

# BRITISH CHEMICAL ABSTRACTS

## B.—APPLIED CHEMISTRY

DECEMBER 30, 1927.

### I.—GENERAL; PLANT; MACHINERY.

#### PATENTS.

**Centrifugal apparatus and process for continuously separating liquids from solids.** H. C. BEHR (U.S.P. 1,642,662, 13.9.27. Appl., 6.5.25).—The periphery of a distributing member is surrounded by a foraminous separating member mounted within a receiving member. The separating and receiving members rotate respectively at a different speed from, and in phase with, the distributing member. H. HOLMES.

**Apparatus for separating liquids of different specific gravity.** T. FISHER, ASSR. to FISHER ENGINEERING CORP. (U.S.P. 1,641,843, 6.9.27. Appl., 14.1.25).—A channel between inner and outer vertical casings is provided with a helical deflector terminating in a vertical portion extending into the lighter liquid zone defined by an enlargement on the inner casing. The liquids are delivered into the channel below the lighter liquid zone at the upper side of the deflector. A discharge pipe for the heavier liquid extends upwards within the inner casing to the lighter liquid zone, and a discharge pipe for the lighter liquid is provided at the upper end of this zone. H. HOLMES.

**Apparatus for continuous dialysis.** O. FAUST and H. VOGEL (G.P. 441,258, 1.7.24).—A dialysing unit comprises a spiral dialysing tube constructed of cellulose esters, cellulose ethers, or regenerated cellulose, wound around a hollow framework of square, polygonal, circular, or oval cross-section, constructed of wood, ceramic material, metal, or vulcanite, and containing an impermeable core. The units are connected together in a battery in such a manner that the water and dialysing liquid pass through in opposite directions. L. A. COLES.

**Liquid and gas contact apparatus.** F. H. WAGNER, ASSR. to BARTLETT HAYWARD Co. (U.S.P. 1,637,975, 2.8.27. Appl., 17.6.25).—A gas-scrubbing tower is divided into chambers by horizontal bubbling plates, each chamber being fitted with a rotating device adapted to produce a transverse spray of liquid. T. S. WHEELER.

**Apparatus for removing dust from gases.** J. G. SCHULZ and H. J. M. LORiot (G.P. 441,000, 27.3.24. Conv., 16.5. and 10.7.23).—The gases pass upwards through a chamber containing bundles of chains, so disposed that they are easily removable for cleaning, resting upon a perforated plate. The bottom of the chamber is bowl-shaped, and contains oil or other liquid on which the gas impinges, thus causing it to spray on to the chains. Deposition of the dust is facilitated by varying the cross-section of the chamber in the direction of the gas stream, thereby causing the gas to pass through it with varying velocities. L. A. COLES.

#### Heat-exchanging device for air or other media.

A. SANDBERG (E.P. 255,418, 29.4.26. Conv., 18.7.25).—The gas to be heated and that to be cooled flow in parallel chambers or groups of chambers in both of which a number of discs are revolved, half of each disc in each chamber. The partitions between the discs, forming the dividing wall between the gas chambers, are flexibly mounted to allow for expansion and contraction, and make resilient contact with the discs. B. M. VENABLES.

**Viscosimeter.** E. H. PEABODY, ASSR. to PEABODY ENGINEERING CORP. (U.S.P. 1,639,057, 16.8.27. Appl., 23.11.22).—A receptacle for a liquid is adapted to be filled in one position and emptied in another position. The movement from the filling to the emptying position brings into operation a device for measuring the duration of the outflow. H. HOLMES.

**Balance for measuring differences in gravity.** "EXPLORATION" BODENUNTERSUCHUNGS- U. VERWERTUNGS-GES.M.B.H. (E.P. 270,754, 7.5.27. Conv., 8.5.26).—The beam of a balance on the Eötvös system is made Z-shaped, the suspending wire being attached to about the middle of the vertical limb and enclosed in the same casing as that limb. The wire may be attached directly to the limb by bending the latter to clear the wire, or it may be in the form of a tube with the wire inside. B. M. VENABLES.

**Apparatus for analysing substances by means of Röntgen or cathode rays.** F. DESSAUER, ASSEE. of METALLBANK U. METALLURGISCHE GES. A.-G. (E.P. 252,206, 17.5.26. Ger., 15.5.25. Addn. to E.P. 252,207; B., 1927, 735).—In the apparatus described in the original patent, filters are placed in the path of the rays entering the ionisation chamber by which the characteristic kinks or discontinuities are magnified in relation to the general ionisation-voltage curve. The filters may either effect selective absorption, allowing only the characteristic secondary radiations to be emitted, or they may have an ionisation capacity lower than that of the substance to be examined. B. M. VENABLES.

**Concentrator for liquids.** W. VOGELBUSCH (U.S.P. 1,637,431, 2.8.27. Appl., 7.8.24. Conv., 22.11.23).—See E.P. 196,935; B., 1924, 157.

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

**Water-gas production from coal dust and finely-divided fuels.** Gwosdz (Chem.-Ztg., 1927, 51, 585—586, 606—608).—A critical survey of modern processes designed for producing water-gas from finely-divided



fuels. Proposed methods of continuous water-gas production have hitherto been found impracticable. External heating of the producer presents difficulties, *e.g.*, choice of suitably resistant refractory material, prevention of excessive heat loss in the waste gases. The possibilities of inorganic catalysts are noteworthy, and practical importance attaches to the gasification, by an alternating process, of the fine fuel maintained in suspension.

W. T. K. BRAUNHOLTZ.

**Electrolytic corrosion of [gas] mains.** A. BOLZINGER (Gas J., 1927, 189, 499–501, 551–553, 628–629, 754–756).—The presence of lead peroxide is definite evidence of electrolytic corrosion of a lead pipe, but its absence does not prove the absence of electrolytic action. Stray currents due to town distribution systems (*e.g.*, lighting or telephones) are normally not serious, but such is not the case with tramway systems. Induced currents may also occur, the system of mains constituting a secondary coil, one of its sides often being parallel to the tram rails, which constitute the inducing coil. Paints and dressings do not generally afford adequate protection against electrolysis, the chief difficulty being their power of absorbing moisture. Other methods of protection (*e.g.*, insulating joints, baffle plates, lowering the potential of the mains, electric drainage of mains) are costly and of doubtful value. It is more logical and effective to suppress stray currents by exacting observance of certain conditions by electricity undertakings. Details are given of French legislation in this connexion. At the same time the gas engineer must exercise a methodical supervision of his mains, including the charting of stray currents and the carrying out of tests periodically at selected points in the system.

W. T. K. BRAUNHOLTZ

**Evaluation of transformer oils.** J. G. FORD (Ind. Eng. Chem., 1927, 19, 1165–1171).—Determinations of unsaturated hydrocarbons by absorption in sulphuric acid ( $d$  1.84) and oxidation at various temperatures for long periods show that transformer oils freed from unsaturated hydrocarbons are susceptible to oxidation and consequent sludge formation, whereas the presence of unsaturated hydrocarbons considerably retards oxidation, but if present in small amount high acidity and excessive sludge subsequently develop. Oxidation tests with oils containing naphthene and paraffin as their basic compounds, but with the same sulphuric acid absorption values, show that when over 5% of unsaturated hydrocarbons are present the quantity of sludge is independent of the base of the oil. Naphthene hydrocarbons of high mol. wt. are not so sensitive to oxidation as those of low mol. wt., and mixtures of the former class of naphthenes with paraffins give an oil with a high resistance to oxidation and sludging. No general rule can be given concerning the effect of different temperatures on the rate of oxidation of different oils, but high-temperature tests do not correlate with results obtained in actual use; transformer oils should, however, be operated at the lowest possible temperature.

W. G. CAREY.

**Catalysts and their effects on the oxidation of mineral oils.** G. W. CUPIT (Refiner Nat. Gasoline Manuf., 1927, 6, No. 7, 61, 68).—Vanadium pentoxide

(except on addition of chromic acid), iron, tin, nickel, aluminium, and cupric oxide are ineffective; reduced copper is effective. The type and weight of residue vary with the time and temperature of reaction. The oils darken and become turbid in sunlight.

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**Solubility of paraffin wax in oil.** F. W. SULLIVAN, JUN., W. J. MCGILL, and A. FRENCH (Ind. Eng. Chem., 1927, 19, 1042–1045).—Paraffin waxes of m.p. 43.9°, 51.7°, and 63.8° were prepared by the repeated fractionation of a commercial wax of m.p. 51.7° from midcontinent crude oil. The solubilities of these waxes in light petroleum and in a number of distillate oils were determined. The cloud temperature was taken as the point of saturation. The results prove that the solubility of paraffin wax increases as the m.p. decreases, that it decreases with increasing viscosity of the solvent, and that these variations are less marked the lower the temperature.

C. IRWIN.

**Heat of solution of paraffin wax.** F. W. SULLIVAN, JUN., W. J. MCGILL, and A. FRENCH (Ind. Eng. Chem., 1927, 19, 1040–1041).—The heat of crystallisation of paraffin wax from the wax distillate out of midcontinent crude oil was redetermined and found to be 72.5 B.Th.U. per lb. A wax-free gas oil was used as solvent.

C. IRWIN.

#### PATENTS.

**Gas analysis apparatus.** R. EISENSCHITZ, Assr. to BAILEY METER Co. (U.S.P. 1,643,155, 20.9.27. Appl., 31.12.26. Ger., 18.1.26).—A pipe conveying the gas is provided with conduit means for withdrawing a gas sample, passing it together with a fluid supporter of combustion through a catalytic analyser, and returning it to the pipe. Means are provided for maintaining a predetermined constant difference between the pressure of the fluid supply and that in the pipe.

H. HOLMES.

**Gas production.** W. W. KEMP (Can. P. 264,747, 12.6.24).—The starting material, *e.g.*, coal, wood, coke, oils, tar, etc., is passed through a closed air-tight retort in which it is subjected to the direct action of a flame produced by the combustion of a mixture of gases and oxygen.

A. B. MANNING.

**Granular material for purifying acetylene.** "HERA" LANDSBERGER & Co., and VER. CHEM. FABR. ZU LEOPOLDSDALL, ZWEIFSTELLE DER KALIWERKE ASCHERSLEBEN (G.P. 442,368, 28.1.25).—The material consists of sintered kieselguhr impregnated with a solution of chromic acid.

A. B. MANNING.

**Low-temperature carbonisation.** METALLBANK & METALLURGISCHE GES. A.-G. (G.P. 440,379, 22.7.23).—In the carbonisation of fuels by the circulation through them of a mixture of hot carbonisation gases and a supplementary gas, the former circulates only through the carbonising zone, whilst the latter, before admixture with the former, is passed through the cool zone. In this way a supplementary gas of high water-vapour content is obtained, with consequent improvement in the quality and yield of the tar.

A. B. MANNING.

**Manufacture of light hydrocarbon liquids.** W. S. YARD and E. N. PERCY (U.S.P. 1,643,401, 27.9.27. Appl., 17.3.24).—Heavy hydrocarbon oils are sprayed upon a



deep bed of incandescent solid fuel, and the evolved vapours are passed over and then through a mass of finely-divided carbonaceous material electrically heated to incandescence. Steam is used to prevent fouling of the mass by cracking products. C. O. HARVEY.

**Treatment of petroleum hydrocarbons.** W. M. CROSS, ASSR. to GASOLINE PRODUCTS Co. (U.S.P. 1,643,446, 27.9.27. Appl., 13.8.24).—The oil is heated to a cracking temperature, collected in a reaction chamber under such conditions of temperature and pressure as will induce cracking, while maintaining the oil in a liquid state, and is then injected into an enlarged zone maintained at reduced pressure, where the oil stream meets a jet of steam. The volatile products are removed and collected. C. O. HARVEY.

**Synthesis of hydrocarbons.** THERMATOMIC CARBON Co., Assees. of E. B. SPEAR (Can. P. 264,324, 28.11.25).—Carbon deposited in a heated retort by the passage of methane through it is decomposed by a current of steam, yielding carbon monoxide and hydrogen, and the gas mixture, after the addition of more hydrogen, is used for the synthesis of hydrocarbons. L. A. COLES.

