

BRITISH CHEMICAL ABSTRACTS

B.—APPLIED CHEMISTRY

MAY 8 and 15, 1931.*

I.—GENERAL; PLANT; MACHINERY.

Measurement of viscosity. P. WOOG (Bull. Inst. Pin, 1931, 23—24, 41—47).—Details are given of the methods available for the measurement of viscosity in arbitrary and in absolute units. The units of absolute and kinematic viscosity ("poise" and "stokes," respectively) are defined and their wider usage is recommended.

S. S. WOOLF.

[Hydrostatic] pressure of foam as a measurable quantity. K. SCHIEBL (Chem.-Ztg., 1931, 55, 169—170).—The saturation of limed beet syrup with carbon dioxide produces foaming, the height of the foam being proportional to the alkalinity of the liquor. If this process is carried on with batch-working it can be controlled by the observation of hydrostatic pressure at the bottom of the vessel, and at a point above the original surface of the liquid. Time-pressure curves show the gradual rise of the foam and its partial settlement up to completion of the reaction. The method can also be adapted to continuous working, and it is thought that it may be applicable to other industrial processes.

C. IRWIN.

Application of legal requirements in the building of steam boilers to the chemical industry. SCHEFFEL (Chem. Fabr., 1931, 109—111).—Anomalies in German law relative to steam boilers and other pressure vessels such as autoclaves are criticised. A uniform code of specifications for all vessels required to withstand pressure and temperature is advocated. Points discussed include the use of cast steel, of stainless steel and non-ferrous metals, the strength of welded joints, expansion allowances, and safety factors.

C. IRWIN.

Necessity for the chemical supervision of boiler feed water. H. PROSKE (Chem.-Ztg., 1931, 55, 226—227).—An example is quoted showing the necessity for careful adjustment of the lime and soda used in the Reisert-Derveaux method of softening boiler feed water. In the case cited too large an excess of soda was used and insufficient time was allowed for the precipitate to settle; as a result undue foaming occurred in the boiler and a deposit of soluble salts formed in the superheater tubes which finally caused the complete stoppage and bursting of a tube. The deposit contained 67% Na_2SO_4 , 29% Na_2CO_3 , 1% NaCl , and 1.2% $\text{Fe}_2(\text{SO}_4)_3$ and, except for a small amount of silica and calcium sulphate, was completely soluble in water. The same water, when properly softened, behaved quite satisfactorily in a similar type of boiler.

A. R. POWELL.

Method of representing the analytical results obtained in the examination of boiler feed water. J. LEICK (Z. angew. Chem., 1931, 44, 100—102).—It

is recommended that the results should be expressed in millival (1 val = equivalent weight in g./litre); as most of the titrations are made with 0.1N-reagents the number of c.c. required in the titration of 100 c.c. of water gives directly the amount of the substance present in millival. By multiplying the results by the g.-equiv. of the substance the amount of the substance present in mg./litre is obtained.

A. R. POWELL.

Nomograms in chemical technology. A. SULFRIAN (Chem.-Ztg., 1931, 55, 209—211).—The applications of nomograms in industrial chemistry are reviewed. A nomogram for use in the control of boiler and domestic water, which facilitates conversions from one to another of the various scales of hardness, calculations from analytical data, and the evaluation of the quantities of reagents required for conditioning any type of water, is reproduced and explained in detail. Various methods of expressing the composition of a specimen of water are discussed, and it is recommended that all quantities be expressed in milliequiv. per litre.

H. F. GILLBE.

Nomography. O. LIESCHE (Chem. Fabr., 1931, 4, 122).—The nomogram described shows the weight to which a solution must be evaporated, or a solid dried, in order to increase the percentage content of non-volatile matter to a predetermined value.

H. F. GILLBE.

Horizontal tank chart. W. F. SCHAPHORST (Ind. Eng. Chem., 1931, 23, 314—315).—A nomogram is given for determining the volume (gals.) of liquid at any depth in tanks of 2—200 in. in diam. and up to 100,000 in. long.

W. J. WRIGHT.

Inexpensive crystal or molasses separator. R. H. KING (Ind. Eng. Chem., 1931, 23, 300).—The device comprises a container constructed from $\frac{3}{4}$ -in. pipe, having a perforated plug and sieves for drainage at the lower end, and a plug with a central hole at the upper end through which air at any desired pressure is admitted. The efficiency of crystallisation of the liquid is determined from the ratio of the concentration of the product in the original magma to that in the mother-liquor after crystallisation.

W. J. WRIGHT.

Control of distillation columns. M. PÉREARD (Chim. et Ind., 1931, 25, 286—290).—For each column the temperature on a particular plate near the top corresponding to the desired removal of a constituent, e.g., alcohol from a distillery effluent, is determined by experiment, and this temperature is maintained by automatic control of the steam supply. When live and exhaust steam are used they should be mixed before entering the column, the live-steam supply being automatically regulated. A preheating condenser and a water-

* The remainder of this set of Abstracts will appear in next week's issue.

cooled condenser in series are indicated. The speed of the vapour through the column should not be too great, otherwise the plate efficiency will be reduced and priming will result.

