 mol.) are condensed with a primary amine (2 mols.), and the product is condensed with a reactive aldehyde (1 mol.) to give compounds of the general formula $R_1R_2N\cdot C_6H_4\cdot N{<}^{NR_3}_{NR_3}{>}CHR_4$, which are of value as accelerators. T. S. Wheeler.

XV.—LEATHER; GLUE.

Analysis of chrome[-tanned] leather and mechanism of the chrome-tanning process. F. Hudson (J. Soc. Leather Trades' Chem., 1927, **11**, 133—144).—The basicity of the chromium salt on the fibre is obtained from the acid radicals and chromium content. The former are determined by a modification of Meunier and Chambard's method (cf. B., 1923, 367 a). Good agreement has been obtained between this and the nitric acid method (Procter, "Leather Chemists' Pocket Book," 1912, 197), the new method being more rapid. Experiments show that there is no connexion between the basicity of the chromium salt on the fibres of the leather and its ability to withstand the boiling test. The latter is not a satisfactory measure of the completeness of tanning. The results of the test depend not only on the chromium content, but also on the nature of the combined acid radicals. Leather tanned with a basic chromium chloride liquor fails to withstand the test irrespective of its chromium content. Leather tanned with a basic

sulphate liquor to which neutral chlorides have been added shows a lessened stability to the test, the extent of which depends on the concentration of the neutral salt. In leather which withstands the boiling test at the completion of the tanning and fails to do so when finished, the combined bivalent acid radicals originally present have been replaced by univalent acid radicals, *e.g.*, SO_4 by fatty acids. Irregularities in the boiling test are the same for both one- and two-bath chrome-tanned leathers. The different behaviour of combined univalent and bivalent acid radicals is attributed to their different mode of combination. The chromium atom may be attached by primary valency to the carboxyl groups in the collagen or indirectly attached to the imino-groups by means of the bivalent radical. The combination with basic chromium chlorides is of the first type only. The amount of sodium hydroxide accounted for in some determinations by the new method of basicity determination was in excess of that used to the extent of 0·9% on the leather. It is suggested that neutral salts are attached to the chromium atom by secondary valency forces in accordance with Werner's theory.

D. WOODROFFE.

[Determination of] insoluble [matter] in tannin solutions. J. G. PARKER and J. T. TERRELL (J. Soc. Leather Trades' Chem., 1927, **11**, 196—199).—Tests on quebracho, solid oakwood, and chestnut extracts, using the official method of determining the insoluble matter and the Kubelka method (cf. B., 1925, 412, 516, 603), show that the latter indicates a decreased amount of insoluble matter, in some cases to a marked degree; the treatment darkens the colour of the solution both in red and yellow units. The Kubelka method was shown to yield results as concordant as those by the official method. It does not determine the true insoluble matter.

D. WOODROFFE.

Adhesives and adhesion. MCBAIN and LEE.—See I.

XVI.—AGRICULTURE.

Accumulation and movement of nitrates in a four-field rotation. N. MOKIN (Isvestia opitnomu Severnogo Kavkaza [Russia], 1926, No. 9, 22—35).—On black or clean fallow the quantity of nitrates was large, the greatest accumulation occurring in the autumn. During the summer the nitrate content varied according to rain and tillage; towards the spring the fallow lost most of the nitrate. The course of nitrate accumulation was examined for maize, potato, and winter wheat (following fallow); with winter wheat the nitrates do not disappear at all during the growing season. With maize and potato the nitrate content rises from spring to mid-summer, then decreases until the early autumn, rising again in late autumn. The author concludes that clean fallows do not stimulate nitrate accumulation.

CHEMICAL ABSTRACTS.

Determination of sulphur in arable soil. G. BERTRAND and L. SILBERSTEIN (Bull. Soc. chim., 1927, [iv], **41**, 950—954).—To determine total sulphur the sample is evaporated to a paste with fuming nitric acid and neutralised with sodium carbonate solution, excess being added and the whole evaporated to dryness and fused with an equimolecular mixture of sodium carbonate and nitrate. The sulphate is dissolved in dilute hydrochloric acid and precipitated by means of barium chloride. Sulphates present as such in the soil are separated by extracting at least three times with boiling dilute hydrochloric acid. Electrical heating is used throughout to prevent contamination from sulphur compounds in burnt gas.

F. S. HAWKINS.

Modifications of nitrogenous substances in soil dried in the air and left fallow. A. LEBEDIANTZEF (Compt. rend., 1927, **185**, 293—295; cf. B., 1924, 305, 436; 1926, 182).—Duplicate samples are taken from the top 20 cm. and 40 cm. layers of soil of triennial crop rotation, and the top 20 cm. layer of fallow soil, and one series is dried as in previous work, the other left undried. All the samples are exposed to the air, left fallow, and kept moist by distilled water, for 180 days. Figures are given for the proportions of nitrate and ammoniacal nitrogen (determined by the methods of Schlœsing and of Boussingault) in the samples at regular intervals. The dried earth is distinguished by a gradual accumulation of nitrates, and by an initial increased content of ammoniacal nitrogen, which subsequently fluctuates.

E. W. WIGNALL.

Relation between the available phosphoric acid of soils and the geological formation. H. NIKLAS, R. PÜRCKHAUER, and H. POSCHENRIEDER (Z. Pflanz. Düng., 1927, **A9**, 136—160).—The *Azotobacter* test for phosphoric acid has been applied to some 1300 soils, derived from different geological formations in Bavaria, and certain relationships are found between the content of the soils in available phosphoric acid and their geological origin. In general, soils from marine deposits are less in need of phosphoric acid than those of terrestrial origin. Further, soils with an acid reaction are generally definitely poorer in phosphoric acid than those with a neutral or alkaline reaction, probably because the former have been subjected to more thorough leaching processes. The *Azotobacter* test is very satisfactory for this type of investigation.

C. T. GIMINGHAM.

Do soil zeolites contain directly exchangeable hydrogen ions? M. TRÉNEL (Z. Pflanz. Düng., 1927, **A9**, 121—135).—Sodium permutite, deprived of base by continuous extraction with water saturated with carbon dioxide, does not show an acid reaction either in water or in potassium chloride solution. The author holds that, on removal of the bases from soil zeolites, "free combining power" remains, and that, contrary to the views of Hissink and others, there is no direct replacement by hydrogen ions. Only the aluminium adsorbed on the surface of the mineral soil colloids is exchangeable. The injurious action of unsaturated soils on plants is explained by the suggestion that certain plants are not able to obtain sufficient nutrient bases on account of the adsorptive capacity of the unsaturated soil particles. The degree of unsaturation of such soils should be investigated in suspensions in potassium chloride solutions. The "total acidity" and the p_H of a suspension in potassium chloride solution are functionally dependent on one another; hence, it is the exchanged aluminium which brings about the acidity of mineral soils.

C. T. GIMINGHAM.

Determination of soil fertility by chemical

means. K. Bamberg (Z. Pflanz. Düng., 1927, **A9**, 161—175).—Detailed investigations on the determination of phosphoric acid by extraction with different acids are reported, the results being compared with those given by Mitscherlich's physiological method. Special attention was given to the effect of the p_H of the acid extract on the amount of phosphoric acid dissolved, and, in order to obtain the same final p_H in the extracts, the amounts of acid used were adjusted to the buffering capacity of the soils. The phosphoric acid dissolved was found to depend not only on the p_H, but also on the nature of the soil phosphates and on the properties of the particular acid used. Different acids dissolve different amounts of phosphoric acid from the same soil even when the final p_H and other conditions are the same. Much further work on the subject is required.