**Purification of hydrocarbons.** L. W. PARSONS and S. P. COLEMAN, ASSRS. to STANDARD DEVELOPMENT Co. (U.S.P. 1,640,720, 30.8.27. Appl., 10.11.22).—Petroleum is heated with oxide of copper or lead (1–15%) at about 150° for  $\frac{1}{2}$  hr., and the product distilled in contact with sodium hydroxide (2–8%). T. S. WHEELER.

**Centrifuges, particularly for the purification of oil.** AKTIEBOLAGET SEPARATOR, Assees. of T. H. MILLER (E.P. 271,526, 23.5.27. Conv., 24.5.26).—A centrifugal bowl mounted on a hollow shaft carried by two bearings is kept in position by springs which allow of slight displacements of the rotating bowl by vibration. The oil enters and leaves the bowl *via* inlet and outlet pipes which pass through the bearings and communicate with the hollow shaft and thence with the bowl. By this arrangement entrainment of air and oxidation of the oil are avoided. C. O. HARVEY.

**Process of treating [cracking] hydrocarbon oils.** C. P. DUBBS, ASSR. to UNIVERSAL OIL PRODUCTS Co. (U.S.P. 1,638,112–3, 9.8.27. Appl., [A], 29.9.19, [B] 17.2.21. Renewed [A, B] 24.3.27).—(A) A continuous stream of oil under pressure is cracked by passage through a heating zone, and enters an enlarged vapour chamber whence the unvaporised residue is withdrawn and kept apart from the incoming charging stock. The condensate formed by passing the vapours through a vapour line and reflux condenser is trapped and returned to the heating zone, the remaining vapours being condensed and collected. (B) The oil is cracked in a horizontal cylindrical still and the vapours pass to a dephlegmator, the reflux condensate being returned to the base of the still where the temperature is highest. The precipitated carbon is collected out of contact with the lower heated portion of the still. C. O. HARVEY.

**Conversion [cracking] of hydrocarbon oil.** L. C. HUFF, ASSR. to UNIVERSAL OIL PRODUCTS Co. (U.S.P. 1,638,735, 9.8.27. Appl., 18.11.25).—The oil flows in a continuous restricted stream into a furnace-heated coil, and thence the vapours and unvaporised oil pass to

an enlarged reaction zone where conversion occurs. The mixture now passes to a zone maintained at a lower pressure wherein the more volatile portions vaporise and are separated from the residual oil. Condensation of the vapours takes place in reflux condensers cooled by means of charging oil, which is thereby preheated. C. O. HARVEY.

**[Cracking] treatment of heavy hydrocarbons.** A. D. SMITH and J. PERL (U.S.P. 1,640,223, 23.8.27. Appl., 28.1.22).—The oil in circulation is partially cracked by heating under pressure whereby gaseous and semi-liquid polymerised hydrocarbons are formed, the latter remaining in solution in the hot residual oil, which then passes to a cooler zone, where precipitation occurs. Thence the residual oil passes back to a second heating zone, where it is mixed with a further quantity of the original oil stock. C. O. HARVEY.

**Apparatus for cracking hydrocarbons.** G. EGLOFF and J. C. ALTHER, ASSRS. to UNIVERSAL OIL PRODUCTS Co. (U.S.P. 1,638,116, 9.8.27. Appl., 23.12.20. Renewed 24.3.27).—The oil, cracked in a heated coil, passes to an expansion chamber connected with a reflux condenser cooled by means of charging stock. The residual oil from the expansion chamber is used to preheat incoming charging stock, which passes, along with the heated charging stock and condensate from the reflux condenser, to the cracking coil. C. O. HARVEY.

**Apparatus for cracking hydrocarbons.** J. E. BELL (L. R. BELL, extrix.) and E. W. ISOM, ASSRS. to SINCLAIR REFINING Co. (U.S.P. 1,641,941, 6.9.27. Appl., 25.7.25).—A horizontal cylindrical still member, divided into communicating compartments, is situated above a furnace fitted with flues and adapted for re-circulation of the flue gases. Heating pipes pass downwards into the furnace from each compartment of the still, those connected to the supply compartment being nearest to the fire box. C. O. HARVEY.

**Apparatus for cracking mineral oils and the like.** WERSCHEN-WEISENFELSER BRAUNKOHLN A.-G., and A. FÜRTH (G.P. 439,520, 18.1.23. Addn. to G.P. 439,010; B., 1927, 695).—The catalyst comprises a fine-grained material which is heated directly by passing a current through it. To ensure efficient insulation from the conducting walls of the autoclave, the current is led in by a cooled tube, the cold end of which is provided with a stuffing-box or other arrangement to prevent leakage of the high-pressure gases. A. R. POWELL.

**[Demulsifying] treatment of hydrocarbons.** A. B. WAX, ASSR. to L. A. WAX (U.S.P. 1,638,021–2, 9.8.27. Appl., 19.3.24).—Emulsions of hydrocarbon oils are broken and the fluidity of the oils is increased by treatment for about 10 hrs. at below 95° with 0.02% of a finely divided mixture of naphthalene (95.5%) and nitrobenzene (4.5%). T. S. WHEELER.

**Dehydration of oils.** S. BORN, H. E. BONNETTE, and J. C. WALKER, ASSRS. to EMPIRE GASOLINE Co. (U.S.P. 1,639,325, 16.8.27. Appl., 20.4.20).—Water is separated from petroleum, treated with an alkali hydroxide in an amount less than that required substantially to affect its hardness, and the alkaline solution then mixed with the petroleum. C. O. HARVEY.



**Preparation of an adsorbent for oils.** W. D. RIAL and E. W. GARD (U.S.P. 1,639,274, 16.8.27. Appl., 26.4.26. Cf. U.S.P. 1,634,514; B., 1927, 771).—Clay is agitated with a mixture of petroleum hydrocarbons and aqueous alkali, separated from the excess of hydrocarbons, and recovered. C. O. HARVEY.

**Oil-refining apparatus.** H. A. W. HOWCOTT (U.S.P. 1,641,852, 6.9.27. Appl., 7.2.24).—The oil passes through a number of horizontal preheaters rigidly attached to a vertical cracking chamber and communicating therewith beneath the surface of the oil. A rotating horizontal shaft passing through the apparatus carries paddles for agitating the oil in the preheaters and propellers on either side of each paddle, to force the oil towards the paddle. The shaft is also provided with cranks and means attached thereto for agitating the oil in the cracking chamber, from which the vapours are withdrawn, and in which a predetermined pressure is maintained.

C. O. HARVEY.

**Refining of hydrocarbon oils.** E. B. PHILLIPS and J. G. STAFFORD, ASSRS. to SINCLAIR REFINING CO. (U.S.P. 1,639,531, 16.8.27. Appl., 22.10.24).—Sulphuric acid-refined oil, treated with an alkali, is passed down a reflux tower in direct contact with upcoming vapours from a still situated below the tower.

C. O. HARVEY.

**Recovering styrene [from carburetted water-gas drip-oil].** R. L. BROWN (U.S.P. 1,640,975, 30.8.27. Appl., 10.11.22).—Styrene is recovered from carburetted water-gas drip-oil by a process involving fractionation followed by conversion of the styrene into a relatively non-volatile form from which other compounds are separated by distillation.

C. O. HARVEY.

**Process for recovering vanadium from petroleum hydrocarbons.** A. OBERLE, ASSR. to T. E. SCOFIELD (U.S.P. 1,638,057, 9.8.27. Appl., 8.9.25).—The exhaust gases of Diesel engines working on heavy oils containing vanadium are passed through activated charcoal to separate vanadium oxide.

T. S. WHEELER.

**Manufacture of a mineral oil derivative.** G. ALLEMAN, ASSR. to SUN OIL CO. (U.S.P. 1,637,510, 2.8.27. Appl., 6.2.24).—Alkali sludge obtained in refining petroleum is heated with water under a pressure of 4 atm. for 2 hrs., the solution obtained being concentrated to separate soaps and resins. This mixture is treated in aqueous solution with a metallic salt, e.g., calcium chloride, to give a precipitate of value as an adhesive, filler, etc.

T. S. WHEELER.

**Production of a carbon catalyst.** C. B. JACOBS, ASSR. to E. I. DU PONT DE NEMOURS & CO. (U.S.P. 1,623,598, 5.4.27. Appl., 27.11.20. Cf. U.S.P. 1,462,752; B., 1923, 975 A).—Black liquor from the soda-cellulose process is evaporated, and the residue incinerated at 200–350°. After washing out soluble matter with water, a highly active carbon remains.

T. S. WHEELER.

## V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

**Oxidation of alkali-cellulose by gaseous oxygen.** W. WELTZIEN and G. ZUM TOBEL (Ber., 1927, 60, 2024–2032; cf. B., 1926, 911).—Cotton wool or hydrated cellulose is immersed in sodium hydroxide solutions of

different concentrations; the products are squeezed and exposed to the action of oxygen at 60°. The sodium hydroxide is thus present partly in combination with the cellulose as established by Vieweg, and partly adherent to the fibre (swelling hydroxide). With increasing concentration of alkali in the bath up to 30%, the absorption of oxygen increases considerably, and attains remarkably high values; reaction is complete within about 15 days. With higher concentrations the absorption is smaller, but is less rapidly completed. If the primary oxidation consists in the conversion of a carbonyl group into a carboxyl group which is neutralised by the alkali or in the complete combustion of the cellulose, the absorption of 1 atom of oxygen is causative of the neutralisation of 1 mol. of sodium hydroxide, and the established, practical cessation of the reaction when the greater part of the alkali has been neutralised is readily understood. The rate of absorption of oxygen depends on the concentration of the alkali, and attains a maximum of 23.8%. With hydrated cellulose, owing to the presence of greater amounts of "swelling alkali," the rate of absorption of oxygen and the amount of oxygen absorbed are higher than with cotton wool. The absorption is also influenced by the extent to which the material is squeezed and the density of its packing into the apparatus. Acidification of the resulting solution causes the evolution of large amounts of carbon dioxide and the separation of alkali-soluble cellulose, which shows only slightly pronounced signs of oxidation. It appears that the reaction proceeds in such a manner that greatly oxidised fission products are comparatively rapidly eliminated. In an atmosphere of nitrogen, the alkali solubility increases gradually in the course of a few days, and subsequently remains nearly constant. The reaction certainly differs fundamentally from that which occurs in oxygen, and the diminution of alkalinity in the solution observed under the latter conditions is almost entirely to be ascribed to the action of oxygen.

H. WREN.

**Inorganic solvents for cellulose.** H. E. WENNSTROM (Rayon, 1927, 4, No. 11, 20–22).—The peptising action of saline solutions on cellulose is attributed to the combination of the hydroxyl groups of the cellulose molecule with molecules of anhydrous salts, forming compounds in which the cellulose is substituted for water of crystallisation.

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**Viscose silk. IV. Analysis of viscose.** I. FUKUSHIMA, Y. TAKAMATSU, and I. WATANABE (J. Cellulose Inst., Tokyo, 1927, 3, 214–219).—The analytical procedure for determining the distribution of the alkali in crude viscose is modified to include alkali combined as trithiocarbonate.

D. J. NORMAN.

**Mechanism of the loading of paper.** K. ATSUKI and M. NAKAMURA (J. Cellulose Inst., Tokyo, 1927, 3, 49–60).—The amount of china clay fixed by sulphite pulp from a neutral suspension in water under standard conditions increases with increasing concentration of the clay until the latter reaches 3–4%, when a constant maximum value is attained. The addition of starch paste or acidified viscose solution to such a suspension greatly increases the amount of clay fixed, no increase being obtained, however, if the cellulose is not regenerated



from the viscose. Glue acts as a protective colloid to the clay particles and prevents enhanced fixation. The increase which results from the addition of aluminium sulphate is attributed to the action of the acid liberated from the salt by hydrolysis. For different pulps the amount of clay fixed is determined by their physical nature and condition, prolonged beating of the pulp causing an increase, whilst prolonged agitation of the clay and pulp mixture causes a decrease. It is concluded that occlusion of the clay by the fibre is the cause of the fixation and that adsorption plays a minor part. The hydrogen-ion concentration of the medium is of importance, since the clay particles tend to become aggregated by acid and peptised by alkali, so that greater occlusion takes place in slightly acid suspensions.