D. K. MOORE.

Heat transmission to water flowing in pipes. Effect of tube length. A. E. LAWRENCE and T. K. SHERWOOD (Ind. Eng. Chem., 1931, 23, 301—309).—Experiments were carried out on heating water flowing through a copper tube (inside diam. 0.593 in.) at velocities of 0.62—22.4 ft./sec., the tube being heated by means of a steam-jacket, and its surface temperature determined by means of thermocouples. Data are tabulated for pipes 11.09, 9.03, 6.03, and 2.91 ft. in length. The calculated film coefficients for the water side fall within narrow limits, but are not proportional to the pipe lengths. It is concluded that for turbulent flow the effect of pipe length on the film coefficient of heat transmission is negligible, and this is confirmed by graphical analysis of the data on the overall coefficients of heat flow from steam to water. The film coefficients for condensing steam on the outside of the pipes agreed with the Nusselt equation.

W. J. WRIGHT.

Flax residues.—See V.

PATENTS.

Heat-treatment furnaces. ELECTRIC FURNACE CO., LTD., and D. F. CAMPBELL (B.P. 343,306, 7.2.30).—The furnace is electrically heated and is operated in a horizontal position and then pivoted to a vertical position so that the goods may be discharged directly into a quenching bath without contact with the air; as an additional precaution, goods, such as drills or rods, may be inserted into nickel-chromium tubes.

B. M. VENABLES.

Furnaces and/or apparatus for the annealing or heat treatment of metal and other goods. A. SMALLWOOD and J. FALLON (B.P. 343,187, 22.11.29).—In a continuously operating apparatus having a slowly moving conveyor, the latter is provided with upstanding vanes which almost make contact with the walls of zones at each end of the furnace, to which zones inert gas is supplied, forming seals preventing the ingress of air.

B. M. VENABLES.

Operation of reversible regenerative furnaces. W. ALBERTS and P. ZIMMERMANN (B.P. 344,289, 9.5.30. Ger., 21.5.29).—A connexion having an adjustable valve is provided between the upper parts of the air and gas uptakes, so that a proportion of the waste gases leaving by the air port may be diverted into the gas regenerator; the connexion is useful when the gas ports are restricted for the use of rich gas.

B. M. VENABLES.

Rotary kilns. M. VOGEL-JØRGENSEN (B.P. 343,513, 18.11.29. Denm., 26.10.29).—The low thermal efficiency of a rotary kiln compared with that of a shaft kiln is considered to be largely due to poor heat transmission from the gases and walls to the material. A rotary kiln is therefore provided at the calcining zone, and, if desired, also at the preheating zone, with outwardly extending chambers (bulb-shaped in cross-section) in which the material is lifted and showered across the path of the gases. Alternating with these chambers, in positions such that the showering material does not enter

them, are other openings which serve for the outlet of gases of combustion and are regulable by dampers operated while the kiln is in motion.

B. M. VENABLES.

Apparatus for recovery of dry-distillation material. L. HONIGMANN and F. BARTLING (U.S.P. 1,774,554, 2.9.30. Appl., 2.6.26. Ger., 2.6.25).—Dust-like or granular material from dry-distillation processes in which a revolving hearth is used is transported pneumatically to a closed chamber provided with baffles and an outlet pipe. Steam may be injected into the chamber to induce separation of dust without producing condensation of the distillation products. The separated dust is carried by means of a vertical, revolving worm into a cooling chamber communicating with the bottom end of the separating chamber, and may be removed continuously from the lower end of the cooling chamber by a second revolving worm.

H. E. BLAYDEN.

Furnace-wall structure. F. J. TONE, Assr. to CARBORUNDUM CO. (U.S.P. 1,775,414, 9.9.30. Appl., 21.1.26).—Water-tubes coated with a silicon carbide refractory are built into the lining of a furnace which is constructed of blocks of that material, these being mechanically interlocked with the tubes; the wall of the furnace is thereby supported throughout its entire area and slipping or movement prevented.

C. B. MARSON.

Heat-insulating material made of a metal or of textile fibres. C. KOHLER (B.P. 343,632, 5.12.29. Switz., 12.12.28).—The material is made of textile or metallic tubular fibres which are evacuated without collapsing the walls; the material is also enclosed in an airtight shell.

B. M. VENABLES.

Transference of heat from solid surfaces to liquids and semi-liquids. E. METCALFE-SHAW (B.P. 342,830, 3.12.29. U.S., 3.12.28).—The liquid is spread in a thin layer on a heated moving surface and is kept turning over by a number of plough-like devices, preferably formed on the ends of wires having a certain amount of resilience and arranged in such a way that the space cleared by one plough is covered by the tilth from the next.

B. M. VENABLES.

Processing plant [for canned goods etc.]. CARRIER ENG. CO., LTD., and W. S. YARROW (B.P. 342,722, 4.11.29).—The apparatus comprises a fixed cylindrical chamber within which a drum of smaller diameter rotates slowly. The drum is provided with longitudinal ribs interrupted to allow the intercalation of circumferential ribs on the interior of the fixed casing; in one longitudinal line spaces are left in all the circumferential ribs, and at the ends of this line charging and discharging means for one can at a time are provided. Every cell contains a can and each can goes round a complete circle and is then pushed to the next circle and so on through every circle, the cooking being effected by steam or other hot fluid in the chamber.

B. M. VENABLES.

Heat-exchange apparatus. A. D. HARRISON (B.P. 342,959, 10.4.30. U.S., 10.4.29).—An exchanger of the filter-press type is described. Circular plates with uninterrupted packing rings are utilised.