C. T. Gimingham.

Influence of reaction of soil on formation and composition of marjoram. H. Deel and (Mrs.) Deel (Bull. Soc. chim., 1927, [iv], **41**, 955—957).—The maximum yield was obtained in soil at p_H about 9·5. Variations in the value of p_H caused large variations in the weight of plant and oil obtained per hectare, but only small alterations to their ratio until the p_H value fell below about 5·6.

F. S. Hawkins.

Automatic recording device for carbon dioxide in air from 0 to 3·5%. C. Z. Rosecrans (J. Opt. Soc. Amer., 1927, **14**, 479—490).—This instrument has been designed for experimental work in greenhouses, and depends on the thermal conductivity of the gas mixture. An accuracy of 0·05% of the scale reading, independence of scale reading on velocity of gas flow, and compensating devices for current and temperature fluctuation are the principal claims. The application of the instrument to the analysis of other gas mixtures is discussed.

R. W. Lunt.

Relation of size of oil drops to toxicity of petroleum oil emulsions to aphids. E. L. Griffin, C. H. Richardson, and R. C. Burdette (J. Agric. Res., 1927, **34**, 727—738).—The toxicity of oil emulsions to aphids increased with the size of the oil droplets and depended to a far greater extent on this than on the nature of the oil or emulsifier used. With large-drop emulsions a far greater proportion of oil was retained by the leaf surfaces, and presumably by the bodies of the insects. These phenomena are explained on the basis of the intensity of repulsion between the negatively charged oil droplet sand the negatively charged leaf surface.

A. G. Pollard.

Sulphuric acid as a weed spray. A. Åslander (J. Agric. Res., 1927, **34**, 1065—1091).—The influence of various conditions on the killing of weeds by spraying with sulphuric acid (1—2%) has been investigated. Sprayed plants of mustard, kept under different conditions of humidity, were all killed, but most readily in dry air (30% relative humidity). Plants grown in moist soil were killed by a 1·5% solution, whereas in dry soil a 2% solution was required. The plants were killed much more quickly at 30° than at 6°. Spraying with water 1 hr. after treatment with 2% sulphuric acid did not decrease the effect of the acid. Solutions of iron sulphate (5—15%) were much slower in action, and were most destructive under conditions of high humidity and low temperature. Oat plants grown with the mustard were not injured either by the sulphuric acid or iron sulphate solutions.

C. T. Gimingham.

Decomposition of vegetable matter under soils. Taylor.—See II.

XVII.—SUGARS; STARCHES; GUMS.

Colour in the sugar industry. I. Colour nomenclature. II. Colorimetric clarification of turbid sugar solutions. H. H. Peters and E. F. Phelps (U.S. Bur. Standards, Techn. Paper 338, 1927, **21**, 261—308).—This paper is the first of a series to be published on the application of precise spectrophotometric methods to the colorimetric investigation of sugar products. In Part I the terms and symbols employed, which are those recommended by the Optical Society of America, are defined and explained. Part II deals with the preparation of solutions of sugar products for colorimetric analysis. The method of preparation usually employed, which consists in making up an aqueous solution of appropriate colour concentration, treating it with kieselguhr, and filtering through a folded filter paper, is unsuitable for precise colorimetric work. Solutions thus obtained are seen to be optically turbid if observed obliquely under strong illumination in a dark room, and their optical properties are liable to change for a considerable time after preparation. Moreover, kieselguhr has selective adsorbent action on the colouring matters present. To avoid these defects the authors have worked out a method of preparing solutions, of which the following is a bare outline. A known weight of the sample is made up to a solution of about 55° Brix by addition of boiling water, added in small quantities. Any further reduction of colour necessary is effected by dilution with a specially prepared solution of pure decolorised sucrose of the same density. After removal of any coarse impurities by straining through cloth, the solution is shaken for 5—15 min. with 2% of dry, specially treated asbestos fibre and filtered. It is finally filtered repeatedly through a pad of similar asbestos in a Gooch crucible, until optically clear. Spectrophotometric observations are made on the prepared solution in a glass cell, a similar cell containing pure water or sucrose solution being used for comparison. If the thickness of the liquid layer in the cell is b cm. and the concentration of the sample is c g. of dry substance per c.c., and T is the transmittancy, *i.e.*, the fraction of the incident light which is transmitted by the solution (divided if necessary by the corresponding fraction for the solvent, which is usually 1), then by the Lambert–Beer law the expression $(-\log T)/bc$ is a constant for the sample and equal to $-\log t$, the specific absorptive index. This represents the absorptive power of unit weight of dry substance of the sample for the particular light employed. It varies with the wave-length, but the authors have found that for a wave-length of 560 mμ it has substantially the same value as for white light. If $-\log t$ for light of this wave-length be divided by 0·00485, the corresponding value for water, the quotient n represents the number of units of colouring matter in 1 g. of dry substance of the sample.

J. H. Lane.

Determination of sugar and non-sugars in sugar beet. A. B. Fremel (Bull. Sakharotresta, 1927, No. 1, 50—66).—The determination should preferably be made on an aqueous extract prepared at 20°.

Chemical Abstracts.

Use of hyposulphites in the [beet] sugar industry. R. Mestre (Bull. Assoc. Chim. Sucr., 1927, 44, 320—334).—The use of readily hydrolysable hyposulphites, such as those of zinc and aluminium, is recommended for raw juices. The bases liberated by hydrolysis act as adsorbents and precipitants of colloidal impurities, whilst the liberated acid combines loosely with stronger bases, such as lime, or with organic matters, from which it is set free by subsequent sulphitation. Diffusion juice is treated with 1 litre of 10% zinc hyposulphite solution per 20 hectolitres. Data are given showing how the p_H value and viscosity of juices so treated change during the later stages of sugar manufacture. J. H. Lane.

Determination of sugar in carbonatation scums. P. Orth (Bull. Assoc. Chim. Sucr., 1927, 44, 334—336).—According to Vondrak (B., 1923, 369) and Kunz (B., 1925, 255) the sugar in carbonatation scum cakes can be accurately determined only after complete dissolution of the calcium carbonate. Using acetic acid for the latter purpose, and basic lead acetate for subsequent clarification, the author found differences up to 1·38% in the sugar content of scums, as compared with the usual method. The extent of the differences may depend on the quality of the lime used for defecation. Prolonged contact of scums with water appears to render the whole of the sugar determinable by the usual method. J. H. Lane.

Determination of sulphurous acid in sugar solutions. R. Mestre (Bull. Assoc. Chim. Sucr., 1927, 44, 317—319).—The determination of sulphur dioxide in sulphited beet factory syrups cannot be satisfactorily carried out by the distillation method owing to the small quantities to be determined and the large excess of sugar. Direct iodometric titration will give consistent results provided the liquids are not alkaline.

J. H. Lane.

Effect of heat on sugar-refinery products. M. I. Nakhmanovich and I. F. Zelikman (Nauch. Zapiski [Russia], 1926, 4, 107—115).—Products of high purity, but not those of low purity, are unchanged at 80° for 12 hrs., although at 100° considerable decomposition takes place. Chemical Abstracts.

Purification and drying of potato starch. Mariller (Bull. Assoc. Chim. Sucr., 1927, 44, 299—303).—The relative merits of vats, tables, and centrifugal apparatus for the purification and deposition of starch, and of hot-air and vacuum apparatus for drying, are briefly discussed, and some types of starch centrifuges and dryers are described with data of output and efficiency. Continuously operating centrifugal machines simplify the processes of purification and deposition, and reduce the labour required. Vacuum dryers are strongly recommended. J. H. Lane.