B. P. RIDGE.

### Colloid chemical investigation of sulphite lye.

III. Fractions obtained by electro-dialysis. M. SAMEC and I. RIBARIĆ (Koll.-Chem. Beih., 1927, 24, 157—180; cf. Samec and Rebek, *ibid.*, 1923, 19, 106).—Dialysed sulphite lye, if concentrated by electro-dialysis and then subjected to further electro-dialysis until the conductivity of the cathode cell liquid reaches a constant value, is separated into two portions, one of which appears in the middle cell (the "colloidal residue"), the other in the anode cell. The anode cell product is concentrated *in vacuo* at 45°, and, on repeated electro-dialysis, the greater part of the organic matter remains in the middle cell (the "anode colloid"), whilst the free sulphuric acid and the constituents of lower mol. wt. appear in the anodic compartment. Investigation of the colloidal residue, by fractional precipitation of the barium and  $\beta$ -naphthylamine salts, showed it to be a well-defined ligninsulphonic acid. By determination of the sulphur content, the titratable acidity, the methoxyl content, and the acetyl content, the values 551, 549, 219, and 1096, respectively, were obtained for the equivalent weight, and the value 1100 for the minimum mol. wt. Cryoscopic measurements lead to the value  $M = 1136$ . From measurements of the alteration of the equivalent conductivity of the free acid and of the sodium salt with increasing dilution, and the application of the valency rule, it is concluded that the acid is dibasic. The mol. wt. of the "anode colloid" is smaller than that of the ligninsulphonic acid, the methoxyl content is less, and the number of acid groups greater. The individual acid groups are ionised to different extents. Assuming these to be carboxyl groups, a scheme is suggested to show the relation between the ligninsulphonic acid and the ligninsulphocarboxylic acid.

L. L. BIRCUMSHAW.

### PATENTS.

**Production from viscose of artificial formations suitable for the textile industry.** BORVISK SYND., LTD., Assees. of B. BORZYKOWSKI (E.P. 273,647, 27.11.26. Ger., 2.7.26).—Artificial filaments with a matt appearance are obtained from ordinary sodium viscose by adding to the spinning solution suitable quantities, *e.g.*, 5% on the weight of cellulose, of oils, fats, soaps, emulsified mineral oils, hydrogenated aromatic hydrocarbons such as tetralin.

D. J. NORMAN.

### Manufacture of hollow articles from cellulose

**or its derivatives.** WOLFF & CO., E. CZAPEK, and E. BAUER (E.P. 276,206, 27.11.26).—In the manufacture of hollow articles, *e.g.*, bottle caps, from viscose solution or other solution containing cellulose or a cellulose derivative, special effects may be obtained by superimposing two or more layers of viscose on the mould before coagulation. In this way a thin adherent film of colourless or suitably dyed viscose may be superimposed on an opaque viscose or one containing an iridescent loading material to give a glossy finish and a metallic appearance.

D. J. NORMAN.

**Production of pulp having a high percentage of resistant cellulose.** G. A. RICHTER, Assr. to BROWN Co. (U.S.P. 1,640,853, 30.8.27. Appl., 27.5.24).—Wood is first digested under pressure with a hot solution of sulphurous acid containing sodium sulphite, the liquor then made alkaline, and the digestion continued.

B. P. RIDGE.

**[Treatment of] wood-pulp paste etc.** RAMAR SYNDICATE, INC. (F.P. 615,809, 8.5.26).—For the treatment of the vegetable material comparatively dilute solutions of salts (sulphates of sodium, potassium, magnesium, iron, etc., or mixtures of these) are used in order to loosen the intercellular binding material without dissolving the lignin. If necessary, a mixture with the soluble salts of chromium, cobalt, nickel, or zinc is used.

B. P. RIDGE.

**Artificial product from absorbent material.** W. HEUER and A. LANG (G.P. 440,813, 21.11.23).—The material (paper, paper or textile waste, etc.), after treatment with water-glass and talc in the form of layers or paste, is dried, then steeped in a bath of hydrochloric acid, and immediately washed with water. The products are resistant to weather etc.

B. P. RIDGE.

**Process of elaborating corn stalks into pulp for paper-making etc.** O. R. SWEENEY (U.S.P. 1,639,152, 16.8.27. Appl., 15.11.26).—The material is cooked with sodium hydroxide, lime, sulphite, etc., the mass submitted to bacterial action to promote partial disintegration of the stalks, and finally treated in a mechanical beater.

B. P. RIDGE.

**Recovery of pulp from printed waste paper.** E. T. MCGREGOR (U.S.P. 1,640,612, 30.8.27. Appl., 21.6.26).—The paper is treated with a solution of trisodium phosphate, which is kept cool, then pulped, beaten, unknotted, and finally washed with cold water.

B. P. RIDGE.

**Improving the spinning properties of cellulose solutions.** CHEM. FABR. POTT & Co. (F.P. 617,600, 16.6.26. Ger., 17.6. and 15.12.25).—Alkylated naphthalenesulphonic acids, or their salts or derivatives, produced by condensing naphthalenesulphonic acids with isopropyl or *sec.*-butyl alcohol, are added to the solution and/or the precipitation bath.

L. A. COLES.

**Treatment of acetic acid [mother] liquor [from cellulose acetate manufacture].** SOC. CHIM. DES USINES DU RHÔNE (E.P. 266,684, 19.1.27. Fr., 26.2.26).—The precipitation of dissolved cellulose during the recovery of acetic acid is prevented by heating the dilute acid for, *e.g.*, 6 hrs. at 65° or 2 hrs. at 90°, with a small quantity of an acid which is capable of hydrolysing the dissolved cellulose to water-soluble products



*e.g.*, 10 c.c. of sulphuric acid ( $d$  1.53) per litre of 27% acetic acid. The sulphuric acid is subsequently neutralised with sodium carbonate.

D. J. NORMAN.

**Recovery of ammonia from cuprammonium precipitation baths.** "CUPRAM" A.-G. (Swiss P. 117,969, 26.3.25. Ger., 6.5.24).—Magnesium ammonium phosphate is precipitated by the addition of magnesium hydrogen phosphate to the bath.

L. A. COLES.

**Manufacture of cellulose compounds.** L. LILIENFELD (U.S.P. 1,642,587, 13.9.27. Appl., 23.7.24. Conv., 4.4.24).—See E.P. 231,800; B., 1925, 913.

**Manufacture of artificial materials.** L. LILIENFELD (U.S.P. 1,642,588, 13.9.27. Appl., 23.7.24. Conv., 4.4.24).—See E.P. 231,802; B., 1925, 913.

**Production of artificial silk [by the dry-spinning process] and apparatus therefor.** COURTAULDS, LTD., F. SHEDDEN, A. E. DELPH, and N. G. BAGULEY (E.P. 275,042, 4.10.26).

Carbon catalyst (U.S.P. 1,623,598).—See II.

## VI.—BLEACHING; DYEING; PRINTING; FINISHING.

**Dyeing of neps.** L. G. LAWRIE (J. Soc. Dyers and Col., 1927, 43, 294—295).—The affinity for direct dyes of neps consisting of dead cotton hairs (cf. Slater, B., 1927, 551) frequently present in cotton fabrics is increased so as to equal that of normal cotton by mercerisation with strong caustic soda, with or without tension, this result being contrary to the conclusions of Clegg and Harland (B., 1923, 709 A). Many sulphur, basic, and anthraquinone vat dyes dye neps satisfactorily, but indigo and some indigoid vat dyes are resisted by neps. A list of twenty-four direct dyes which are most suitable for dyeing neps is given. About 50% of dyes which coloured viscose silk did not colour neps.

A. J. HALL.

**Method for detecting complete development of Indigosols and Soledon colours on wool.** H. R. HIRST and P. E. KING (J. Soc. Dyers and Col., 1927, 43, 266—267).—Aqueous solutions and dyeings on wool of Soledon and particularly Indigosol dyes show a strong fluorescence when exposed to ultra-violet light, this fluorescence being destroyed by complete oxidation to the normal vat dye. The presence of an incompletely developed (oxidised) Indigosol dye on wool may thus be readily detected. Wool dyed with Indigosol O and incompletely developed is fluorescent in ultra-violet light, but when subsequently exposed to light from a Fadeometer the shade develops progressively and is accompanied by a decrease in fluorescence.

A. J. HALL.

## PATENTS.

**Production of printed and dyed effects on artificial silk fabrics.** CALICO PRINTERS' ASSOC., LTD., J. R. WHINFIELD, and C. LEVIN (E.P. 273,011, 26.3. and 25.5.26).—A cellulose acetate fabric is printed with caustic alkali (*e.g.*, 40% sodium hydroxide, suitably thickened), the alkali is washed off, and the fabric is treated with a delustring agent (*e.g.*, boiling water, aqueous phenols or naphthols, aqueous aniline or pyridine, formic, acetic or lactic acids, acetone, or furfuraldehyde), leaving a lustrous pattern on a matt ground. The pattern may be dyed with direct dyes, the matt

ground with dyes for acetate silk, or either may be left colourless.

C. HOLLINS.

**Dyeing cellulose acetates.** I. G. FARBENIND. A.-G., Assees. of E. MÜLLER and A. SCHAEFFER (G.P. 438,378, 1.12.22).—Ammonium salts (excluding the thiocyanate) are added to the dye-bath, whereby good dyeings are obtained, without acidification, with basic, acid, and some substantive dyes. No claim is made to dyeing with salts of basic dyes with the aid of ammonia.

C. HOLLINS.

**Dyeing acetate silk.** I. G. FARBENIND. A.-G., Assees. of A. AUEDNICEK, E. KEINER, and R. KRECH (G.P. 439,111, 21.12.24).—Acetate silk is dyed in an aqueous bath with insoluble or sparingly soluble dyes or pigments (excluding colour bases), with the addition of soap and organic compounds (amyl alcohol, glycerol, glycerol monochlorohydrin, cyclohexanol, phenol, *p*-toluenesulphonamide or -anilide, etc.) which form easily dissociated salt-like alkali derivatives. An improved exhaust is claimed.

C. HOLLINS.

**Dyeing cellulose acetate.** G. LACROIX (F.P. 603,123, 12.9.25. Conv., 2.6.25).—The dye (*e.g.*, benzeneazophenylmethylpyrazolone, hexahydroxyanthraquinone, Algal Brilliant Violet 2B) is dissolved in a chlorinated or hydrogenated hydrocarbon (*e.g.*, trichloroethylene, tetra- and penta-chloroethane, chlorobenzene, chlorotoluenes, turpentine, tetralin, decalin, etc., or mixtures of these), with addition of soap, and poured into a boiling soap solution. The mixture, after sieving, constitutes the dye-bath.

C. HOLLINS.

**Dyeing and printing cellulose acetate silks.** A.-G. FÜR ANILIN-FABR. (F.P. 605,127, 29.10.25. Conv., 3.12.24).—Cellulose acetate silk is treated in presence of ammonia and an oxidising agent with arylamines or their derivatives, or with mixtures of amines and phenols suitable for production of indamines or indophenols. Treatment with *pp'*-dihydroxydiphenylamine, ammonia, and Turkey-red oil at 40° gives a brownish-red on acetate silk; 3:5-dichloro-4-amino-4'-hydroxydiphenylamine, a bluish-red; 4-dimethylamino-4'-hydroxydiphenylamine, a blue; 4-amino-4'-hydroxydiphenylamine, a violet. By the use of *p*-phenylenediamine, ammonia, and hydrogen peroxide at 50—60° a brown shade is obtained, which is deepened by after-treatment with copper sulphate and alkali dichromate in acetic acid. The bronze-brown obtained with *p*-aminodiphenylamine, ammonia, and ferricyanide becomes by similar treatment violet-brown. An alkaline solution of *p*-hydroxyphenyl- $\beta$ -naphthylamine, ferricyanide, and ammonium chloride give a reddish-orange; similarly *pp'*-dihydroxydiphenylamine gives a full red, a mixture of *p*-phenylenediamine and phenol a violet, *p*-phenylenediamine and dimethylaniline a deep violet, and *p*-aminophenol and dimethylaniline a blue.