B. M. VENABLES.

Construction of air preheaters or other heat-exchange apparatus. R. P. WALLIS (B.P. 343,600, 26.11.29).—The oval tubes of a heat exchanger are arranged in staggered rows in such a manner that the passages for the outer transversely flowing fluid are of constant cross-section, which area may have any desired relation to the cross-section available for the inner fluid. The ratio of the axes of the elliptical tubes is made as large as is possible consistent with preserving enough flow area, so as to reduce the distance of any particle from the tube walls. B. M. VENABLES.

Method of heat exchange between viscous liquids. H. BOOTH, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 343,231, 10.12.29).—A comparatively non-viscous liquid, *e.g.*, water, under a pressure suitable to the temperature is continuously circulated between two exchangers, flowing inside the tubes at such a speed that the flow is always turbulent. The viscous fluids (*e.g.*, oils for cracking purposes) flow in a zig-zag manner outside the tubes of their respective exchangers. B. M. VENABLES.

Minimising the formation of scale and similar deposits in steam boilers, evaporators, condensers, boiling pans, coolers, etc. W. THALHOFFER (B.P. 343,025, 8.11.29. Austr., 1.12.28).—The electro-osmotic conditions existing in the scale are changed at arbitrary intervals of not less than one week by the addition of chemical substances to the feed water alternately with additions of other substances or with periodical use of electric currents, with the result that the scale already formed is caused to drop off. B. M. VENABLES.

Water-cooling towers. L. G. MOUCHEL & PARTNERS, LTD., and A. T. J. GUERITTE (B.P. 343,288—9 and 343,415, [A, B] 23.1.30, [C] 18.12.29).—The patents refer to cooling towers constructed of brick and/or concrete. In (A) a profile is described, in (B) a method of construction partly in brick and partly in reinforced concrete, in (C) a method of reinforcing the concrete. B. M. VENABLES.

Drying of wet materials [*e.g.*, wood]. AKTIEBOLAGET FRIBERG'S HÖGVACUUMPUMP (B.P. 343,981, 27.11.29. Swed., 29.11.28).—The material to be dried is heated by direct steam in a closed chamber which is afterwards evacuated to remove air etc. Then steam is readmitted, but the temperature is not allowed to rise above 60°, and during part at least of the second steaming period the pressure must be below 200 mm. Hg. The chamber is then again evacuated until the temperature of the material falls to 35–40°. The second steaming and evacuation process may be repeated as often as is necessary and the use of superheated steam is sometimes desirable. B. M. VENABLES.

Apparatus for extracting liquid from finely-divided material. L. ALTPETER, and GUTEHOFFNUNGSHÜTTE OBERHAUSEN A.-G. (B.P. 344,293, 19.5.30).—For the dehydration of finely-divided coal or similar material which retains too much moisture when treated in a centrifuge of the decanting type, thus clogging the meshes of the basket of an extractor of the strainer type, a centrifuge with impervious walls is converted into a strainer by the provision through the walls of devices through which the liquid can leave from points

of large radius, but only in an inwardly inclined direction so that the heavier solid matter does not enter the discharge passages. B. M. VENABLES.

Dehydrator. C. DUNNING (U.S.P. 1,775,036, 2.9.30. Appl., 13.12.26).—The apparatus, suitable for delicate liquids, comprises a casing, through which heated or unheated air is blown, containing a sort of water-wheel of considerable axial width, the radial vanes of which are composed of wire-mesh or other perforated material, and each terminates in a lifting trough the liquid from which is spilled over the mesh work after the vane concerned has reached the horizontal. The bottom of the casing is curved to the shape of the wheel over an arc of about 90° and has a subsidiary trough to draw off the liquid when sufficiently concentrated; during most of the period of concentration the supply of liquid is constant to maintain the depth of the bath. B. M. VENABLES.

Utilising the waste heat of moisture in drying apparatus which is charged and discharged continuously. W. E. EVANS. From MADRUCK GES. F. MASCHINELLE DRUCKENTWÄSSERUNG M.B.H. (B.P. 343,593, 23.8.29. Cf. B.P. 338,950; B., 1931, 329).—It is intended to dry peat, lignite, etc. in the complete absence of air so that the water vapour produced can be completely condensed at a temperature only slightly below 100°, with consequent improvement in the re-utilisation of the latent heat. The drying zone is operated at a pressure slightly above atmospheric and the charging and discharging apparatus at the ends of the dryer are maintained full of the material from which the air is expelled by steam diffusing outwards. The bulk of the steam is led off by pipes to a heat-exchanging condenser and the resistance of the pipes etc. automatically produces an increase in pressure. B. M. VENABLES.

Grinding mills. BABCOCK & WILCOX, LTD. From BABCOCK & WILCOX Co. (B.P. 343,257 and 344,124, 2.1.30. Addns. to B.P. 334,058; B., 1930, 970).—Modifications to the apparatus described in the prior patent are described. Thus, *e.g.*, in (A) the screen within the upper ring of balls is replaced by a conically shaped, imperforate plate, and in (B) the air is led at high velocity inside the lower ring of balls and at a lower velocity outside the upper ring. B. M. VENABLES.

Mills for grinding paints, enamels, inks, and other viscous substances. S. SMITH (B.P. 344,316, 24.6.30).—A roller mill in which the doctors are enclosed in a casing is described. B. M. VENABLES.

Hammers, beaters, or the like for pulverising mills. GEN. ELECTRIC Co., LTD., and D. H. WAYMARK (B.P. 342,605, 12.9.29).—A form of hammer head which can be adjusted outwards to compensate for wear is described. B. M. VENABLES.