Albumin from carbohydrates. Claassen.—See XIX.

XVIII.—FERMENTATION INDUSTRIES.

Antiseptic action of the bitter substances of hops. W. Windisch, P. Kolbach, and W. Schüren (Woch. Brau., 1927, 44, 285—290, 297—301, 309—314, 324—328, 335—339, 345—350).—The minimum amounts of the different hop resin fractions required to inhibit entirely the development of *Bacillus Delbruckii* in wort under various conditions of hydrogen-ion concentration were determined directly, and also after 2 hrs.' boiling, and after 2 hrs.' boiling followed by fermentation. *B. Delbruckii* was employed because its development could easily be measured by titration of the lactic acid produced. The antiseptic power of the α-bitter acid, humulone, is much greater than that of the other hop resins. It is very dependent on hydrogen-ion concentration, being 30 times as great at p_H 4·3 as at p_H 8·2. Probably the free acid alone is antiseptic, and the salts are indifferent. Boiling for 2 hrs. in wort reduces the antiseptic power, but rather increases its sensitiveness to hydrogen-ion concentration. In wort having the average reaction of beer (p_H 4·3), the amounts of humulone required to inhibit growth in 100 c.c. of wort were:—Before boiling, 0·75 mg.; after boiling, 0·83 mg.; and after boiling and fermentation, 1·65 mg. The resin fraction comprising the β-acid, lupulone, plus the soft resins, is much less active and less sensitive to hydrogen-ion concentration. The amounts of humulone required to inhibit growth in 100 c.c. of wort after 2 hrs.' boiling, at a reaction of p_H 7, at the average reaction of wort (p_H 5·6), and at the average reaction of beer, are 14, 5·0, and 0·83 mg., respectively, the corresponding figures for lupulone, plus soft resins, being, 30, 18, and 16 mg. The antiseptic action of the hard resins is negligibly small. J. H. Lane.

Fermentation of pectin substances in mixed cultures. V. L. Omelianskii and M. M. Kononova (Arkh. Biol. Nauk, 1926, 26, 53—58).—Normal fermentation of retting flax, with easy separation of fibres, takes place on addition of aerobic organisms (*Bacterium fluorescens liquef.*, *B. coli*, *B. mesentericus vulg.*, and *Oidium lactis*) to the anaerobic *Granulobacter pectinovorum*. Hence pure cultures of *G. pectinovorum* should be obtainable from spores in pasteurised flax straw, using aerobic non-sporogenic organisms which are eliminated by subsequent pasteurisation. At the end of flax fermentation the p_H changes from 6·4—6·2 to 4·6—4·2.

Chemical Abstracts.

Nutritive value of spent hops. Davies and Sullivan.—See XIX.

Albumin from carbohydrates. Claassen.—See XIX.

Patents.

Production of sparkling wines. M. Jordt (E.P. 274,707, 11.12.26).

Manufacture of vinegar. A. K. Croad. From F. Noldin (E.P. 274,328, 1.11.26).—See U.S.P. 1,610,465; B., 1927, 122.

XIX.—FOODS.

Oiliness in milk. A. T. R. Mattick (J. Agric. Sci., 1927, 17, 388—391).—A widespread "oily" taint of milk has been traced to the catalytic oxidising action of

exceedingly minute amounts of copper taken up by the milk from the surface of the cooler or other apparatus. The reaction is dependent on free access to oxygen, and occurs only at comparatively low temperatures. The action of bacteria limits the production of "oiliness" to cold weather, either by absorption of oxygen, or by the production of acidity. "Oiliness" is not identical with other flavours in milk caused by somewhat larger amounts of copper. C. T. GIMINGHAM.

Factors, other than bacteria, which influence the body of buttermilk. G. KNAYSI (J. Agric. Res., 1927, **34**, 771—784).—In the preparation of artificial buttermilk the addition of sodium salts improved the homogeneity and "body" of the product. This effect depended to some extent on the particular salt used. Heating to 100° resulted in a better product than the customary heating to 80°, the improvement depending on physical conditions and not on the removal of micro-organisms. The tendency of artificial buttermilk to separate when stored at high temperatures is largely a physical phenomenon, and was not affected by the addition of such substances as starch and gelatin. A. G. POLLARD.

Movement of substances through cheese. Theory of salting-down cheese. M. YEGUNOV (Visti Odeskii Silsko-Gospodar'skii Inst., 1925—6, **1**, 90—93).—Various kinds of cheese were tested with copper sulphate and silver nitrate as diffusion solutions, and the relation between the height of diffused substance and the square root of the time was determined. CHEMICAL ABSTRACTS.

Production of food albumin from carbohydrates. H. CLAASSEN (Chem.-Ztg., 1927, **51**, 577—578).—A dried yeast containing 42% of albumin can be obtained after development of the organism by means of molasses, ammonium sulphate, and superphosphate, but it cannot compete with natural feeding stuffs owing to its high cost of production, which is approximately twice that of dried yeast from brewery residues and five times that of nut cakes with the same albumin content. The use of cheaper sources of carbohydrates such as waste waters from cellulose, starch, or sugar factories, or the substitution of other micro-organisms for yeast, give unsatisfactory results. F. R. ENNOS.

Comparison of meats pickled with saltpetre made from Chili saltpetre and from synthetic sodium nitrate. G. RIESS and R. MEYER (Chem.-Ztg., 1927, **51**, 361—363).—No difference could be detected in the colour, odour, or taste of meat pickled with salt and saltpetre, when the latter was made from natural or from synthetic sodium nitrate. Determination of sodium chloride in the outer and inner layers after definite times indicated that the rate of penetration of salt into the meat was not appreciably different in the presence of the two nitrates. The process of pickling and formation of the red colour are accompanied by a gradual increase in the proportion of nitrite present. F. R. ENNOS.

Lowering of the "essence titer" in preparations of black mustard seeds. LASAUSSE (Ann. Falsif., 1927, **20**, 275—279).—Determinations were made of the allyl mustard oil in mustard flour and other mustard preparations, after keeping for varying periods in closed vessels, by the following reliable method: 5—20 g. were macerated with water and alcohol, and 75—85% of the liquid was distilled very slowly (3 hrs.) from an oil-bath at 130° into standard ammoniacal silver nitrate solution. The distillate was finally heated in a water-bath under a reflux condenser, and the precipitated silver sulphide collected and washed. The excess of silver in the filtrate was then determined with 0·1*N*-thiocyanate solutions (cf. Colombier, B., 1926, 606). A gradual diminution in the essence content was observed, depending on the time the preparations were kept and the nature of the containing vessel. F. R. ENNOS.

Composition of fenugreek seed and the inconvenience of its mixture with grain destined for milling. E. FLEURENT (Compt. rend., 1927, **184**, 1344—1345).—From a detailed examination the author's previous conclusions are verified (cf. B., 1926, 418). Apart from its bitterness, the extracted resin gives out an acrid, penetrating odour which is also possessed by the aqueous extract of the grain. E. H. SHARPLES.

Net energy values of maize silage, soya-bean hay, lucerne hay, and oats. E. B. FORBES, W. W. BRAMAN, M. KRISS, J. A. FRIES, C. D. JEFFRIES, R. W. SWIFT, R. B. FRENCH, and J. V. MANCHER, JUN. (J. Agric. Res., 1927, **34**, 785—796).—The net energy values of these feeding stuffs were determined by direct calorimetry. The heat values were more nearly proportional to the dry matter present than to the metabolisable energy of the foods; the latter in turn depended on the nature of the material, notably whether bulky or concentrate. A. G. POLLARD.