C. HOLLINS.

**Rendering cellulose acetate silk etc. resistant to hot or boiling aqueous liquors.** SILVER SPRINGS BLEACHING & DYEING Co., LTD., and A. J. HALL (E.P. 277,089, 8.6.26).—Cellulose acetate filaments, in fully set and finished condition, are stretched beyond their elastic limit (*e.g.*, 15—25% elongation), with or without a previous treatment with a swelling agent (acetone, alcohol, formaldehyde, glycerol). The fibre can then be



boiled with water for 1 hr. without curling, losing lustre, or becoming woolly. C. HOLLINS.

**Manufacture of aqueous solutions or emulsions of solvents or other liquids or solids insoluble in water.** J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (E.P. 277,277, 10.3.26).—Aqueous emulsions or solutions of insoluble liquids or solids, particularly for the treatment of fibrous materials, are made with the help of an emulsifying agent consisting of a sulphonated polynuclear hydrocarbon (naphthalene) containing a side-chain of 5 or more carbon atoms. Naphthalene- $\beta$ -sulphonic acid, *e.g.*, may be condensed in sulphuric acid with amyl or hexyl alcohol and the product used as an emulsifying agent. C. HOLLINS.

**Treatment of vegetable fibres with alkalis, or with oxidising or reducing agents.** M. BERGMANN, E. IMMENDÖRFER, and H. LÖWE (G.P. 440,996, 29.3.23. Cf. G.P. 426,624; B., 1926, 785).—Solutions used in processes such as washing, bleaching, Aniline Black dyeing, discharging, reserving, boiling with alkalis, etc. contain natural or artificial tanning agents in quantity insufficient for the complete reduction of any oxidising agents present. L. A. COLES.

**Fireproofing organic fibrous material.** H. STELLING (G.P. 439,765, 7.1.25. Addn. to G.P. 429,918; B., 1926, 858).—Silicon halides other than the chloride, oxyhalides, hydrides, or halogen hydrides, or organic silicon compounds, are used instead of silicon chloride in the process described previously. L. A. COLES.

**Production of fast-coloured discharges on fast dyeings.** W. COTTON, Assr. to GRASSELLI DYESTUFF CORP. (U.S.P. 1,638,475, 9.8.27. Appl., 16.1.26. Ger., 19.1.25).—See E.P. 246,183; B., 1927, 363.

**Dyeing and printing with phenylamine black.** G. ARIS (U.S.P. 1,643,233, 20.9.27. Appl., 16.2.22. Spain, 1.3.21).—See E.P. 176,343; B., 1923, 651 A.

**Manufacture of stable derivatives of vat dye-stuffs.** A. WOLFRAM, Assr. to DURAND & HUGUENIN SOC. ANON. (U.S.P. 1,639,206, 16.8.27. Appl., 11.3.27. Conv., 17.3.26).—See E.P. 267,952; B., 1927, 772.

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

### PATENTS.

**Apparatus for the production of ammonium sulphate.** BAYERISCHE STICKSTOFF-WERKE A.-G. (G.P. 441,260, 24.8.22).—Ammoniacal gases and vapours are passed into sulphuric acid solutions on the counter-current principle in an apparatus comprising a saturation vessel of small cross-section connected by means of a short tube with a second vessel of broader cross-section. This serves as a crystallising chamber, and is connected with a third vessel which acts as an equaliser, and, by its arrangement, provides additional acid and liquid to make up for any variation in the circulating solution. Liquid is withdrawn periodically from the third vessel, heated, and passed into the saturator. The process effects almost complete utilisation of the heat of neutralisation of the ammonia. A. R. POWELL.

**Manufacture of precipitated calcium carbonate.** B. G. WOOD, Assr. to IVANPAH LIME & CHEMICAL CO.

(U.S.P. 1,641,563, 6.9.27. Appl., 8.9.25).—Intimate and finely-divided contact is made between an aqueous suspension of calcium hydroxide and carbon dioxide at about 35°, the resulting finely-divided calcium carbonate being then separated and dried. W. G. CAREY.

**Production of lead suboxide.** L. GUTERSOHN (G.P. 440,978, 11.12.23).—A mixture of lead monoxide with the equivalent weight of an organic acid or ester is heated rapidly and kept for a short time, *e.g.*, spread out in thin layers, at 330° in the absence of air. L. A. COLES.

**Production of lead acetate.** W. STERN (G.P. 441,112, 9.11.24).—Lead is treated with acetic acid and air at 60–90°, the temperature being maintained by the heat of reaction or by external heating. L. A. COLES.

**Production of voluminous bismuth silicate.** J. ZELTNER (G.P. 440,623, 5.3.25. Addn. to G.P. 433,526; B., 1927, 218).—Bismuth silicate precipitated as described in the prior patent is washed with organic liquids miscible with water, before drying, and the liquid is removed as completely as possible. L. A. COLES.

**Production of finely-divided cuprous oxide.** I. G. FARBENIND. A.-G., Assees. of G. JANTSCH and F. BENCKER (G.P. 440,755, 23.3.23).—The oxide is formed by the electrolysis of hot alkali or alkaline-earth halide solutions using copper anodes, alkali or alkaline-earth hydroxides being added to the electrolyte during the process. L. A. COLES.

**Method and apparatus for condensing aluminium chloride.** G. L. PRICHARD and H. HENDERSON, Assrs. to GULF REFINING CO. (U.S.P. 1,641,503, 6.9.27. Appl., 3.2.23).—A gaseous mixture containing aluminium chloride vapour is passed through a tubular heat-radiating chamber the interior walls of which are scoured to produce the chloride in a finely-divided state and to prevent accumulation of solid chloride thereon.

W. G. CAREY.

**Production of magnesia from ores containing magnesium oxide or carbonate, such as dolomite.** F. VAN DEN BERGH (F.P. 616,644, 25.5.26).—The ore is treated with sodium bisulphate to obtain magnesium sulphate, and this is converted into the oxide by treatment with sodium carbonate and subsequent calcination of the magnesium carbonate obtained thereby.

L. A. COLES.

**Production of alkali silicates.** L. HACKSPILL and J. SALOMON (F.P. 617,739, 17.6.26).—Alkali chlorides are heated with silica at 1000° *in vacuo*, or in a current of gas, so that hydrogen chloride and chlorine are removed.

L. A. COLES.

**Production of crude alkaline-earth sulphides.** H. SCHULZE (G.P. 442,024, 15.7.25).—A mixture of lumpy or powdered barytes, celestine, or gypsum with the theoretical quantity of coal or less, is heated in an electric arc furnace under such conditions that the material sinters superficially and forms a protective coating around the remainder.

L. A. COLES.

**Production of barium carbonate suitable for the manufacture of pure barium oxide.** RHENANIA-KUNHEIM VER. CHEM. FABR. A.-G. (G.P. 441,736, 18.6.24).—Commercial barium hydroxide is treated with alkali carbonates.

L. A. COLES.



**Production of compact aluminium hydroxide.** J. D. RIEDEL A.-G. (G.P. 442,255, 25.2.20).—Solid aluminium salts are treated with ammonia solution saturated with ammonium sulphate. L. A. COLES.

**Alumina coagulant.** H. McC. SPENCER, Assr. to SEYDEL CHEM. CO. (U.S.P. 1,643,962, 4.10.27. Appl., 16.4.24).—A coagulant for clarifying aqueous liquids is made by adding to a concentrated solution containing alumina sufficient sulphur dioxide to peptise the alumina. W. G. CAREY.

## IX.—BUILDING MATERIALS.

### PATENTS.

**Calcining Portland cement in rotating kilns.** H., R., and I. DORMANN (G.P. 440,747, 5.12.24).—The calcining zone is provided with an attachment containing channels for conveying the material under treatment, and with axial or approximately axial conduits through which a portion of the air for combustion is drawn into the flame. L. A. COLES.

**Production of cement and other binding agents.** SOC. DES CIMENTS FRANÇ. ET BUREAU D'ORGANISATION ÉCONOMIQUE (F.P. 612,391, 26.6.25).—The raw material is conveyed in small wagons through a tunnel kiln in which it passes successively through a drying and causticising zone, a clinkering zone, and a cooling zone. L. A. COLES.

**Production of cement and mortar impervious to water.** CIMENT PORTLAND ARTIFICIEL DE PONT-À-VENDIN, ANC. ÉTABL. E. CAMBIER (F.P. 612,129, 22.6.25).—Material such as cement or its constituents, sand, slag, ashes, shale, clay, gypsum, coke, bauxite, or pyrolusite, or mixtures of these, ground to pass 10,000-mesh, is added to Portland cement or to unground clinker. Solutions containing alkali hydroxides, carbonates, or chlorides, magnesium chloride and lime, mineral acids, oils, fats, bitumen, or albumins or their decomposition products, such as lysalbic acid, may also be added. L. A. COLES.

**Production of unsintered hydraulic cement.** REKORD-ZEMENT-IND. G.M.B.H., and O. TETENS (G.P. 440,795, 4.3.23).—An intimate mixture of clay with quick, dry, or slaked lime is calcined, using oil shale as fuel, and the product is ground to cement. Burnt shale may be added to the original mixture, and limestone or lime marl at any stage of the process. L. A. COLES.

**Preparation of a plastering mortar.** C. A. KAPFERER (F.P. 612,932, 18.3.26).—Prepared mortar is treated with solid or dissolved acidic substances, such as calcium hydrogen phosphate, ammonium hydrogen carbonate, calcium hydrogen carbonate, or gelatinous silica, or with insoluble unoxidisable organic substances, such as wax or mineral oils, preferably together with glycerides. The product is waterproof but allows permeation of air. A. R. POWELL.

**Process and apparatus for burning clay products.** J. A. REAMS, Assrs. to FULTON BRICK WORKS (U.S.P. 1,639,271, 16.8.27. Appl., 2.12.26).—A kiln furnace having a fuel grate, a shovel-stoking door, and a rear flame exit leading to the kiln is provided with entrances for air and fuel situated in the top of the furnace and having closure devices. C. O. HARVEY.

**Fire- and weather-proofing wood.** H. SUIDA and H. SALVATERRA (Aust. P. 105,361, 27.12.22).—The wood is first impregnated with an aqueous solution of a metallic salt, *e.g.*, the double salt of calcium chloride and calcium acetate, sodium silicate, a magnesium salt, etc., and then again impregnated with a difficultly or non-inflammable chlorinated naphthalene, the second impregnation preventing the subsequent washing-out of the fire-proofing inorganic salt. For soft woods the first impregnation requires only a simple immersion in or coating with the liquid and then drying at 15°, but for hard woods a pressure-vacuum process is necessary. The second impregnation is carried out by immersion either in an easily melting, wax-like chlorinated naphthalene at higher temperatures, or in a solution of the same material in tar or petroleum hydrocarbons or chlorinated hydrocarbons at 15°, or by using a liquid chlorinated naphthalene at 15° in one of the known technical impregnating processes. A. B. MANNING.

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

**Oxygen in iron and steel.** P. OBERHOFFER, H. J. SCHIFFLER, and W. HESSENBRUCH (Stahl u. Eisen, 1927, 47, 1540—1543).—The solubility of oxygen (as ferrous oxide) in iron appears to be of the order of 0.05—0.06%; its presence is marked by a more electropositive potential and by a more pronounced "primary structure" when the metal is etched with alcoholic cupric chloride. Silicon and more especially manganese reduce the amount of oxygen (as oxide) retained in solid solution, but neither effects complete removal of dissolved oxide. A highly oxidised low-carbon steel is not sufficiently deoxidised with the usual amount (0.1%) of aluminium, and is characterised by more or less red-shortness which can be removed only by the addition of at least 0.84% Al. With 2% Al a hypereutectoidal steel forges well, but gives low impact resistance values due to the presence of inclusions of thin films of alumina. The simultaneous presence of 0.03% O and 0.014—0.020% S is sufficient to cause distinct red-shortness. The presence of dissolved oxide in steel hinders the cementation process, but an excess of aluminium above 1% has a much greater retarding action on the diffusion of the hypereutectoidal zone away from the surface of the metal. Prolonged over-heating of steel containing many oxide inclusions results in the formation of groups of nitride needles around the inclusions, and decarburisation tests at 1050° showed a more rapid loss of carbon than in normal steels. A. R. POWELL.