Pulverisation of solid materials. M. MADORE (B.P. 343,759, 28.2.30).—The material is held centrifugally in a layer on the interior of a drum rotating it in one direction, and crushing is effected by rollers rotating about fixed axes in the other direction. B. M. VENABLES.

Crushing of ores [etc.]. J. G. CLOKE (B.P. 343,130, 11.11.29).—Fuel and other minerals, cereals, etc. are crushed by a number of mullers arranged in line in a trough or plane surface of which only that portion near the feed end is roughened. The mullers are fixed to a single frame which in turn is connected to the means for reciprocating it by a link from one point only, so that the ends are free to rise. Spaces are provided above the mullers through which water carrying finely-crushed ore can pass from end to end without further crushing, except that the passage is stopped at at least one intermediate point so that all material must pass under at least one muller. B. M. VENABLES.

Production of steel abrasive materials. S. D. LAYTON (B.P. 343,319, 24.2.30).—Steel "shot" is broken up into angular particles by crushing between rolls. B. M. VENABLES.

[Dry] separation of intermixed divided materials. A. E. WHITE. From R. PEALE, W. S. DAVIES, and W. S. WALLACE (B.P. 343,906, 23.10.29).—The apparatus is intended for the separation of materials that differ greatly in size but not much in sp. gr. It comprises two reciprocating tables, operated in tandem by the same mechanism but with independent control of the slope and stroke; the air supplies to the pervious decks are also separately controlled, though they may be derived from the same source. Provision may be made for a selected product from the first table to fall directly on to the second. B. M. VENABLES.

Jigs and like concentrators and classifiers. W. A. HARRIS (B.P. 342,682, 4.10.29).—In a multi-compartment jig the products are discharged through side or end chambers having adjustable, serrated, sliding doors to control the inlet apertures and mechanically operated or spring-controlled outlets which are also above the screen bed. B. M. VENABLES.

Porous medium [perforated rubber sheet] for aerating apparatus [for pulp]. F. P. EGEBERG, Assee. of W. T. MACDONALD (B.P. 344,238, 17.3.30, U.S., 18.3.29).—A method of making small, clear perforations through rubber is described. In the case of rubber sheet (0.06–0.1 in. thick), this is sandwiched between sheets of stiff paper and cut by a punch, the pieces of rubber removed being dumb-bell shaped. Claim is made for the use, as an air-dispersing diaphragm, of sheet rubber (or other elastic material), supported by means such as perforated metal and having 50–500 apertures per in.², each having a clear diam. of 0.005–0.02 in. B. M. VENABLES.

Filtering apparatus. PATERSON ENG. CO., LTD., and R. WHITEHEAD (B.P. 343,660, 24.12.29).—A system of pipes for the withdrawal of filtrate from, and the supply of wash-water and air simultaneously to, a filter bed is described. B. M. VENABLES.

Filters or strainers for petrol or other liquids. A. G. FENN, and ANGLO-AMERICAN OIL CO., LTD. (B.P. 343,219, 5.12.29).—A strainer suitable for attachment to the delivery end of a hose and easily opened for cleaning is described. B. M. VENABLES.

Centrifugal machines. T. BROADBENT & SONS, LTD., and J. V. LEVETT (B.P. 344,224, 5.3.30).—An

underdriven type of machine is described. The basket and motor form a rigid unit which is flexibly supported on the stand by a rubber buffer. B. M. VENABLES.

Purification of liquids. R. M. BERLINE (B.P. 317,453, 16.8.29, Luxemb., 16.8.28).—The purification of a liquid such as used transformer or lubricating oil, where the solid impurity is heavier and the liquid impurity more volatile than the stock, is effected in a centrifuge provided with an airtight casing at the discharge end in which the issuing fluid is subjected to a vacuum or to a current of inert gas while in a highly dispersed state. The gas may be circulated in a closed circuit through the casing, a condenser, and a reheater, or, alternatively, the raw oil may be heated. If the quantity of impurities is large the crude liquid may be pretreated in the centrifuge under atmospheric conditions. [Stat. ref.] B. M. VENABLES.

Means for separating particles from free water. C. B. THORNE (B.P. 343,327, 26.2.30).—The apparatus comprises a slowly rotating drum which is slotted and provided with a surrounding framework supporting filter medium in a number of V-shaped pieces which bridge the slots. The white-water or other prefilter is supplied to the interior of the drum and the collected pulp flushed from the filter, backwards through the slots, into a trough below the upper circumference of the drum. The drum is rotated intermittently, as required, by the incipient clogging of the then lower part, by means of a ratchet wheel operated (or not) by a hit-and-miss pawl controlled by a float. B. M. VENABLES.

Evaporators. O. ENGISCH (B.P. 344,125, 2.1.30, Addn. to B.P. 308,622; B., 1930, 399).—Pivoted, double-edged scrapers are placed between the deep corrugations of the rotating heating element described in the prior patent. B. M. VENABLES.

Evaporators intended particularly for generating high-pressure steam. K. BAUMANN (B.P. 342,815, 21.11.29).—A form of connexion between a tube-plate and an end-cover is described. B. M. VENABLES.

Evaporation and crystallisation of liquids and drying of materials. E.M.S. INDUSTRIAL PROCESSES, LTD., R. A. STOKES, and E. G. L. ROBERTS (B.P. 343,057, 11.11.29).—The apparatus comprises a number of troughs abreast, the material being assisted over the ridges by paddles. Heat exchange is provided for by jacketing the troughs throughout, and, in the case of some individual troughs, by having jackets or spaces in the paddles or their shafts. B. M. VENABLES.