Nutritive value of dried spent hops. W. L. DAVIES and R. S. SULLIVAN (J. Agric. Sci., 1927, **17**, 380—387).—Dried spent hops contain crude protein 21·5%, ether extract 8·3%, crude fibre 25%, nitrogen-free extractives 33%, ash 6·2%, and water 5·8%. The digestibility is low, and the material is not readily eaten by sheep. The production starch equivalent was 24·5. Attention is drawn to the use of spent hops to absorb molasses or treacle. C. T. GIMINGHAM.

Influence of binding material in sausages on the detection of added water by the Feder method. H. WILLEKE and F. JUNKER (Z. Unters. Lebensm., 1926, **52**, 478).—In determining the Feder ratio for sausages, differences were observed in the numbers for fat-free organic matter and nitrogenous matter. This was traced to the use of protein substances as binding material. The presence of 3—5% of such binding material effectively conceals considerable additions of water as determined by the Feder process. A. G. POLLARD.

Vanilla powders. J. MOROY (Ann. Falsif., 1927, **20**, 21—25).—Vanilla sold as powder is necessarily prepared by grinding with sugar; the quantity of sugar present and, consequently, the proportion of vanilla (to within 1—2%) may be determined by means of the saccharimeter, provided that a microscopical examination reveals the absence of any insoluble matter foreign to vanilla. D. G. HEWER.

Occurrence of arsenic and lead on fruit after spraying. K. LENDRICH and F. MAYER (Z. Unters.

Lebensm., 1926, **52**, 441—457).—Fruit from sprayed trees retained varying amounts of lead and arsenic on the surface. No indication of penetration into the pulp of the fruit was observed. The presence of lead in addition to arsenic is objectionable as its toxicity is cumulative. With fruit, other than apples and pears, where washing to remove spray material is not practicable the use of calcium in place of lead arsenate in sprays is suggested. In most cases spraying should be carried out once only, and this soon after the flowering period. Analytical methods for determining arsenic and lead are examined. A. G. Pollard.

Discoloration of canned cranberries. F. W. Morse (J. Agric. Res., 1927, **34**, 889—892).—The brown or black discoloration appearing in tins of cranberry sauce was traced to the reaction of iron dissolved from the inside of the can with the colouring matter of the fruit and to a small extent with the tannin.

A. G. Pollard.

Straw. Honcamp.—See V.

Patents.

Preservation of natural products [eggs etc. with wax]. S. Fowler and E. Edser (E.P. 274,200, 16.4.26).

Evaporating apparatus (E.P. 272,703).—See I.

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

Determination of higher alcohols, particularly hydrogenated phenols, in presence of some organic solvents, especially hydronaphthalenes. II. Determination of methylhexalin in presence of tetralin. K. Lindner and J. Zickermann (Chem. Umschau, 1927, **34**, 199—205).—The methods described earlier (cf. B., 1924, 768) are invalidated owing to the fact that commercial hydrophenols are not chemical individuals, commercial methylhexalin, *e.g.*, being a mixture of the three isomeric hexahydrocresols with ketones and unknown condensation products. A method for determining methylhexalin in the presence of tetralin depends on the distribution of the former between the latter and water. If y be the amount of methylhexalin found in the water layer when 15 g. of a mixture of methylhexalin and tetralin are shaken with 300 g. of water, then x, the percentage content of methylhexalin in the mixture is given by the equation $y^{1\cdot3}=0\cdot76x$. In practice the mixture is obtained free from impurities by steam distillation, the methylhexalin in the aqueous layer being extracted with ether and recovered, whilst that in the tetralin layer is shaken out with water and determined as above. S. S. Woolf.

Digitonin—its properties, isolation, and determination. I. S. Mellanoff (Amer. J. Pharm., 1927, **99**, 390—401).—Gravimetric methods (precipitation with cholesterol, α- and β-naphthol, thiophenol, terpineol, and bromo-β-naphthol) for the determination of digitonin are described. Whilst the α- and β-naphthol methods are the most economical, the most accurate results are obtained by precipitation with cholesterol, which forms the least soluble additive compound. The additive compounds of all the above substances with digitonin are separated into their components by means of hot xylene or benzene. The properties and extraction of digitonin from *Digitalis purpurea* are described, and the determination of digitonin showed that there is about 1·4% in the seeds, 31·1% in digitalin (Merck), and 81·1% in digitonin (Merck). E. H. Sharples.

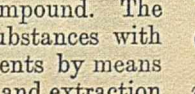
Assay of podophyllum. L. E. Warren (J. Assoc. Off. Agric. Chem., 1927, **10**, 272—280).—The resin content of podophyllum has been determined by three methods, U.S.P. X, U.S.P. IX, and that proposed by Jenkins (cf. B., 1914, 885). The first method consists in digesting and percolating the drug for 3 hrs. with boiling alcohol, an aliquot portion of the tincture being then shaken with chloroform and a saturated solution of potassium citrate. The chloroform layer is then drawn off, the solvent evaporated, and the residue dried and weighed. In the U.S.P. IX method, the drug is macerated for two days with cold alcohol, the extract being evaporated down to a syrup, and the resin precipitated by pouring into cold water slightly acidified with hydrochloric acid, from which it is filtered, dried, and weighed. The Jenkins method consists essentially in extracting with alcohol, shaking an aliquot portion of the extract with chloroform and very dilute hydrochloric acid, followed by further extractions with chloroform–alcohol mixture. The assay given by the first method always exceeded those given by the other methods, in some cases by as much as 70%. The resin obtained by this method also contains an alcohol-insoluble fraction, which is physiologically inert, the ash content is much higher than the limit specified by the U.S. Pharmacopœia, whilst the podophyllotoxin content as determined by the Eder and Schneiter method (cf. B., 1926, 384) is lower than that of the commercial resin. This process is therefore concluded to be unreliable, whereas the Jenkins method is satisfactory.

H. J. Dowden.

Ephedrine sulphate. Anon. (J. Amer. Med. Assoc., 1927, **88**, 924—925).—Three commercial specimens gave the following values, respectively: m.p. 236—243°, 233°, 230°; α_D in water −29·27°, −26·12°, −5·97°; sulphate 22·76, 28·08, 21·87%; base 76·18, 75·16, 71·64%; α_D of free base in ethyl alcohol, −6·06°, −4·5°, +7·5°. Suggested standards are: base 74·5—77·25%, sulphate 21·8—23·1%, α_D of base −6·0° to −7·5° in absolute ethyl alcohol.

Chemical Abstracts.