**Deoxidation of iron with manganese.** P. OBERHOFFER and H. SCHENCK (Stahl u. Eisen, 1927, 47, 1526—1536).—The work of earlier investigators concerning the reaction  $\text{FeO} + \text{Mn} \rightleftharpoons \text{MnO} + \text{Fe}$  is critically reviewed. As there is no known method of determining the separate proportions of ferrous and manganous oxides present in iron, the equilibrium constant can be determined only indirectly in the following way. On addition of manganese to iron containing oxygen part of the manganese is oxidised and goes into the slag and part remains alloyed with the iron; the part going into the slag takes a certain



amount of ferrous oxide with it, whilst small quantities of both oxides remain in the metal phase. Designating the constituents of the slag with symbols in round brackets and the constituents of the metal with symbols in square brackets, then, if  $L$  is the partition coefficient and  $K' = [O]_{Fe}[Mn]/[O]_{Mn}$ ,  $K'/[Mn] + 1 = \Sigma [O]L/(MnO)$ . In this equation  $K'$  and  $L$  are the two unknowns, and these have been determined from the analysis of several melts at 1600°. The results obtained indicate that the equilibrium constant is a function not only of the temperature, but also of the ferrous oxide content of the metal, and that the analytical figures obtained for the oxygen content of the metal are lower than the true values when the manganese content is relatively high. With up to 0.4% Mn in the iron the ratio  $(MnO)/(FeO)$  is a linear function of  $[Mn]$ .

A. R. POWELL.

**Influence of oxygen on the properties of steel.** W. EILENDER and W. OERTEL (Stahl u. Eisen, 1927, 47, 1558—1561).—With increase of oxygen content to about 0.03%, mild steel becomes more and more brittle and distinctly red-short with 0.11% O, whilst 0.05% O in knife steel results in a poor polish being obtained owing to the formation of small pits on the surface in places where the minute slag inclusions have been removed by the polishing operation. More than 0.035% O in tungsten tool-steel decreases the effective cutting life, and more than 0.05% O prevents the cold-working of the metal. The permeability and wattage losses of transformer iron are at a minimum when the carbon and oxygen contents are equal. The tendency to "blue brittleness" in ingot steel is increased by the presence of oxygen—no brittleness occurring after a low-temperature anneal if less than 0.03% O is present and very marked brittleness with 0.06%. In view of these results the necessity of controlling the oxygen content of the steel bath during its treatment in the furnace is emphasised.

A. R. POWELL.

**Normal and abnormal steels.** S. EPSTEIN and H. S. RAWDON (Trans. Amer. Soc. Steel Treat., 1927, 12, 337—375).—The abnormality of some case-hardened steels is shown to relate both to grain size and thickness of the carburised layer. The small irregular grain size may be removed by normalising, but the structural abnormality is not affected. With drastic quenching of normal and abnormal steels the degree of hardening is essentially the same, but with less drastic quenching of abnormal steel shows a greater tendency to soft spots. The presence of dissolved gases in the quenching medium has a pronounced effect in the formation of soft spots. No connexion was found between the gas content of the steels themselves and the occurrence of abnormality. The abnormal condition is considered to have its origin in the deoxidation process during the making of the steel. Abnormal steel was found to have a higher aluminium content. Addition of aluminium or ferrovandium in the mould produced abnormality. T. H. BURNHAM.

**Normality of steel.** J. D. GAT (Trans. Amer. Soc. Steel Treat., 1927, 12, 376—412).—Abnormality of case-hardened steel is shown to be connected with the presence of iron-carbon-oxygen eutectoid films or layers in the cementite mesh surrounding the crystals in the hyper-

eutectoid zone. These layers hinder heat-transfer on quenching and decrease the rate of passage through the critical temperature to the extent that troostite is formed instead of martensite.

T. H. BURNHAM.

**Properties and heating treatment of cast iron.** F. B. COYLE (Trans. Amer. Soc. Steel Treat., 1927, 12, 446—465).—The results of over 3000 tensile tests are plotted on a Maurer constitutional diagram for cast iron, the maxima all falling within the pearlitic zone. This type of iron showed a true elastic limit at 3.6 tons in tension and 20 tons in compression. The tensile strength of a Diesel engine iron was well maintained in tests up to 482°. The resistance to wear of cast iron was found to be greatest at a Brinell hardness of 180—210 corresponding to a pearlitic matrix. The effect of manganese on the expansion and constitution of cast iron is shown. Annealing for 1 hr. did not appreciably affect the tensile strength or Brinell hardness up to 650° for 1.44% Si and 600° for 1.69% Si. Quenching in oil and reheating increased the tensile strength. There was no appreciable effect on tensile strength and amount of combined carbon by quenching up to 600°, but above this temperature a rapid fall occurred.

T. H. BURNHAM.

**Fragility of steel.** P. RÉGNAULD (Rev. Mét., 1927, 24, 509—515).—Some varieties of special steels after hardening develop internal fissures on keeping or during use, so that the resistance to shock becomes greatly reduced whereas little change occurs in the tensile strength. This phenomenon is discussed theoretically from the point of view of hidden internal stress and molecular de-cohesion, and it is suggested that the mechanism is analogous to that of season-cracking in brass.

A. R. POWELL.

**Determination of oxide inclusions in pig iron and steel.** P. OBERHOFFER and E. AMMANN (Stahl u. Eisen, 1927, 47, 1536—1540).—For the determination of silica and silicate inclusions in steel 20 g. of the turnings are dissolved in a slight excess of a cold filtered solution of 100 g. of potassium bromide and 160 g. of bromine in 1 litre of water. The liquid is filtered on a "Cella" membrane filter, the insoluble material washed thoroughly first with cold then with hot water, the gelatinous silica formed by oxidation of any silicide in the steel dissolved by pouring 500 c.c. of hot 3% sodium carbonate solution through the filter, and the thoroughly washed residue treated with 50 c.c. of cold 5% hydrochloric acid and again washed with cold water. The final residue is ignited, weighed, treated with hydrofluoric and sulphuric acids, dried, and again ignited and weighed, loss in weight being equivalent to silica in the steel. The residue contains any alumina originally present; this may be dissolved by fusion with pyrosulphate and recovered as phosphate in the usual way. The bromine method gives low and erratic results for ferrous and manganous oxide inclusions.

A. R. POWELL.

**Paradox of corrosion and protective film [on iron] theory.** T. FUJIHARA (Ind. Eng. Chem., 1927, 19, 1008—1009; cf. B., 1926, 243).—The "paradox" consists in the fact that the corrosion product being protective, the more rapid the initial corrosion the less the final effect. The comparative rates of corrosion of



Armco iron and electrolytic iron by a drop of distilled water are illustrated by photomicrographs. The corrosion as measured by the diameter of corrosion spots was found with the former to cease after a short time, but with the latter to grow steadily. A similar result with Armco iron was obtained by the oxygen drop method. This less pure iron forms a protective film of corrosion product, whilst the pure electrolytic iron does not.

C. IRWIN.

**Silica gel as a medium for drying blast.** E. H. LEWIS (Iron and Steel Inst., Sept., 1927. Advance copy. 10 pp.).—The silica-gel drying plant installed at Wishaw to treat 35,000 cub. ft. of air per min. consists of six adsorber units, five being in use while one is being activated by the combustion of blast-furnace gas. The air is supplied at a constant degree of humidity. Comparative data are given for wet- and dry-blast conditions. The output per furnace has been increased by not less than 7½%, and the iron produced has been of more regular quality. There has been no loss of tar with the drier air conditions, and only a slight reduction in ammonia recovery. The costs of running the plant are small.

T. H. BURNHAM.

**Behaviour of mild steel under prolonged stress at 300°.** W. ROSENHAIN and D. HANSON (Iron and Steel Inst., Sept., 1927. Advance copy. 6 pp.).—Specimens of rolled mild steel containing 0.11% C and 0.39% Mn were heat-treated to give different forms and distribution of cementite and subjected to uniform loads one third, one half, and two thirds of the tensile strength at 300° for over 5 years. In no case did fracture occur, and the actual extension was very slight except in the case of one of the more heavily stressed specimens. The Brinell hardness of the stressed portions of the test pieces increased considerably, much more than would have been anticipated from the amount of work done on the material. No changes in microstructure were observed.

T. H. BURNHAM.

**Work-hardening of steel by abrasion.** E. G. HERBERT (Iron and Steel Inst., Sept., 1927. Advance copy. 12 pp.).—The work-hardening of metals as measured by the Herbert pendulum increased to a maximum and then fell off. This increase in hardness occurred not only in soft steel, but in hardened steel, whether hardened throughout or case-hardened. The increase in hardness of alloy steels was greater than that of carbon steels. In metals subject to abrasion a surface layer of higher hardness is produced, the maximum corresponding to that induced by the pendulum test, which is thus a measure of the resistance of the metal to wear. When work-hardening occurs, plastic flow of the subjacent metal is caused, even in hardened steel.

T. H. BURNHAM.

**Magnetic and other changes concerned in the temper-brittleness of nickel-chromium steels.** H. A. DICKIE (Iron and Steel Inst., Sept., 1927. Advance copy. 16 pp.).—Specimens of three nickel-chromium steels were treated to obtain the tough, intermediate, and fully brittle conditions, each bar being tempered for a total of 4 hrs. at 660°. The slow-cooling treatment produced an increase in remanence up to 8% and a rise in maximum permeability. The coercive force and hysteresis loss decreased slightly. The magnetic state

of the intermediate condition was similar to that of the brittle condition. The specific resistance decreased with the rate of cooling. The specific volume and hardness were least in the intermediate condition. These features support the view that temper-brittleness is connected with dissolution and redeposition of carbides. On slow-cooling, a portion of the carbide separates out of solid solution in the ferrite, thus modifying the magnetic properties and specific resistance; at moderate cooling rates this also results in a contraction and softening. When cooling is very slow, a network of carbide forms round the grains and brittleness is developed.

T. H. BURNHAM.

**Effect of work and annealing on the lead-tin eutectic.** F. HARGREAVES (Inst. Metals, Sept., 1927. Advance copy. 12 pp. Cf. B., 1927, 255).—Specimens of the lead-tin eutectic alloy were cast under different conditions of cooling, and were then reduced to varying degrees by hammering. The Brinell hardness was then measured immediately and after keeping for varying periods at room temperature, 100°, and 175°. The hardness is lowered by cold-working, and with severe reduction (78%) in thickness the hardness may become less than that of either constituent of the eutectic. There is a critical range at about 30% reduction, and when this is exceeded the softening becomes much more pronounced. On being kept at room temperature the hardness of the deformed specimens gradually increases, except for those in which the reduction is less than 30%. At 100° there is a general increase in hardness which may be followed by a decrease, whilst at 175° alloys with less than 26.5% reduction return to the hardness of the original casting; those with more than 45% reduction in thickness show a further increase. Results for the silver-copper eutectic are also given.