Crystallisation of salts. A.-G. DER MASCHINEN-FABR. ESCHER WYSS & Co., Assees. of F. KRÄMER (B.P. 342,942, 19.3.30, Ger., 21.3.29).—A graining evaporator is arranged to afford rapid circulation round the heater. Crystals of a finer grain than is desired, that drop out of the circulation into a quieter zone, are drawn out by a pump, together with the minimum quantity of brine, and returned to the upper part of the evaporator. When the crystals become coarse enough they are drawn out from time to time through the bottom of the apparatus. B. M. VENABLES.

Crystallisation. E. HOLLAND-MERTEN (B.P. 343,553, 19.11.29).—A crystalliser of the rocking-trough type is

provided with means for the independent regulation of the rate and level of inflowing liquid, of outflowing liquid, and of outgoing crystals. B. M. VENABLES.

Apparatus for carrying out distillation processes. J. Y. JOHNSON. From I. G. FARBERIND. A.-G. (B.P. 342,741, 9.8.28).—In a distillation process involving the bubbling of a scrubbing gas through the liquid in the still, particularly when operating under reduced pressure, the scrubbing gas is used over and over again, being circulated from the upper part of the receiver to the lower part of the still by a pump. B. M. VENABLES.

Continuous distillation apparatus for the refining of oils and fats and for like purposes. BIRMINGHAM ALUMINIUM CASTING (1903) CO., LTD., P. PRITCHARD, and G. W. LACEY (B.P. 342,921, 25.2.30).—The apparatus comprises a vertical cylindrical vessel subdivided by a number of radial partitions. The liquid flows in series through all the compartments thus formed, but the vapour space is common to all. In addition to external heat, steam or other gas is injected through passages and fine apertures formed in the thickness of the partitions. B. M. VENABLES.

Condensing and cooling of vapours. E. B. GRUSELLE (B.P. 344,328, 26.7.30).—An ejector condenser is described. In addition to the supply to the ejector, water is sprayed on the underside of a conical baffle against which the incoming vapour impinges; provision is made for passing a refrigerant through a coil in the sump. B. M. VENABLES.

Bubble-tower grid. L. E. WINKLER and F. C. KOCH (U.S.P. 1,774,581, 2.9.30. Appl., 1.8.27).—A bubble cap with serrated edges is surmounted by a horizontal perforated plate or grid below the surface of the liquid to break up the rising bubbles. B. M. VENABLES.

Preparation of emulsions. E. B. MYERS, Assr. to H. W. DIX (U.S.P. 1,774,609, 2.9.30. Appl., 6.9.28).—The substance to be emulsified is ground in sulphite waste liquor between flexibly supported grinding surfaces, revolving preferably in opposite directions. Several stages with or without a preliminary ordinary grinding may be used. B. M. VENABLES.

Flaker for production of relatively thick flakes of a congealed liquid. E. A. TAYLOR, Assr. to GRASSELLI CHEM. CO. (U.S.P. 1,775,177, 9.9.30. Appl., 13.10.27).—A cooled drum dipping into a bath of, e.g., molten soap or sodium sulphide is rotated under such conditions that only a thin layer is formed at each revolution, but the scraper is put into engagement only for exactly one revolution out of several. B. M. VENABLES.

Gas-cleaning apparatus. J. H. LAWRENCE, Assr. to METROPOLITAN ENG. CORP. (U.S.P. 1,774,604, 2.9.30. Appl., 27.3.25).—The gases are directed against the surface of water to collect and quench cinders or large particles, and are then subjected to electrical precipitation. B. M. VENABLES.

Dust separators. F. W. WILSON, and TILGHMAN'S PATENT SAND BLAST CO., LTD. (B.P. 344,255, 1.4.30).—A system comprising a bag filter and exhaust fan is provided with five valves so that a reverse current of

atmospheric air may be blown through the bags to dislodge the collected dust. B. M. VENABLES.

Removal of solid particles from hot or corrosive gases. J. P. BAXTER, E. STEEL, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 344,227, 6.3.30).—The gases are filtered through the walls of a hollow prism of porous mineral substance which is contained in a housing of acid-resisting material constructed in such a way that a reverse current of gas may be applied to each wall of the prism in turn. The dislodged dirt falls into a hopper and is removed therefrom at intervals by a blast of inert gas. B. M. VENABLES.

Air liquefaction. I. H. LEVIN, Assr. to GAS INDUSTRIES CO. (U.S.P. 1,775,434, 9.9.30. Appl., 1.6.25).—An exchanger for a fluid which is likely to congeal comprises a vertical bundle of tubes provided with restrictions at their upper ends to increase the velocity and pressure-drop of the inner cooled fluid at or near its outlet. The outer fluid flows downwards in a zig-zag manner. B. M. VENABLES.

Gas analysis. AKTIEB. CARBA (B.P. 342,995, 2.8.30. Swed., 3.8.29).—The apparatus is particularly suitable for the determination of both oxides of carbon in flue gases. Before reaching apparatus of known type for the continuous determination of carbon dioxide the sample of gas is passed through a combustion chamber which is heated electrically and unheated during alternate periods. The automatic switch may be controlled either by time or by the temperature of the combustion chamber itself, and if combustion is arranged to take place at two temperatures, e.g., 250° and 700°, the quantity of combustible constituents other than carbon monoxide may also be measured. B. M. VENABLES.