Ethereal oil from the stems and roots of *Pinus silvestris* and comparison of it with the wood and needle oils of this species of pine. F. W. Semmler and H. von Schiller (Ber., 1927, **60**, [B], 1591—1607).—The oil was obtained by distillation of the stems of the German pine with steam and purified by a second steam distillation. It contained a little α- and β-pinene, mainly d-Δ^3-carene, together with d-Δ^4-carene and α-terpinene in quantity which varied with the temperature employed during the preparation. The oil contained also decomposition products of cellulose, and lignin, fatty acids, and abietic acid. d-Δ^3-Carene has b.p. 165—172°, d^{20} 0·8563, n_D 1·4737, α_D +14° 45′. It is converted by ozonisation and subsequent reduction of the ozonide by zinc dust into the *keto-aldehyde*,



$CMe_2<\begin{matrix}CH\cdot CH_2\cdot CHO\\ |\\ CH\cdot CH_2\cdot COMe\end{matrix}$ b.p. 125—130°/12 mm., d^{20} 1·013, n_D 1·4651, α_D +3° 40′ [*disemicarbazone*, m.p. 198—199°

(decomp.)], which is oxidised by permanganate to the *keto-acid*, $C_{10}H_{16}O_3$, b.p. 175—182°/12 mm., d^{20} 1·045, n_D 1·4691 (*semicarbazone*, m.p. 182—183°); the corresponding *methyl* ester, b.p. 132—136°/13 mm., d^{20} 1·019, n_D 1·5021 (*semicarbazone*, m.p. 108—110°), and *ethyl* ester, b.p. 140—142°/12 mm., d^{20} 1·000, n_D 1·4531 (*semicarbazone*, m.p. 150—151°), are described. The ketonic acid is transformed by bromine in alkaline solution into carbon tetrabromide, bromoform, and a *dicarboxylic acid*, $C_9H_{14}O_4$, m.p. 112—113° (*silver* and *copper* salts; *methyl* ester, b.p. 145—150°/13 mm., d^{20} 1·076, n_D 1·4571). Oxidation of the keto-acid with permanganate affords *cis*-caronic acid, m.p. 174—175°. The presence of *d*-Δ^4-carene in the carene fraction of the oil is established by oxidising the latter with potassium permanganate in anhydrous acetone (cf. Simonsen and Rau, J.C.S., 1922, **121**, 1643) and isolation of 1 : 1-dimethyl-2-γ-ketobutyl*cyclo*propane-1-carboxylic acid as the semicarbazone. The neutral products obtained simultaneously (derived from *d*-Δ^3-carene) contain the *ketone* $CMe_2\left\langle\begin{matrix}CH\cdot CH_2\cdot CMe,\\ |\qquad\qquad \|\\ CH\cdot CO\cdot CH\end{matrix}\right.$ b.p. 119—123°/11 mm., d^{20} 1·020, n_D 1·498, α_D — 5° 25′ (*semicarbazone*, m.p. 159—161°), which is reduced by sodium and alcohol to the corresponding, saturated, secondary *alcohol*, $C_{10}H_{18}O$, b.p. 103—107°/11 mm., d^{20} 0·9481, n_D 1·4770, oxidised by chromic acid in glacial acetic acid to the saturated *ketone*, $C_{10}H_{16}O$, b.p. 88—100°/11 mm., d^{20} 0·9262, n_D 1·4760 (*semicarbazone*, m.p. 223—224°). Silvestrene does not appear to be present in the original oil. It is obtained by inversion of *d*-Δ^4-carene, whereas *d*-Δ^3-carene can be inverted only with difficulty. The action of hydrogen chloride leads to the formation of a mixture of the dihydrochlorides of silvestrene and dipentene from which the corresponding hydrocarbons are obtained by removal of hydrogen chloride. Other pine oils show close analogy with the root oil, although the pinene content preponderates slightly. The presence of *d*-Δ^3-carene in the needle oil of *Pinus silvestris* could not be established, but confirmation of this conclusion is desirable. The German pine root oil of turpentine is considered as valuable for technical application as the imported oil except for the preparation of artificial camphor. H. WREN.

Roumanian caraway oil. E. KOPP (Pharm. Zentr., 1927, **68**, 212—216).—Crops were grown from caraway seed of Dutch and cultivated Roumanian origin. The seeds obtained, together with those from the wild Roumanian plant (all ground before steam-distillation), showed the following oil content:—Dutch, 3·93%, d^{15} 0·9150, α_D (in 100 mm. tube) + 75·5°, n^{20} (white light) 1·4865, carvone content 65·3%; Roumanian, 5·23%, d^{15} 0·9085, α_D + 78·7°, n^{20} 1·4846, carvone content 61·6%; wild Roumanian, 3·86%, d^{15} 0·9184, α_D + 75·65°, n^{20} 1·4862, carvone content 65·1%. The carvone content of the seeds was 2·57%, 3·22%, and 2·51%, respectively. The cultivated Roumanian seeds, on distillation without grinding, yielded 3·63% of oil (carvone content 73·7%), the residue on grinding and distillation yielding a further 0·61% of oil (carvone content 20%). B. FULLMAN.

Metaldehyde. LEW.—See II.

PATENTS.

Making peroxides of organic acids. R. H. MCKEE (E.P. 271,725, 26.10.26).—In the preparation of acyl peroxides from acid chlorides and a solution of hydrogen or sodium peroxide, the yield is improved by keeping the p_H of the liquid at about 6—8·5 by adding a buffer substance, *e.g.*, sodium monohydrogen phosphate, the temperature being maintained at 1—18°. With a 5% hydrogen peroxide solution, sodium monohydrogen phosphate is added either in such quantity that during the reaction about 90% of it is converted into the dihydrogen compound, or smaller amounts of this or other buffers may be used, sodium hydroxide or soda ash being added during the reaction. B. FULLMAN.

Production of alkylenediguanidines. M. HEYN (E.P. 274,259, 18.6.26. Addn. to E.P. 272,686; B., 1927, 619).—Alkylenediamines containing more than five carbon atoms react with salts of methyl*iso*thiocarbamide in concentrated aqueous solution at 100° to give alkylenediguanidines. *Hexa-* and *deca-methylenediguanidines* are described. C. HOLLINS.

Manufacture of 1-phenyl-3-methyl-5-pyrazolone. O. Y. IMRAY. From I. G. FARBENIND. A.-G. (E.P. 274,366, 5.2.27).—1-Phenyl-3-methyl-5-pyrazolidone is oxidised in hydrochloric acid solution by air or oxygen in presence of a heavy metal salt (ferric chloride, cupric chloride). C. HOLLINS.

Extraction of total alkaloids from ergot. W. STRAUB (G.P. 439,042, 1.2.25).—Ergot is shaken with 45—60% aqueous acetone for several hrs. at 15°. On removing the acetone in a vacuum from the filtrate, the active alkaloids are precipitated practically fat-free and free from amine bases. C. HOLLINS.

Organic selenium compound (U.S.P. 1,622,534).—See XIV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic emulsion. I. Comparison of emulsions made with different bromides. B. H. CARROLL and D. HUBBARD (J. Physical Chem., 1927, **31**, 906—921).—Emulsions of the rapid type have been prepared with potassium, ammonium, sodium, calcium, cadmium, and zinc bromides, and have been compared sensitometrically and as to grain size. Data on the solubility of silver bromide in the unwashed emulsions, on the p_H, and on the viscosity of gelatin in the presence of the various bromides are discussed in relation to the mechanism of emulsion making. L. S. THEOBALD.

Schwarzschild effect. I. LÜPPO-CRAMER (Phot. Ind., 1927, 337—339).—Pure silver bromide diapositive plates were exposed (*a*) to blue light for a short time, (*b*) to yellow light for a long time, the times being so chosen that the same threshold values were obtained in the two cases. On development, (*a*) gave high density and high gamma, whilst (*b*) gave only a thin image and a much lower gamma. Treatment of the plates before exposure with sodium nitrite or sodium formate resulted in no change in the blue sensitivity, but the yellow sensitivity increased, becoming almost equal to that of

the blue. The differences between (*a*) and (*b*) may be due to the Schwarzschild effect, in which event it should be influenced by bromine acceptors. This was found to be the case, for after bathing in sodium nitrite, sodium sulphite, sodium bisulphite, sodium formate, phenol, or pyrocatechol, there was practically no Schwarzschild effect. Solarisation and the Herschel effect show that during exposure there is a regressive tendency. It is assumed that this tendency also exists during normal exposure, but since the combination of bromine with silver takes time, this tendency will be shown more at low intensities than at high. It is further supposed that the first atoms of silver which form on exposure can very readily recombine with bromine, and this combination will have more time to take place at weak intensities than at strong, since with the latter the nucleus grows rapidly and becomes less easy to brominate.