W. HUME-ROTHERY.

**Constitution of alloys of aluminium with silicon and iron.** A. G. C. GWYER and H. W. L. PHILLIPS (Inst. Metals, Sept., 1927. Advance copy. 54 pp.).—The equilibrium diagram of the system aluminium-silicon has been investigated by thermal and microscopical methods. The diagram shows a simple eutectic system, the eutectic point being at 11.70% Si and 577–578°. The solubility of silicon in solid aluminium is quite low, remaining almost constant at 0.2% up to 450° and then increasing rather rapidly to about 1% at 550°. Consequently the chill-cast alloys show slight age-hardening. From the eutectic arrest times the solubility of aluminium in solid silicon is probably less than 2%, but this was not determined in detail. The equilibrium diagram of the system aluminium-iron has been similarly determined. Aluminium and the compound FeAl<sub>3</sub> form a eutectic at 1.89% Fe and 653°, and there is no solid solution in aluminium. The liquidus rises from the eutectic to a slight maximum at 40.6–41.1% Fe, and alloys in this region are homogeneous (FeAl<sub>3</sub>). A second maximum occurs on the liquidus at 45.3% corresponding to the compound Fe<sub>2</sub>Al<sub>3</sub> with limited solid solubility. This compound forms a eutectic with a constituent denoted *A*, which is of variable composition, but is stable over a limited temperature range only and exhibits a well-defined eutectoid transformation at 57% Fe and 1103°, at which the constituent *A* breaks up into a constituent *B*



containing about 53% Fe, and an iron-rich solid solution *C* which extends from about 65 to 100% Fe. In the unetched state the compound  $\text{FeAl}_3$  is pale lavender in colour, whilst  $\text{Fe}_2\text{Al}_5$  is Chinese white. The constituent *A* is formed at 1232° by a peritectic reaction between *C* and the liquid. The constitution and structure of the ternary aluminium-silicon-iron alloys over the range 0–20% Fe and 0–30% Si have been studied in detail, a general survey being made of the whole ternary system lying between the aluminium-silicon face of the triangular model and the section parallel to the face comprising the alloys containing 30% Fe. The results are very complex and involve both stable and metastable conditions. In addition to the constituents previously known, namely aluminium, silicon,  $\text{FeAl}_3$ , and *X* (Rosenhain, Archbutt, and Hanson, B., 1921, 851A), other ternary compounds  $\beta$ ,  $\delta$ , and  $\zeta$  are present; of these constituents  $\beta$  and *X* are ternary solid solutions.

W. HUME-ROTHERY.

**Age-hardening tests with elektron alloys.** K. L. MEISSNER (Inst. Metals, Sept., 1927. Advance copy. 18 pp.).—Age-hardening tests have been carried out on various "elektron" alloys containing 0–10% Al and 0–4% Zn, the remainder being magnesium. The specimens were annealed at temperatures of 400–440°, quenched in water, and then tested after keeping for varying periods at temperatures up to 200°. No appreciable age-hardening occurred on keeping the quenched specimens at room temperature. Considerable age-hardening could be obtained by "artificial ageing" at temperatures of 50–200°, provided that the amount of aluminium or zinc, or both metals, present was in excess of the solubility in magnesium at ageing temperature. The solubility of both zinc and aluminium in solid magnesium increases with the temperature, and this accounts for the age-hardening, which is due to the precipitation of particles of the compounds  $\text{MgZn}_2$  and either  $\text{Al}_2\text{Mg}_3$  or  $\text{Al}_3\text{Mg}_4$ . A new diagram for the solubility of zinc in solid magnesium is given. W. HUME-ROTHERY.

**Grain growth in compressed metal powder.** C. J. SMITHELLS, W. R. PITKIN, and J. W. AVERY (Inst. Metals, Sept., 1927. Advance copy. 13 pp.).—Tungsten powders having a mean particle size of from 0.6 to 3.5 $\mu$  were compressed into bars by pressures of from 8 to 32 tons/in.<sup>2</sup> When such bars were heated in hydrogen to different temperatures and then allowed to cool, a marked shrinkage took place when the heating temperature exceeded a certain limit. A similar discontinuity was shown by the number of watts required to heat the bar electrically to gradually increasing temperatures. These changes are attributed to grain growth beginning at a certain definite temperature which depends on the size of the initial particles and on the pressure at which the bars were formed; this is confirmed microscopically. Under the above conditions the temperatures at which grain growth began varied from 1100° to 1500° Abs., a low temperature being favoured by small particle size and high pressure. The results are in conflict with those of Sauerswald (A., 1922, ii, 746), who detected no grain growth below 2800° Abs.

W. HUME-ROTHERY.

**Influence of rate of cooling on structure of alloys.**

A. A. BOTSCHWAR (Z. anorg. Chem., 1927, 164, 189—

194).—In order to ascertain the influence of rate of cooling on the pearlitic crystallisation of carbon steels, the structure of steel rods which had been heated at about 100° above the  $\text{Ac}_3$  point, then chilled at one end, was examined. In steels containing 0.11–0.53% of carbon, the region of transition from the non-chilled to the chilled part, which corresponds with the maximum rate of cooling and the maximum supercooling, consisted of martensite and the eutectoid interspersed with the primary ferrite. Hence, with the maximum supercooling the rate of the primary crystallisation always exceeded that of the eutectic crystallisation. The transition region in steels with 0.6–1.43% C, on the other hand, showed no signs of the primary crystallisation, so that the rate of this process must be equal to or smaller than that of the eutectic crystallisation.

R. CUTHILL.

**Cathodic disintegration as a method of etching specimens for metallography.** C. S. SMITH (Inst. Metals, Sept., 1927. Advance copy. 3 pp.).—The method of cathodic sputtering can be used to develop the structure of certain alloys for microscopical examination. A simple apparatus is described in which the specimen is attached to the cathode, and a voltage of 2000–7500, depending on the gas pressure, is used. The method is particularly suitable for copper-silver alloys.

W. HUME-ROTHERY.

#### PATENTS.

**Bimetallic element.** W. M. CHACE, ASST. to W. M. CHACE VALVE CO. (U.S.P. 1,642,485, 13.9.27. Appl., 6.7.25).—One of the elements consists of a nickel-steel alloy containing not more than 42% Ni to which is welded a steel the composition of which is approximately 64.05% Fe, 22.00% Ni, 8.00% Cr, 2.00% Cu, 1.00% Co, 1.75% Si, 0.70% Mn, and 0.50% C.

F. G. CROSSE.

**Aluminium alloy.** ÉTAB. MÉTALLURG. DE LA GIRONDE (F.P. 613,758, 11.2.26. Conv., 19.2.25).—The alloy comprises 96.91% Al, 2% Cu, 0.37% Ni, 0.27% W, and 0.45% Mg. The copper, nickel, and tungsten are melted with a small part of the aluminium, and the alloy together with the magnesium are added to the remainder of the aluminium. The product has a high tensile strength and ductility, and remains unaffected by repeated melting.

A. R. POWELL.

**Compound to solder aluminium.** G. E. GAIL, ASST. to A. SEITZ (U.S.P. 1,641,422, 6.9.27. Appl., 12.3.26).—The method of making an aluminium solder consists in melting, chilling, and remelting 9 $\frac{1}{4}$  lb. of zinc, and adding to the melt in sequence 15 $\frac{1}{4}$  lb. of block tin,  $\frac{1}{4}$  lb. of lead, and  $\frac{1}{4}$  lb. of phosphorous tin. The mixture is stirred and cleared by immersing a block of wood, finally adding  $\frac{1}{4}$  oz. of beeswax to assist in removing impurities.

C. A. KING.

**Solder for aluminium and its alloys.** A. PASSALACQUA (F.P. 611,114, 23.5.25).—A solder for aluminium comprises an alloy of aluminium, tin, zinc, magnesium, manganese, bismuth, cadmium, and cobalt in suitable quantities. The parts to be soldered are heated to 250–550°, and the solder is rubbed on with metal brushes.

A. R. POWELL.



**Material for making tools of high mechanical strength.** STAHLWERKE RÖCHLING-BUDERUS A.-G. (F.P. 609,734, 24.1.26. Conv., 25.2.25).—Finely-powdered oxides of metals having a high m.p., with or without a proportion of the corresponding metal, are melted in graphite crucibles, in a carbonising atmosphere, or in the presence of metal carbides having a high carbon content, in such a manner that air is excluded from the fused mass. The proportions of the constituents are so arranged that the mixture has the eutectic composition. *E.g.*, 100 pts. of crude tungsten are fused with 5–10 pts. of thorium carbide and 3–5 pts. of molybdenum, and immediately the mixture is molten it is cast into suitable moulds. A. R. POWELL.

**Recovery of gold from sea water.** B. SZILARD (F.P. 612,081, 18.6.25).—Filtered sea-water is treated with a reagent which precipitates gold from its compounds, then with a second reagent which gives an insoluble compound with the first; *e.g.*, ferrous sulphate and barium chloride may be used. The precipitate is removed and the water evaporated to recover sodium chloride.

A. R. POWELL.

**Apparatus for production of pure metal.** S. L. MADORSKY, Assr. to GATHMYS RESEARCH CORP. (U.S.P. 1,642,683, 20.9.27. Appl., 5.7.24).—A converter is provided with a spout which can be brought into position with either a melting furnace or a discharge duct. The latter is provided with means for preheating a reducing gas before its introduction into the contents of the converter. M. E. NOTTAGE.

**Process for recovering metals from slag.** F. ROSENZWEIG (U.S.P. 1,643,610, 27.9.27. Appl., 17.9.26).—The blast-furnace slag which contains the metal in the form of an oxide is allowed to flow from the furnace and an electric current applied to it while still molten to reduce the oxide to metal, which is then collected. M. E. NOTTAGE.

**Furnace for heating or melting metals.** A. ZILLIACUS (U.S.P. 1,643,569, 27.9.27. Appl., 25.3.26. Ger., 28.3.25).—The furnace consists of a hearth on which a layer of protective gas to envelope the metal can be produced, and across which a heating flame can be passed above the protective gas. M. E. NOTTAGE.

**Gas-fired annealing furnace.** DOWSON & MASON GAS PLANT Co., LTD., and J. PATON (E.P. 277,251, 26.4.27).—In a furnace particularly suitable for annealing malleable castings the furnace chamber is preferably divided into a number of soaking pits, operated independently, by means of hollow transverse walls which contain horizontal passages for heating air to be delivered through ports in the side wall of the furnace. Gas is also conducted through a duct in the furnace wall to ports situated below the air ports. Waste gases leave through ports connecting with a flue in the opposite side wall of the furnace. C. A. KING.

**Working bright-annealing furnaces.** SIEMENS ELEKTROWARME-GES.M.B.H. (E.P. 272,214, 31.5.27. Ger., 3.6.26).—The protecting gas in a bright-annealing process circulates upwardly through the furnace and downwardly in an adjacent cooling chamber, due to the difference in density between the hot gas in the furnace and the cooling gas. C. A. KING.

**Producing a refractory coating on metallic surfaces.** PETROLE SYNTHETIQUE SOC. ANON., and A. FOLLIET (E.P. 277,211, 1.1.27).—Metals, *e.g.*, iron and steel, are heated at about 800° in contact with a mixture of aluminium, silica, and a volatile chloride, in a closed container. C. A. KING.

**Coating of materials by metal spraying.** F. G. COZENS, and METALLISATION, LTD. (E.P. 277,071, 4.6.26).—For coating the interior of elongated articles, *e.g.*, pipes, the metal-spraying jet is carried by a longer extension tube and the issuing metal is deflected at any desired angle by means of an independent blast. The article to be coated is given a rotary and longitudinal motion in relation to the jet. The method may be applied to sand-blasting. C. A. KING.

**Protection of metal surfaces.** DUNLOP RUBBER Co., LTD., A. LAKEMAN, and F. C. MACCABE (E.P. 276,705, 29.4.26).—A vulcanising solution is applied to the cleaned metal surface, which is then covered with a sheet made by mixing at least 75% of tyre scrap with sulphur, brown substitute, mineral oil, and stearic acid; the whole is then vulcanised, preferably in an elastic mould. M. E. NOTTAGE.