Diffusion apparatus for detecting and indicating the presence and proportion of absorbable gases. H. R. WEBSTER (B.P. 342,949, 2.4.30).—A chemical absorbent is placed within a porous cylinder; one end-closure of the cylinder affords means for easy renewal of the absorbent, the other embodies a thin diaphragm or other means for measuring the partial vacuum. B. M. VENABLES.

Apparatus for automatically testing gases [volumetrically]. C. A. HARTUNG (B.P. 343,874, 21.8.29).—More than one constituent of a mixture of gases may be determined by the same reacting gas by maintaining the temperature of the reaction chamber and contact substance (e.g., by an electrically heated wire spiral) between two limits, the lower determined by the temperature at which the desired reaction starts, and the upper by the commencement of undesired reactions. E.g., carbon monoxide may be oxidised at 250°, and in the remainder of the same sample hydrocarbons may be oxidised at 800°. B. M. VENABLES.

Catalytic gaseous reactions. J. L. BRILL (B.P. 342,854, 31.12.29. U.S., 31.12.28).—In carrying out exothermic gas reactions at temperatures higher than the external gas conduits can withstand, and using a main catalyst which is not active at such lower temperature, the pressure-resisting vessel may be made of metal superior to that necessary for the drawn pipes and may also be kept cool by the entering gases. The initial rise of temperature is obtained by the use of an auxiliary

catalyst which effects an exothermic reaction, not necessarily the finally desired reaction, at a lower temperature. Two methods of arranging the catalysts are described.

B. M. VENABLES.

[Carrying out] catalytic gas reactions [e.g., synthesis of ammonia]. DU PONT AMMONIA CORP., Assees. of R. WILLIAMS (B.P. 344,119, 31.12.29. U.S., 31.12.28).—In a process wherein the poisoning of the main catalyst is prevented by a subsidiary reaction in an auxiliary catalyst (which may sometimes be of the same nature as the main catalyst) the heat of the purifying reaction is not usually sufficient to maintain the temperature of the auxiliary catalyst if the feed gases were passed through it first. To avoid the separate heating of the auxiliary catalyst the process is worked on the following cycle: the gaseous reactants are passed through the hot main catalyst, the make-up unpurified gases are added, and the whole is passed through the auxiliary catalyst, the desired products being then removed in external apparatus and the residual gaseous reactants returned.

B. M. VENABLES.

Gaseous reactions taking place in the presence of steam or water vapour. O. PIETTE, and UNION CHIM. BELGE, SOC. ANON. (B.P. 342,701, 4.11.29).—When carrying out gaseous catalytic reactions in the presence of excess of steam, the steam condensed from the cooling emergent gases is transferred to the entering gases in the stages of a heat exchanger, the transfers being made from and to points at substantially the same temperature; the pressure of the hot and wet gas at the inlet end of any transfer pipe is slightly above that of the comparatively cool and dry gas at the outlet.

B. M. VENABLES.

Sp. gr. indicators or recorders. J. L. HODGSON (B.P. 343,218, 5.12.29).—The apparatus comprises a pair of displacers balanced on a scale beam and submerged in the liquid of which the sp. gr. is to be determined. The liquid is continuously renewed and may be under pressure, in which case the swing of the beam may be transmitted to the outside by magnetic means. One displacer is much larger than the other and is hollow. It is filled with liquid of suitable coefficient of expansion in relation to the liquid under test, and, when the temperature rises, the excess liquid is expelled to another vessel situated so as to have no moment, i.e., surrounding or under the pivot.

B. M. VENABLES.

Furnace roofs. E. BLOCK (B.P. 344,724, 19.5.30). SCHEIDHAUER & GIESSENG A.-G. (B.P. 344,754, 4.7.30. Ger., 17.7.29).

Air- and water-cooled walls for furnaces and the like. AMER. ENG. CO. (B.P. 342,806, 19.11.29. U.S., 5.7.29).

Mechanisms for opening the doors of furnaces, retorts, etc. M. B. WILD & CO., LTD., and J. A. TURNER (B.P. 344,546, 14.12.29).

Refrigerating machines. E. KLEPETAR and A. SCHOENFELD (B.P. 344,706, 25.4.30. Austr., 19.7.29).

Lubricating devices for centrifugal separators. AKTIEB. SEPARATOR (B.P. 345,097, 20.3.30. Swed., 22.3.29).

Moving-chamber [measuring] apparatus for granular and pulverulent materials. C. W. O'LEARY (B.P. 343,987, 31.8.29).

Drum-type mill.—See V. Catalyst carriers.—See VII. Lehr.—See VIII. Fireproof paste.—See XIII.

II.—FUEL; GAS; TAR; MINERAL OILS.

Inflammation of coal dusts: effects of the presence of firedamp. T. N. MASON and R. V. WHEELER (Safety in Mines Res. Bd., 1931, Paper No. 64, 33 pp.).—As a result of tests on the dusts from 7 coals of volatile matter content (ash-free dry basis) 13–44% in the Buxton explosion gallery, it is shown that (i) the inflammability of a coal dust, determined experimentally, can be expressed as the least proportion, S , of incombustible matter required to be added to suppress inflammation, or as the ratio $100/(100-S)$; (ii) there is a fairly regular relationship between the volatile matter content of a coal (V) and its inflammability: the index of inflammability, $100/(100-S)$, is given by the derived expression $V/12.5$, i.e., $S = 100 - 1250/V$, an expression which enables calculation to be made for any coal dust, of known volatile matter content, of the proportion of incombustible matter required to be added to suppress inflammation; (iii) from the experimental results with 7 coal dusts, and up to 4% of firedamp in the air, for each 1% of firedamp the proportion of incombustible dust required to suppress inflammation must be increased by $(100-S)/6$; (iv) the additional amount of incombustible dust required to suppress inflammation of coal dusts of known volatile matter content for each 1% of firedamp in the air can be derived from the relationships given above, and is S (additional) $= 208/V$.