W. CLARK.

Schwarzschild effect. II. LÜPPO-CRAMER (Phot. Ind., 1927, 363—365).—The Schwarzschild effect is decreased or prevented by bathing the plate in water and drying. This is not due to the washing out of potassium bromide, but is probably an effect of swelling and re-drying. It is not noticeable at low intensities of exposure, nor if the treatment is given after exposure, and is not a development effect. It is given only with slightly ripened diapositive emulsions. Ordinary plates do not show it, although they show the ordinary Schwarzschild effect. The Herschel effect is affected by water in much the same way as the Schwarzschild effect, indicating that the nuclei are more readily attacked before than after water treatment. The water effect may be due to some sort of agglutination ripening, by which the nuclei become less susceptible to attack in the more compact medium. W. CLARK.

Schwarzschild effect as a regression phenomenon. LÜPPO-CRAMER (Phot. Ind., 1927, 495—498).—A rapid emulsion was pre-exposed to give the maximum density on development, and then given further scale exposures at differing values of *It*. At the longer exposures and lower intensities the solarisation was very much greater than at the short exposures at high intensity. The preparation of a silver iodide–gelatin emulsion is described which does not show the "water-effect," but which gives a marked Schwarzschild effect, which is prevented by impregnation with sulphite or potassium ferrocyanide, and almost completely so by nitrite. With physical development there is practically no Schwarzschild effect, as is also the case with silver bromide emulsions. Silver bromide–collodion emulsions show a Schwarzschild effect of the same order as fine-grained gelatin emulsions. If the Schwarzschild effect is due to regression, this result may be taken as indicating that gelatin is not a halogen acceptor. In presence of nitrite the latent image on diapositive plates formed by exposure to long-wave-length light begins to print out sooner than when white light of low intensity is used. Evidence is given that the time effect may influence photochemical reactions so strongly that complete reversal may take place. W. CLARK.

Time effect. LÜPPO-CRAMER (Phot. Korr., 1927, 63, 103—106).—It is shown that bleaching of pre-exposed plates, bathed in phenosafranine bromide or plain Pinacryptol Yellow, followed by a second exposure, is more marked if the last exposure is long and at low intensity than if it is short and at high intensity. This would be expected if the Schwarzschild effect is due to regression having time to take place at the long exposures and low intensities. The time effect can also be observed in absence of dyes, when reversal is carried out by Renwick's method of pre-exposure, iodising, and then giving an ordinary exposure. It is stated that solarisa, tion is also increased when, for the same value of *It*-*I* is weak and *t* is long. The time effect does not appear to play a part in the Herschel effect, although this does not show that the Herschel effect is not a variant of solarisation due to regression. W. CLARK.

High-temperature drying of photographic layers. O. PAPESCH and M. LIPPERMAYR (Phot. Ind., 1927, 193—195).—A general account of a process for the quick drying of gelatin films at high temperatures and low pressures, with a discussion of the advantages to be gained by the use of the method. W. CLARK.

PATENTS.

Preparation of a [coloured] photographic image. W. V. D. KELLEY, Assr. to PRIZMA, INC. (U.S.P. 1,628,248, 10.5.27. Appl., 19.11.19. Renewed 21.10.26). —A transparent plate, coated with sensitive emulsion on both sides, is exposed on both sides through a screen of opaque and transparent lines, so that unprinted portions on one side correspond with printed portions on the other. The exposed portions are then developed and treated so that they are capable of being dyed. Two-colour selection negatives, taken by known methods so as to record both ends of the spectrum, are then employed, one to each side, to print the prepared positive, which is finally developed and treated with complementary dyes, one to each side. T. S. WHEELER.

Production of a photocollographic printing plate. M. DE'SPERATI, Assr. to ARGENTOGRAPHICA (U.S.A.), LTD. (U.S.P. 1,625,714, 19.4.27. Appl., 12.5.26. Conv., 3.5.25).—The printing plate comprises a celluloid base coated on one side with layers of gelatin, those next to the support being impervious to moisture. The outer layers are sensitised with ammonium dichromate, the prepared plate being exposed to the action of light and used for lithographic printing. T. S. WHEELER.

Laminated [photographic] film with a layer of polymerised vinyl chloride. R. L. STINCHFIELD, Assr. to EASTMAN KODAK CO. (U.S.P. 1,627,935, 10.5.27. Appl., 1.4.26).—A flexible photographic film comprises a layer of polymerised vinyl chloride, coated on both sides with films of cellulose acetate, one of which carries a sensitive emulsion. The cellulose acetate inhibits accumulation of electric charges on the polymerised vinyl chloride.

T. S. WHEELER.

Photographic printing in colours. L. DUFAY (U.S.P. 1,631,524, 7.6.27. Appl., 25.1.24).—See E.P. 217,557; B., 1925, 379.

Kinematograph and other colour films. J. E. THORNTON (E.P. 274,591, 6.5.26).

XXII.—EXPLOSIVES; MATCHES.

"Force" and other constants of explosives. N. YAMAGA (J. Fac. Eng. Tokyo, 1927, **17**, 79—88).—On the assumption that thermodynamically the gas reaction at the moment of explosion of smokeless powders may be represented by the water-gas reaction (cf. B., 1925, 301) it is shown that the "force," the explosion temperature, and the specific volumes of the explosion gases may be obtained by graphic solution of three equations if the composition of the powder and the heats of formation of the constituents are known. Cordites with 15—65% of nitroglycerin are taken as examples. In the case of a nitrocellulose powder the effects of variations in the diphenylamine and volatile matter contents on the explosive constants are investigated. S. BINNING.

Determination of moisture in smokeless powder. E. BENESCH (Chem.-Ztg., 1927, **51**, 578).—A current of dry air is drawn over weighed portions of the powder in two glass tubes heated for 4 hrs. in a water bath. One tube is connected to an absorption apparatus containing sulphuric acid for determination of the total volatile matter, which consists of moisture, alcohol, and acetone. Following the other is a combustion tube containing red-hot copper oxide, whereby the alcohol and acetone are burnt to water and carbon dioxide, which, with the moisture originally present, are absorbed and weighed in the usual manner. From the weights of total volatile matter, total moisture, and carbon dioxide the percentages of moisture, alcohol, and acetone in the powder can be calculated. F. R. ENNOS.