## XII.—FATS; OILS; WAXES.

**Detergent action of soaps.** II. G. P. VINCENT (J. Physical Chem., 1927, 31, 1281–1315).—Soap solutions suspend solid material stably because the solid particles adsorb negative ions from the solution, and cataphoresis experiments show that the manganese dioxide used by Fall (B., 1927, 727) is negatively charged in dilute solutions. Positive ions are also adsorbed and more strongly with increasing concentration until a region of zero stabilisation by the soap is reached. The maximum stabilisation observed by Fall (*loc. cit.*) arises when the negative in comparison with the positive adsorption is greatest. The discrepancy between the results of McBain (A., 1924, ii, 155) and Fall disappears when the carbon suspensions used by the former are so treated that the non-stabilised carbon does not clog the pores of the filter paper used. The emulsification of kerosene oil and a heavy machine oil by palm oil, olive oil, tallow, commercial Green Arrow, and commercial silicated Green Arrow soaps, which vary but little in their emulsifying powers, is at a maximum at a soap concentration of 0.05–0.10%. A concentration higher than this maximum is beneficial, but temperatures above 40°—the optimum—are detrimental. Emulsification is furthered by the presence of ammonia solution (optimum concentration 1.2%), sodium orthophosphate, sodium hydroxide (0.32%), and to a lesser degree by sodium carbonate, and by borax. An excess of sodium hydroxide, but not of ammonia and its salts is detrimental. Contrary to the findings of Stericker (B., 1923, 364 A), sodium silicate, alone or mixed with ammonia, is not an emulsifier of oils (cf. Fall, *loc. cit.*). The importance of wetting in detergency has been studied. Sodium phosphate will cleanse from oils which it does not emulsify. Emulsification is not essential, although highly beneficial. The high detergent value of concentrated soap solutions lies in their efficiency as both wetting and emulsifying agents. Sodium phosphate



is especially efficacious with greases containing calcium oleate on account of the formation of sodium soap from the calcium salt present. The grease is disintegrated and the sodium soap thoroughly incorporated therein. The wetting power of the phosphate is also a factor. A mixture containing 20% of soap and 80% of sodium silicate of the correct composition has noteworthy possibilities as a detergent, and its effect in water softening, content of free alkali, and upon textile fibres has been investigated. Sodium hydroxide is more efficient than sodium silicate in softening waters containing iron, but the carbonate is less so. The beneficial effects obtained by adding sodium silicate to a bleaching solution of sodium hypochlorite are as follow: (i) weakening of the bleaching solution is reduced by forcing back the reaction forming hypochlorous acid; (ii) the cloth fibres are less weakened because of less bleaching, and silica, which strengthens the fibres, is probably adsorbed; and (iii) the removal of the yellow decomposition product formed is facilitated.

L. S. THEOBALD.

### XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

**New cadmium pigments.** A. EIBNER (Farben-Ztg., 1927, 32, 2308—2309).—The "cadmopone" pigments, relatively new to England (cf. Ward, B., 1927, 196), have been manufactured in Germany since 1907, and references to the literature are given. The more recent development (1919) in this field is the production of cadmium reds etc. as pure pigments (free from co-precipitated barium sulphate etc.). These consist of cadmium sulphide-selenide mixtures, and their colour, purity of tone, and fastness to light are discussed.

S. S. WOOLF.

**Arsenic in printing inks.** R. S. MORRELL and C. I. SMYTH (Analyst, 1927, 52, 339; cf. B., 1927, 371).—The proposed limit for arsenic in printing ink of 1 in 50,000 is considered unnecessary, since it would mean only 1 pt. in 5 million of foodstuff, assuming all the printing ink to be absorbed by the food, or the whole wrapper to be consumed. Further, it would involve the use of arsenic-free chemicals in the manufacture of the ink. One part of arsenic in 7000 of ink would mean 1 pt. in 700,000 of food, and would not exceed the legal limit, even if all the arsenic were absorbed.

D. G. HEWER.

**Composition of the white resin of *Pinus silvestris*.** B. A. ARBOUSOV (J. Russ. Phys. Chem. Soc., 1927, 59, 247—264).—Owing to the difficulty of obtaining pure individual products from terpenes, due to their readiness to isomerise, and to their close resemblances among themselves (the hydrogenation of  $\alpha$ -pinene is cited), it has been decided to base the classification of turpentine derivatives upon their physical methods of separation and identification, the optical methods of analyses of turpentine showing special significance, especially the measuring of the rotatory dispersion. The several physical methods suggested are critically discussed, the data obtained for the physical constants of the several fractions of the liquid portion of the white resin from *P. silvestris* being tabulated. It is concluded that (1) the white resin obtained without

access of air contains 35.5% of turpentine, an amount exceeding that of turpentine in non-treated resin (31%) according to the hypothesis of Dupon; (2) this turpentine contains up to 87% of  $\alpha$ -pinene; (3) the prepared  $\alpha$ -pinene, with  $[\alpha]_D + 40.79^\circ$ , shows it to be more optically pure  $\alpha$ -pinene of *P. silvestris* than that described in the literature; and (4) the chemical characteristics of  $\beta$ - $\alpha$ -pinene may depend upon its rotatory dispersion (for this compound,  $\alpha_F/\alpha_C = 1.97$ ). Further, the rotatory dispersion may be used not only for the determination of the purity of pinene, but also for that of the turpentine obtained from the resin of *P. silvestris*.

J. KAYE.

**Two natural resins.** F. H. GEAKE (Ind. Eng. Chem., 1927, 19, 826—827).—Two new resins from trees growing in south-eastern Siam have been investigated. Neither is completely soluble in alcohol and the solubility is not improved by "melting." Neither resin yields an appreciable quantity of essential oil. Both give varnishes with alcohol, benzene, and oil of turpentine. Both resins yield oils on dry distillation, which, however, do not resemble rosin oil, and are not likely to find immediate commercial application.

A. B. MANNING.

### XV.—LEATHER; GLUE.

**Chemistry of liming.** G. D. McLAUGHLIN, J. H. HIGHBERGER, and E. K. MOORE (J. Amer. Leather Chem. Assoc., 1927, 22, 345—363).—It has been shown that 76% of the total sulphur dissolved by a lime liquor is derived from the epidermis, 17% from the corium, and 7% from the hair. A certain minimum degree of degradation of the epidermis must occur before the hair is loosened, and, judged by the amount of dissolved sulphur in the lime liquor, the decomposition of keratin is the same for a given skin or hide, at the point of hair loosening, regardless of the time required to reach this point. Primary alkylamines greatly reduced the time required to produce satisfactory hair loosening in fresh lime liquors to which they had been added, but secondary and tertiary amines had little or no effect. Ammonia added to fresh lime liquor in greater amounts than are found in very mellow lime liquors had no effect on the rate of hair loosening, but only increased the amount of dissolved skin substance. The increased hair-loosening properties of a mellow lime liquor are attributed to the appreciable quantities of amines present. These do not increase the solubility of the lime nor the alkalinity of the liquor, but probably react directly with the epidermal keratin. The inhibitory influence of salt in lime liquors is due to an actual retardation of the decomposition of the epidermal keratin.

D. WOODROFFE.

**Bacteriology of liming.** G. D. McLAUGHLIN, G. E. ROCKWELL, and I. H. BLANK (J. Amer. Leather Chem. Assoc., 1927, 22, 329—344).—Pieces of freshly-flayed steer hide were kept for varying periods of time and limed. The longer the period of keeping, the shorter the time required for hair loosening, the greater the total and non-protein nitrogen in solution, the less the swelling, and the greater the amount of hide sulphur in the liquor. These effects are attributed to the action of bacteria which affect the physical and chemical condition of the



hide before it is limed. Thus the cure of a skin affects the liming and liming effects. Over-soaking affects the liming process in the same way as delay in curing or exposure of fresh hide to air. Liming tests were made with and without the addition of chloroform to water and lime water respectively. Fresh hide unhaird in water undoubtedly as a result of bacterial action because it did not unhair in water and chloroform. The chloroform did not prevent unhairing in lime liquor so that unhairing is possible without the aid of bacterial growth. Non-spore-forming bacteria were killed by fresh lime solution containing excess lime whilst sporulating micro-organisms were not killed. The antiseptic value of lime increases with increasing temperature and increasing alkalinity, the latter being probably due to its ability to remove carbon dioxide, which is essential to bacterial growth. Bacteria do not function in lime liquors under normal conditions but only when the skin entering the liquors contains so many bacteria due to poor curing or over-soaking that the lime liquor is unable to cope with them. A photomicrograph of a section of an over-soaked hide which has been limed reveals numerous bacteria in the depths of the hide. There are two types of mellow limes, one in which only the products of hydrolysis have accumulated, and the other containing in addition the accumulation of the protein cleavage products resulting from bacterial action.

D. WOODROFFE.

**Micro-tannology of unhairing [hides and skins].** G. D. McLAUGHLIN and F. O'FLAHERTY (J. Amer. Leather Chem. Assoc., 1927, 22, 323—329).—Samples of steer, calf, and goat skins were soaked in 4 times their weight of water at 20°, then the steer and calf skin limed in 4 times their weight of lime liquor containing 6% of excess lime on the weight of unsoaked skin. The goat-skin was limed in 12 times its weight of lime liquor. Different tests were made with and without additions of ammonia, amines, and sodium sulphide respectively and for different periods. The results show that the main function of an unhairing solution is so to digest the skin epidermis that it, together with the hair or wool, may be easily removed by mechanical means. Unhairing can be effected by any agent capable of digesting, destroying, or detaching the epidermis from the surface and the hair follicle linings of the skin. The gland cells are digested during the process and removed as debris. The usual unhairing agents employed affect the epidermis and glands by digestion and the hair and corium by swelling or plumping, accompanied by more or less dissolution of the skin and hair proteins. If the skin remains in the unhairing solution longer than is necessary for unhairing, an abnormally large amount of the skin is dissolved by the solution, which is harmful for heavy hides. Too short a time is also harmful. The desirable unhairing agent is one that requires the least time and does the least damage to the skin or hair.

D. WOODROFFE.

## XVI.—AGRICULTURE.

**Nitrate assimilation by soil micro-organisms in relation to available energy supply.** F. E. ALLISON (Soil Sci., 1927, 24, 79—93).—Biological activity in

soil is stimulated by the addition of easily-decomposable organic matter, and the increased utilisation of nitrates by the organisms may result in injury to growing crops, due to lack of nitrate supplies. The injury may be prevented by treatment with sufficient sodium nitrate. The extent of the nitrate starvation depends upon the carbon:nitrogen ratio of the material added. The unfavourable effect observed when fresh farmyard manure is used is attributed solely to this cause. Soil so treated recovers as the stored-up nitrogen in dead bacterial cells becomes again available to the plant.

A. G. POLLARD.

**Delayed effect of liming [soils].** P. E. KARRAKER (Soil Sci., 1927, 24, 147—148).—A period of some weeks was observed between the application of limestone to an acid soil and the resulting improvement in the growth of lucerne. The importance of this delayed action in experimental work is emphasised.

A. G. POLLARD.

**Solodisation (dealkalisation) of soils.** K. K. GEDROIZ (Nosovskaya Selskokhosyaistvennaya Opuit naya Stantzia [Russia], Bull., 1926, No. 44, 1—48).—There are essential differences between the degraded alkali soils (solonetz) and the primary podsoils. A degraded solonetz is the final stage in the evolution of the salinised soils; the destructive effects on the humus and the aluminosilicate complex which are highly dispersed result in the formation of compounds, e.g., amorphous silica, not present in podsoils. In alkali soils not containing calcium carbonate, dealkalisation ("solodisation") is more rapid; the inactive portion of the humus remains, and the silica content is increased.

CHEMICAL ABSTRACTS.

**Effect of acidity on the activities of the micro-organisms of the soil.** E. H. PANGANIBAN (Sugar News, 1926, 7, 902—905).—Ammonification is only slightly affected whilst nitrification is greatly depressed by soil acidity.  $p_H$  6 is about the most acid limit for the activity of nitrifying organisms. Denitrification and sulphofication are also affected by soil acidity.

CHEMICAL ABSTRACTS.

**Nitrogen manuring necessary for sugar-beet grown after lucerne, red clover, or after green-manuring and farmyard manure.** SCHÖNBRUNN (Z. Pflanz. Düng., 1927, 6B, 399—404).—Following lucerne or red clover, sugar-beet needs no nitrogenous fertiliser except possibly a light top-dressing to give the young plants a start. After straw crops moderate dressings of farmyard manure should be supplemented by some nitrogen fertiliser. Following a green manure crop and a moderate dressing of farmyard manure artificial nitrogenous fertilisers should only be necessary for sugar-beet when the green manure crop was one of low-nitrogen content.

A. G. POLLARD.

**Influence of potash manures in conjunction with increasing supplies of nitrogen on the yield and quality of barley in 1926.** H. WIESSMANN and K. BÜRGER (Z. Pflanz. Düng., 1927, 6B, 408—417).—Potash manures were profitable where moderate supplies of nitrogen were available in the soil. Heavy manuring with ammonium sulphate was not profitable either alone or when used in conjunction with potash fertilisers.



Neither nitrogenous nor potash fertilisers appeared to influence the protein content of barley.