C. B. MARSON.

The hydrogen in coal. A. ECCLES, G. H. KENYON, and A. McCULLOCH (Fuel, 1931, 10, 4–15. Cf. Marsh, McCulloch, and Parrish, J.S.C.I., 1929, 48, 167 T; Eccles and McCulloch, B., 1930, 933).—A study has been made of the chlorination and subsequent distillation of four British coals of different rank. The finely-divided coals were subjected to the action of a current of chlorine for 50 hrs. and the products were stored in a vacuum desiccator over solid potassium hydroxide until they had attained a constant weight. The percentage increases in weight varied from 31% to 66%, and the increases in volume from approx. 25% to 60%. The chlorinated coals were distilled in 100° stages up to 900° in a laboratory assay apparatus, and the volume and composition of the gases evolved at each stage were determined. No tar was evolved. No paraffin hydrocarbons could be detected in the gases evolved below 500°, and in those evolved at higher temperatures methane was the only hydrocarbon present. Hydrochloric acid began to be evolved below 200°, and the evolution continued up to 500–600° and then ceased except with one coal ("Welsh Main"), which continued to evolve hydrochloric acid, but at a diminished rate, up to 900°. The results obtained with the other three coals can be summarised as follows: (a) the percentage of the total hydrogen evolved as hydrochloric acid and water during chlorination, and as hydrochloric acid

during distillation, was considerably greater with a bituminous and a sub-lignitic coal than with an anthracite; (b) the percentage of the total hydrogen evolved as water above 200° increased in the same order as the oxygen contents of the coals; (c) the percentage of the total hydrogen evolved as methane was approximately the same with all three coals; (d) the percentage of the total hydrogen evolved in any form above 600° was of the same order as the proportion remaining in the coke produced by the direct carbonisation of the coal at 600°; (e) the hydrogen contents of the cokes obtained by distilling the chlorinated coals at 900° were less than those of the cokes obtained by direct distillation of the coals at the same temperature. Chlorination and distillation caused a concentration of the carbon in the coke at the expense of the gaseous and liquid hydrocarbons obtained when the coal is distilled in the usual manner. The abnormal behaviour of one coal is attributed to its high content of pyritic sulphur, the presence of pyrites modifying the action of the chlorine on the coal.

A. B. MANNING.

Combustion tests with Illinois coals. A. P. KRATZ and W. J. WOODRUFF (Univ. Ill. Eng. Exp. Sta. Bull., 1930, No. 313, 58 pp.).—Performance characteristics in boiler tests are recorded.

CHEMICAL ABSTRACTS.

Primary oxidation of bituminous coals. W. FUCHS and O. HORN (Brennstoff-Chem., 1931, 12, 65—67).—By treating the coal with nitric acid (*d* 1.4) at 90—94° the humins have been converted into products having the properties of hydroxycarboxylic acids. These form potassium salts on treatment with alcoholic potassium acetate, and ether-esters on treatment with methyl alcohol and hydrochloric acid, or with diazomethane in ether. The primary oxidation products are partly soluble in organic solvents, but are not always peptisable by aqueous sodium hydroxide. Treatment with alkali and then with aqueous pyridine converts them almost completely into water-soluble products; on acidification of the solution with hydrochloric acid, acids of higher basicity than that of the primary products are precipitated. The oxidation products from anthracite and boghead coals cannot be converted into water-soluble products by this treatment.

A. B. MANNING.

Action of various solvents on coal. J. C. PEW and J. R. WITHROW (Fuel, 1931, 10, 44—47).—An Ohio coal was extracted with various organic solvents. The monoalkyl ethers of ethylene and diethylene glycols dissolved 10—12% of the coal. The dialkyl ethers had a considerably lower solvent action, whilst that of the esters of the monoalkyl ethers was very slight. Glycol itself had no solvent action. A solution of potassium hydroxide in ethylene glycol monoethyl ether extracted over 30% of the coal, which was of the same order as the amount extracted by pyridine. The residue showed a high affinity for oxygen. A study of the action of these solvents on a variety of coals should yield useful information on their coking properties.