Explosive ammonium salts. H. KAST (Z. ges. Schiess- u. Sprengstoffw., 1926, **21**, 205—209; 1927, **22**, 6—9, 30—34, 56—61, 77—80, 99—102, 131—135).—A summary is given of the literature on the formation and properties of the following explosive ammonium salts: azide, nitrite, nitrate, chlorate, perchlorate, permanganate, dichromate, and trichromate. Values are given for the heats of formation and explosion, explosion temperature, specific energy, detonation velocity, brisance, and sensitiveness to shock, friction, and heat. In investigating the explosive properties of ammonium nitrate it was found that complete detonation could not be obtained, nor could a definite detonation velocity be found by either the chronographic or Dautriche methods. With mixtures of ammonium nitrate and sulphate the detonation velocity varied with the cubic density of the charge, being, for the 60/40 mixture, 1900 and 2430 m./sec. for cubic densities of 0·88 and 0·90, and, for the 70/30 mixture, 2600 and 2860 m./sec. for cubic densities of 0·76 and 0·87. Ammonium perchlorate is not so hygroscopic as the nitrate, but more hygroscopic than potassium chlorate. Ammonium perchlorate is more stable in hot storage than ammonium nitrate is, and the decomposition is hastened by the presence of the oxy-chlorine decomposition products. Comparative data are given for the ignition points of potassium chlorate and ammonium perchlorate and nitrate, both alone and in presence of certain hydrocarbons, metals, metallic compounds, and combustible organic compounds. Mixtures of potassium permanganate and ammonium nitrate may interact to form the very sensitive and explosive ammonium permanganate. No definite dividing line can be drawn between explosive and non-explosive mixtures of ammonium nitrate with other ammonium or alkali salts, as the mode of ignition, degree of confinement, and size of grain are important factors. The use of blasting to break up mixtures of ammonium salts that have set hard is deprecated. S. BINNING.

Stability of [per]chlorate explosives on storage. VANDONI (Mém. Poudres, 1927, **22**, 150—158).—The explosive properties of explosive P (ammonium perchlorate 61·5%, sodium nitrate 30%, paraffin 8·5%) are known to deteriorate on storage to such an extent that re-working of the explosive becomes necessary, although the absorption of moisture is small. The loss of strength cannot be explained by simple hydration, but is due to a slow recrystallisation of the milled salts under the influence of the absorption of moisture, the amount of which is determined by the sodium nitrate content. S. BINNING.

Reduction of the viscosity of CP2 by boiling in alkaline waters. KOVACHE (Mém. Poudres, 1927, **22**, 159—173).—The reduction of the viscosity of some war-stocks of CP2 (soluble nitrocellulose) from a value of 700—1300 to the stipulated acceptance value of 200 was found to require the boiling of the powder for 36—45 hrs. The operation could be much shortened by adding certain alkaline compounds to the water. The ascending order of effectiveness was the carbonates of calcium, sodium, potassium, and ammonium, and ammonia. With sodium carbonate the addition of 10 kg. per 1000 kg. of CP2 reduced the boiling operation to 16 hrs., whilst addition of 30 kg. reduced it to 8 hrs. No alteration in the nitrogen content of the powder was noticed, and its stability was not affected. The loss of powder was no greater than occurred during the prolonged boiling with ordinary water. The rate of reduction of viscosity increased with the amount of salt employed except in the case of calcium carbonate, where it remained constant. S. BINNING.

Liquid-air blasting explosives. C. BUNGE (Z. ges. Schiess- u. Sprengstoffw., 1927, **22**, 21—27).—Stephan's views on the relative liabilities of ordinary and liquid-air explosives to cause accidents are controverted. The claims of the Sprengluft A.-G. that their "oxyliquit KS0" and "oxyliquit KS7" can be used with safety in dusty mines are not confirmed by experiments that are described. The latter cartridge gives on explosion fumes containing compounds of oxygen and chlorine which are injurious to health. S. BINNING.

Hydrogen peroxide explosives. M. BAMBERGER and J. NUSSBAUM (Z. ges. Schiess- u. Sprengstoffw., 1927, **22**, 125—128).—Attempts have been made to produce explosive mixtures in which hydrogen peroxide is the oxygen carrier. Paraformaldehyde mixed with hydrogen peroxide (60% strength) formed a paste which detonated when heated, or when brought into contact with lead. From this paste crystals of m.p. 50° were obtained which were sensitive to shock and friction, and gave an expansion of 600—630 c.c. in the lead

block test. With cellulose a higher concentration (83·4%) of peroxide is required, and dissolution is assisted by treating the cellulose with alkali. 200 g. of peroxide mixed with 40 g. of wood cellulose gave on explosion expansions of 408—414 c.c., but in 48 hrs. the value fell to 349—371 c.c. Tests in a quarry with a mixture of hydrogen peroxide (88—90% strength) 76 pts., cotton wool 15, and vaseline 9 gave results equal to those from dynamite No. 1, but the high cost and small supplies of hydrogen peroxide render the use of these explosives unpractical. S. Binning.

Method for testing initiating substances (detonators). L. Wöhler, J. F. Roth, and K. Ewald (Z. ges. Schiess- u. Sprengstoffw., 1927, **22**, 95—99, 135—139).—The effects are discussed of certain modifications in the technique of a method previously described for comparing the strengths of detonators (*ibid.*, 1925 and 1926). S. Binning.

Mixed acids. Loriette and Jovinet.—See VII.

Patent.

Propellant powder [for shot-guns]. J. M. Olin and A. S. O'Neill, Assrs. to Western Cartridge Co. (U.S.P. 1,627,859, 10.5.27. Appl., 4.4.24).—A dense colloided nitrocellulose powder is ground and rumbled with dinitrotoluene in presence of water for 2 hrs. at above 75°. The grains are then rapidly cooled and dried. The treatment with dinitrotoluene is repeated at 80° for ½ hr. The product has approximately the density of black powder, and is mixed with about 10% of it to form a propellant suitable for use in shot-guns. T. S. Wheeler.

Manufacture of a [shot-gun] propellant powder. A. S. O'Neill, Assr. to Western Cartridge Co. (U.S.P. 1,627,861—2, 10.5.27. Appl., [A] 10.2.23; [B] 4.9.23).—(A) Dense colloided nitrocellulose treated as described in U.S.P. 1,627,859 (preceding abstract) is employed as a propellant for shot-guns without addition of black powder. (B) Dense colloided nitrocellulose, *e.g.*, waste ammunition, is flaked in presence of water and then rumbled with dinitrotoluene as in (A), in presence of a solution of potassium nitrate. T. S. Wheeler.

Manufacture of an explosive powder. A. S. O'Neill, Assr. to Western Cartridge Co. (U.S.P. 1,627,863, 10.5.27. Appl., 1.12.24).—Molten ammonium nitrate is dropped through a sieve into paraffin oil or other waterproofing material, and is obtained in the form of a coated spherical granule, of value in the manufacture of explosives. Alternatively, the spherical granules are rumbled with a polymerisable oil, *e.g.*, China wood oil, in a volatile solvent, *e.g.*, carbon tetrachloride. T. S. Wheeler.

XXIII.—SANITATION; WATER PURIFICATION.

Treatment of water to prevent corrosion. J. R. Baylis (Ind. Eng. Chem., 1927, **19**, 777—781).—With most waters having p_H 6·5 or under, zinc galvanising corrodes rapidly, but where it is 7·5 and over the galvanising has a long life. Coal-tar coatings are not durable in moderately corrosive water since they are probably slightly porous, but with non-corrosive water they remain satisfactory after 25 years. Portland cement mortar is one of the best coatings for pipes at ordinary temperatures or up to 60—70°, and the lining is best applied centrifugally. Corroding iron removes all the free carbon dioxide in water and nearly half of the combined carbon dioxide, the calcium carbonate precipitated thereby materially aiding the formation of an impervious coating. The majority of domestic waters being below the saturation point of calcium carbonate, corrosion is best prevented by raising the amount to saturation equilibrium, which depends upon the p_H value, and to a certain extent upon other salts in solution. If the calcium carbonate is less than 25 pts. per million, lime may be added, but if above that figure sodium carbonate or sodium hydroxide is used. Water saturated with calcium carbonate offers a fairly good resistance to corrosion; if supersaturated, lime incrustation results. W. G. Carey.