A. G. POLLARD.

**Stimulation [of plant growth].** J. H. ABERSON (*Z. Pflanz. Düng.*, 1927, 6B, 405–407).—Mixtures of magnesium and manganese salts were used as stimulating agents on a number of common farm crops. No positive results were obtained.

A. G. POLLARD.

**Membrane filters in soil analysis.** W. HOFFMANN (*Z. angew. Chem.*, 1927, 40, 1052–1058).—The use of membrane filters for the determination of silica in soils is cheaper and quicker than the ordinary process involving a double evaporation with hydrochloric acid and heating at 130°. In practice, 50–100 g. of the ignited soil are digested with 125 c.c. of 20% hydrochloric acid and 3–5 drops of nitric acid for 1–2 hrs. After cooling for 1½ hrs., 300 c.c. of water are added and the whole is filtered under reduced pressure through a membrane filter and washed with 5% hydrochloric acid. The silica and insoluble material are removed from the filter, dried, and ignited, and the other constituents are determined in the filtrate in the usual manner. An 80–100 sec. membrane filter of pore size 0.2–0.3  $\mu$  is most suitable. The complete filtration occupies  $\frac{3}{4}$ –1 hr., and the amount of silica passing into the filtrate is only 0.03–0.05%, as compared with about 0.02% in the double-evaporation method. By using finer filters, or by a preliminary evaporation to dryness, the silica remaining in solution may be still further reduced, but the time required is increased in both cases. Addition of more than a few drops of nitric acid increases the proportion of silica passing into the filtrate.

F. R. ENNOS.

**Changes in reaction with the ageing of soil samples.** B. AARNIO and A. SALMINEN (*Trans. 2nd Comm. Internat. Soc. Soil Sci.*, 1927, B, 30–33).—Determinations of the  $p_H$  value of soils must be made with fresh field samples. Drying of soils in the laboratory largely increases their active acidity. This is particularly the case with soils rich in humus.

A. G. POLLARD.

**Effect of drying on different types of soils in the "tchernozem" and "podsol" zones of European Russia.** A. LEBEDIANTZEV (*Compt. rend.*, 1927, 185, 568–569).—The increased fertility of soils on drying is a common property of the types examined.

H. BURTON.

## XIX.—FOODS.

**Constants of cow ghee.** B. B. BRAHMACHARI (*Indian Med. Gaz.*, 1927, 62, 318–322).—The Reichert-Wollny value is 19.52–42.35 c.c. (weighted average 25.3 c.c.); butyro-refractometer reading 39.6–44.6 at 20°; saponif. value 213.9–236.4 (average 224.4); iodine value 25.6–41.1 (average 35.8).

CHEMICAL ABSTRACTS.

**Determination of sulphur dioxide in dried fruit.** P. MAY (*Analyst*, 1927, 52, 526; cf. Miller, B., 1927, 615).—Although Miller's method accurately determines the total sulphur dioxide in the distillate, it is not a measure of that in the fruit since prolonged boiling with fairly strong acid is necessary to liberate all the original sulphur

dioxide. Miller's method should be useful for quick sorting purposes.

D. G. HEWER.

**Metabolism of nitrogen compounds in dormant and non-dormant potato tubers.** W. NEWTON (*J. Agric. Res.*, 1927, 35, 141–146).—Sand culture experiments show that absorption of nitrates by the tissues of potato tubers decreases the dormant period. This effect is not produced by ammonium salts. Amino- and amide-nitrogen in non-dormant tubers is usually greater than in dormant ones, but growth is not dependent on the actual concentration of either of these. Examination of the expressed juice of dormant and non-dormant tubers shows the proteolytic enzyme activity to be greater in the latter. Following the addition of casein to the expressed juice, the rate of accumulation of amino-acid becomes a direct function of the period of incubation. Incubation of the expressed juice results in the conversion of amino-acid nitrogen into amide-nitrogen. Carbohydrate hydrolytic enzymes in dormant potatoes are stimulated by asparagine.

A. G. POLLARD.

**Copper as an industrial contaminant in food-stuffs.** C. G. KING and G. ETZEL (*Ind. Eng. Chem.*, 1927, 19, 1004–1005).—Down to 5 to 10 mg. of copper per day may produce toxic results. In addition, the metal accelerates the destruction of vitamin-C. Four groups of fruit preserves tested were found to contain from 3 to 110 parts per million of copper. The pasteurisation of milk in copper apparatus only added 0.1 p.p.m. to the copper content. Condensed milk condensed in copper vacuum pans averaged 3.7 p.p.m.; carbonated fruit beverages were found normally to contain very little copper. The variations in the fruit preserve samples were apparently due to variation in care between different manufacturers. Copper was determined colorimetrically as xanthate.

C. IRWIN.

**Behaviour of the anthocyan pigments in canning.** C. W. CULPEPPER and J. S. CALDWELL (*J. Agric. Res.*, 1927, 35, 107–132).—Discoloration of fruit and vegetables in tinned containers is limited to those commodities having anthocyan pigments in the skin or flesh. Discoloration is most prominent in fruit well coloured during ripening by sunlight and high temperature, and is traced to interaction between the pigment and the tin of the container. Red anthocyan colours form purple tin salts, the transformation being favoured by alkaline conditions. The action is reversible, hence discoloration is minimised in highly acid fruits. When the inner surface of the container is enamelled discoloration is reduced as the area of attack is smaller. On the other hand, perforation of the tin is hastened as the action is localised.

A. G. POLLARD.

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

PATENTS.

**Manufacture of alkyl carbonates.** H. G. MITCHELL, Assr. to U.S. INDUSTRIAL ALCOHOL Co. (U.S.P. 1,638,014, 9.8.27. Appl., 14.7.24).—Producer gas is passed with chlorine over activated charcoal, and the gaseous mixture of carbonyl chloride and nitrogen obtained is treated with alcohol to form ethyl chloroformate and, finally, ethyl carbonate.

T. S. WHEELER.



**Production of organic [nitrogen] compounds.** K. F. SCHMIDT and P. ZUTAVERN, Assrs. to KNOLL & Co. (U.S.P. 1,637,661, 2.8.27. Appl., 11.12.25. Conv., 11.4.25).—Hydrocarbons or their carbonyl derivatives are treated with hydrazoic acid in presence of catalysts, e.g., metallic chlorides, to give nitrogen compounds, e.g., amines or nitriles. Thus a benzene solution of hydrazoic acid is treated with aluminium chloride to form aniline; benzaldehyde gives benzonitrile.

T. S. WHEELER.

**Manufacture of camphene.** I. G. FARBENIND. A.-G., Assees. of V. HILCKEN (G.P. 439,695, 11.11.24).—Bornyl chloride, or oil containing it, is heated at 190–200° with an aqueous solution of a zinc salt (zinc acetate) in presence of zinc oxide or hydroxide and sodium acetate, which prevent the condensing action of the zinc chloride formed in the reaction. Camphene, in 98% yield, is distilled off in steam, and the aqueous residue, after addition of sodium hydroxide and removal of solid sodium chloride, may be used for a fresh batch. Zinc chloride may be used in place of zinc acetate, and the sodium acetate may be omitted.

C. HOLLINS.

**Manufacture of coumarin from o-coumaric acid.** —I. G. FARBENIND. A.-G., Assees. of K. SCHAFFGANZ (G.P. 440,341, 6.7.24).—The yield of coumarin from coumaric acid (hydrobromic or sulphuric acid gives 30%) is increased to 75% by using a small amount of a mercury salt (mercuric sulphate) alone or with mineral acids, much less tar being formed. Aqueous or dilute alcoholic media may be used.

C. HOLLINS.

**Manufacture of o-aminocinnamic acid.** I. G. FARBENIND. A.-G., Assees. of K. OTT and K. SCHAFFGANZ (G.P. 440,052, 13.5.24).—o-Cyanocinnamic acid, m.p. 137°, is hydrolysed with hydrochloric acid at 90–95° to cis-o-carbamidocinnamic acid, m.p. 239, which is converted by alkaline hypochlorite at 80° into trans-o-aminocinnamic acid, m.p. 158°.

C. HOLLINS.

**Stabilisation of chlorinated hydrocarbons used in cleaning and scouring.** J. M. G. DE SCHACKEN (F.P. 615,800, 8.5.26).—The decomposition of tetrachloroethane, trichloroethylene, or the like on exposure to the sunlight may be prevented and the cleansing power increased by addition of 10–20% of toluene, xylene, tetrahydronaphthalene, hydroterpene, or  $\alpha$ -dichlorohydrin.

A. R. POWELL.

**Method for decreasing the toxic action of cocaines.** R. ECKERMANN (E.P. 267,463, 25.6.26. Conv., 13.3.26).—By treating cocaine (or its derivatives) with esters of carbamic acid (or their derivatives), both components being first treated with an organic acid, base, mono- or poly-hydric alcohol, or phenol volatile alone or in steam below 125°, products are obtained having decreased toxic action and increased anaesthetic action, and which may be heated at 125° without decomposition.

B. FULLMAN.

**Manufacture of water-soluble protein-silicic acid compounds.** J. A. VON WÜLFING (G.P. 439,043, 3.12.24).—Compounds valuable in place of sodium silicate against arteriosclerosis, carcinoma, and tuberculosis, are obtained by adding a solution of sodium metasilicate (or polysilicate with enough sodium

hydroxide or sodium-protein to form metasilicate) to an alcoholic suspension of acid proteins, e.g., nucleo-albumins or albuminates. Compounds of sodium metasilicate with casein and lactalbumin are described.

C. HOLLINS.

### XXIII.—SANITATION; WATER PURIFICATION.

**Analysis of insecticides containing finely-divided arsenic, borax, or p-dichlorobenzene.** M. FRANÇOIS and L. SÉGUIN (Ann. Falsif., 1927, 20, 217–224).—The constitution of a number of commercial rat-, mole-, and beetle-killers has been investigated. Those containing free arsenic are usually in the form of deep-coloured powders or pellets, and contain, in addition, a bait such as sugar and an absorbent such as sawdust, kieselguhr, or powdered pumice. Arsenic can generally be detected under the microscope and identified by sublimation in a narrow tube after separation of the soluble matter by washing. The metalloïd can be determined by oxidation with concentrated nitric acid (vegetable constituents are destroyed at the same time), diluting, rendering just alkaline with ammonia, and filtering. To the filtrate are added magnesium chloride solution and ammonia, and after 3 days the precipitate of magnesium ammonium arsenate is collected, washed, dried, and weighed. To detect the presence of soluble arsenic compounds, the use of which is illegal, the material is allowed to remain for 30 min. with two portions of cold water, the mixture filtered, and the filtrate evaporated to dryness. The residue is heated with strong nitric acid for 3 hrs. on a brine bath to destroy the sugar etc., and the residue, if any, analysed for arsenic as before. Arsenious and arsenic oxides are differentiated by the colour of the precipitate which the cold water extract gives with silver nitrate solution. Beetle-killers were found to consist usually of borax with a blue colouring matter, the former being readily detected by borax bead tests with cobalt nitrate or calcium fluoride. The colouring matter may be either ultramarine, indigo, or Prussian blue. These are distinguished by treatment with oxalic acid solution in the presence of lead acetate paper. Ultramarine dissolves giving a turbid solution and stains the lead acetate; indigo gives no reaction; whilst Prussian blue dissolves to form a blue solution, but does not colour the acetate paper. Moth preventatives were found to consist of p-dichlorobenzene either in solution or as pellets. This substance can be identified by its odour, by the production of hydrochloric acid when mixed with camphor and ignited, by its m.p. and b.p., or by its crystalline form after sublimation in a wide tube.

H. J. DOWDEN.

#### PATENTS.

**Antiseptic and disinfectant.** P. L. V. JAMOTTE (E.P. 259,233, 1.10.26. Conv., 1.10.25).—A stable bactericidal compound of dioxymethylene and bromine is prepared by oxidation in the cold of methyl alcohol with a solution of bromine in 100 vol. hydrogen peroxide, in the presence of vanadium oxychloride and mercury as catalysts. The addition of a small quantity of formaldehyde hastens the reaction.

B. FULLMAN.

**Alumina coagulant** (U.S.P. 1,643,962).—See VII.



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