Recarbonation of softened water. C. P. Hoover (Ind. Eng. Chem., 1927, **19**, 784—786).—Water softened with lime is supersaturated with normal carbonates of calcium and magnesium the deposition of which on the sand filters, in distribution systems, meters, and hot-water installations is prevented by adding carbon dioxide before filtration. The use of flue gases for this purpose imparts taste to the water and fouls the compressor with condensed hydrocarbons, but fuel oil, natural gas, coke, and pulverised coal have also been used in suitable furnaces. For a small plant, gas or petroleum is the most suitable fuel, both giving tasteless and odourless products containing about 12% CO_2, compared with 4% when coke is burnt in an ordinary furnace. Producer gas made from coke is the most economical fuel for large installations. W. G. Carey.

Manganese in waterworks. C. A. H. von Wolzogen Kühr (J. Amer. Water Works Assoc., 1927, **18**, 1—31).—Complete removal of manganese dissolved in the raw dune water supplying the purification works at Leiduin, Amsterdam, takes place in the rapid and sand filters by oxidation into insoluble oxide, and by the same process a part of the manganese settles in the shallow canals of the drainage area. The deposit in the filters etc., as determined by iodometric and oxidimetric titration methods, consists of manganese dioxide. The oxidation is due to bacterial action. Chemical oxidation cannot take place owing to the low alkalinity (p_H 8·1) of the raw dune water. Isolation from raw dune water, filter mud, etc. of a group of bacteria capable of oxidising manganous compounds has been effected. The media used consisted of dune water, 100 c.c.; agar, 2·5 g.; calcium acetate, 1·0 g.; ammonium sulphate, 0·1 g.; dipotassium phosphate, 0·05 g.; manganese carbonate, 1·0 g. The colonies developed possessed centres usually dark brown to black in colour, according to the degree of manganese oxidation. Colonies developed on faintly acid media also were dark in colour. The colouring material was found to be manganese dioxide. The bacteria occurred as mono- and diplo-cocci, rods, and bacteria united in pairs, and were usually non-motile. Occasionally a fungus was isolated which also formed manganese oxide freely. Fresh gravel, sand, calcium carbonate, and manganese oxide have the same property

of retaining manganous compounds from water. The removal of manganous compounds from water by filtration is effected by their retention by the filtering media, bacterial oxidation to manganese dioxide, retention of further quantities of manganous compounds by the newly formed manganese dioxide, and the oxidation of the retained matter by further bacterial action etc.

W. T. Lockett.

Removal of dissolved organic substances from water for drinking and general purposes. H. Lührig (Gas- u. Wasserfach, 1927, **70**, 667—671, 684—688).—Sand from the filter bed for removing iron compounds from water becomes coated with a black deposit of manganese oxides. The fresh sand is capable of removing little manganese from river water containing manganese sulphate, but this power increases until with the "black sand" (containing about 2% Mn) the filtered water is completely free from manganese, and is greatly improved as regards colour and oxygen absorption value. The removal of organic substances by the manganese oxides is due essentially to adsorption, though the oxides may also function as oxygen carriers, and this efficiency is gradually reduced by the clogging action of the adsorbed substances. The efficiency can be restored by rubbing the sand or by washing it with water or with potassium permanganate. The de-manganising action of the sand increases with time, and both effects proceed independently. A synthetic "black sand," made by washing sand with a solution of manganese salts, is equally effective as that obtained from the filter bed.

W. T. K. Braunholtz.

Chlorine absorption of water. J. R. Meadow and H. Hale (J. Amer. Water Works Assoc., 1927, **18**, 75—81).—Ten-minute absorption tests, using 1·0, 3·0, 5·0, and 10·0 p.p.m. of free chlorine, showed that the amount of chlorine absorbed depends upon the amount of chlorine added, and extended tests on numerous samples of potable and non-potable waters using the 10-min. chlorine absorption method and the A.P.H. Standard (permanganate) method for oxygen consumed showed that, although in a great many instances the two methods were comparable, no strict correlation could be established between them. According to Keiser, for the determination of organic matter in water free from albuminous products the permanganate process (Kubel) and the determination of the chlorine number of Froboese are equally good, but the content of organic matter in water which has been polluted with sewage can be exactly fixed only by means of the chlorine absorption test. Experiments along similar lines with tap-water containing increasing amounts of urine showed that albuminous products, *e.g.*, urine, were not readily attacked by permanganate, but they absorbed substantial amounts of chlorine. According to all data, correlation between the two methods is good as long as no albuminous material is present. In the latter case the chlorine absorption test is the only safe criterion.

W. T. Lockett.

Cement-lined water mains. H. Y. Carson (Ind. Eng. Chem., 1927, **19**, 781—783).—Cement lining of iron pipes retards corrosion in a more positive manner than do other coatings. At first there is a diffusion of calcium hydroxide from the cement to the water, which gives a zone in which the p_H value is high enough to precipitate and flocculate any iron, so that a thin membrane of iron rust is built up in the cement, thus retarding the action of the water on the pipe and on the cement. A thin coating of cement on iron exposed to atmospheric conditions is not so efficient as when the iron is under water, owing to the different conditions; in air the cement coating is flaked off by expansion of the products of corrosion whereas in water these are washed away. The former method of coating pipes with cement when set vertically, the cement being poured between a cylinder inside the pipe and the pipe wall, is superseded, a denser and smoother coating being formed by distributing the cement in a pipe resting horizontally upon roller bearings and rotating the pipe.

W. G. Carey.

Base exchange in permutites. (Cationic exchange in eugels.) G. Wiegner and H. Jeuny (Kolloid-Z., 1927, **42**, 268—272; cf. Jeuny, A., 1927, 415).—The relation between the power of exchange of an ion and the electric charge and degree of hydration is discussed. The exchange constants are directly proportional to the true ionic volume. With increasing dehydration, the exchange from liquid to solid phase increases. The exchange from solid to liquid phase depends upon the valency of the cation, on the degree of hydration, and on the solubility of the compounds possible in the permutite. These factors are considered.

L. L. Bircumshaw.

Patents.

Preparation of a water-softening [base-exchange] reagent. A. S. Behrman, Assr. to General Zeolite Co. (U.S.P. 1,624,711, 12.4.27. Appl., 1.10.21).—Greensand is treated with 2% hydrochloric acid, washed, treated with slightly alkaline sodium chloride solution, and, finally, with boiling sodium silicate solution,

T. S. Wheeler.

Water still. E. V. Oliver (U.S.P. 1,629,807, 24.5.27. Appl., 10.5.20. Renewed 6.10.24).—The water is distilled from a well in the lower end of a receptacle provided with a hollow condenser within its upper portion. A trough, extending around the inner side of the wall of the receptacle and spaced above the well, receives the distillate from the condenser and defines a space for the upward passage of the steam from the well. Water is supplied to the lower end of the condenser. A tube extends upwards through the condenser and is provided near its upper end with an inlet for the passage through the tube of water from the upper end of the condenser. The lower end of the tube, discharging into the well, is positioned above the space defined by the trough. A rotatable cap is provided for adjustment of the inlet to the tube.

H. Holmes.

Two-flow base-exchange water softener. C. T. McGill, Assr. to Reiter Co. (U.S.P. 1,624,614, 12.4.27. Appl., 14.11.25).

Water softener. V. L. Tannehill, Assr. to Fort Wayne Engineering and Manuf. Co. (U.S.P. 1,626,055, 26.4.27. Appl., 9.8.26).

Permanently preserving animals and plants. F. Hochstetter and G. Schmeidel (E.P. 274,314, 4.10.26).—See U.S.P. 1,602,489; B, 1927 30.