A. B. MANNING.

Heats of coking and of decomposition of coal. III. E. TERRES and K. VOITURET (Gas- u. Wasserfach, 1931, 74, 97—101, 122—128, 148—154, 178—183).—

The methods used previously for determining the heat of coking (cf. B., 1927, 177; 1928, 508) have been modified to allow of more accurate calibration of the apparatus. The method consists essentially in heating the coking system electrically by a current of constant magnitude until thermal equilibrium is established. The thermal capacity of the empty coking system in the range 600—1100° is then directly proportional to the temperature and is independent of the time and amount of heat required to reach the desired coking temperature. The coking system is contained in a water-jacketed calorimeter and is heated to the desired coking temperature and maintained at that temperature until thermal equilibrium is established in the bomb constituting the coking system. The total heat added (a) to the system during this period is found by measuring electrochemically the total current used. The heat absorbed (b) by the calorimeter is observed, and the heat content (c) of the coking system at the coking temperature used is deduced from previous calibration experiments in which quartz powder or graphite is used. The heat utilised in coking the air-dried coal (10 g.) is then given by $a-b-c$. It is necessary to measure the heat content of the gaseous products when the heat of decomposition of the coal is to be determined. Fifteen coking and gas coals were examined by the method described. Each coal gave a characteristic curve for the heats of coking at temperatures between 600° and 1100°. No relationship was observed between the results of analysis of the coals and the heat of coking at various temperatures. Increase in the time of storage resulted in increased heat of coking due to a decrease in the exothermic reactions accompanying carbonisation. The heat of coking of moist coal could not be calculated from the heat of coking of air-dried coal. The methods in use for determining the heat of decomposition of coals are discussed. The values for the heat of decomposition of 28 coals (including the English coals, Boldon and Easington) in the range 600—1100° were determined. A relationship was shown to exist between heat of coking and heat of decomposition for the coals examined. It is concluded that the heat of coking of a coal which undergoes neither exothermic nor endothermic reactions during carbonisation amounts to 325 kg.-cal. per kg. of "pure coal." Coals undergoing exothermic reactions have smaller, those undergoing endothermic reactions larger, heats of coking. Large negative values of heats of decomposition are possible by carbonisation at 1000°, but the positive value of heat of decomposition rarely exceeds 50 kg.-cal. per kg. of "pure coal."

H. E. BLAYDEN.

Compressed low-temperature coke. E. ROSER (Brennstoff-Chem., 1931, 12, 86—87).—The finely-ground coal was charged into vertical cylinders of highly heat-resistant steel (30 cm. diam.; 280 cm. high), and compressed therein to a bulk density of about 1.0. The charged cylinders were placed in the chamber of an ordinary coke oven and the coal was carbonised therein at 750°. Strong, uniform cokes were produced, even when carbonising a 1:1 blend of coking coal and anthracite. The yields of gas and tar were not determined.

A. B. MANNING.

"Melting" of coal during coke formation. R. G. DAVIES and R. V. WHEELER (Fuel, 1931, 10, 100—108).—The plastic flow of a number of French and British coals has been studied by Audibert's method (B., 1927, 383). Although this method has been found of great value in the investigation of the phenomena of coking, Audibert's conclusions relative to the "melting" of coal during coke formation have not been confirmed. The pellet of coal does not become perfectly fluid between the softening and intumescence points; moreover, the apparent homogeneity of the heated pellets is due to surface flow occurring when the specimen is polished. If the surface is subsequently etched the pellet is seen to be heterogeneous.

A. B. MANNING.

Determination of the hardness of coke. F. G. HOFFMANN (Brennstoff-Chem., 1931, 12, 61—65. Cf. Dörfinger, B., 1927, 898; Wolf, B., 1928, 177).—The influence of fissures and internal strains in the coke on the determination of its hardness by the trommel test, the shatter test, and Wolf's pressure test is discussed, and a distinction is drawn between the true hardness of the coke and its "lump strength." Thus a highly fissured coke might possess a low "lump strength" combined with great hardness. The most suitable method for evaluating both these factors consists of a trommel test followed by at least a double-sieve separation of the material, in which, *e.g.*, the percentages over 40 mm. and under 10 mm. are determined. Before subjecting the coke to the test a preliminary sieving over the 40-mm. sieve is recommended.

A. B. MANNING.

Origin and decomposition of organic sulphur compounds under gas-making conditions, with particular reference to the rôle of the carbon-sulphur complex. J. C. HOLTZ (Fuel, 1931, 10, 16—30).—The gas produced on cracking a high-sulphur oil (3.6% S) at 650° contained no carbon disulphide; this, however, was formed in increasing amounts as the cracking temperature was raised above 650°. Carbon disulphide was formed also when a sulphur-free oil was cracked at 850° in the presence of a gas containing hydrogen sulphide; part of the latter, however, was converted into sulphur compounds other than carbon disulphide. When nitrogen containing hydrogen sulphide was passed over sugar charcoal at 850° neither hydrogen sulphide nor carbon disulphide could at first be detected in the outlet gas; after a time a gradually increasing amount of hydrogen sulphide was detected in the gas, and after a further interval carbon disulphide appeared among the reaction products; at the end of the experiment the charcoal contained 2.8% S. When the high-sulphur gas oil was cracked in a tube packed with pumice the sulphur was at first absorbed by the layer of deposited carbon and was later evolved as carbon disulphide. These phenomena are attributed to the formation of a solid carbon-sulphur complex. The influence of various factors on the equilibrium conditions reached when nitrogen containing hydrogen sulphide was passed over charcoal was studied. A rise in the temperature or an increase in the concentration of the hydrogen sulphide caused an increase in the concentration of the total organic sulphur as well as of the carbon disulphide in the outlet gas. The presence of

carbon monoxide or oxygen caused an increase in the concentration of organic sulphur, the increase taking place principally in compounds other than carbon disulphide. Addition of hydrogen caused a decrease in the concentration of organic sulphur. Addition of water vapour did not affect the total organic sulphur, but decreased the concentration of carbon disulphide.

A. B. MANNING.

Application of glass filters in gasworks' practice. H. BRÜCKNER (Gas- u. Wasserfach, 1931, 74, 121—122).—The determination of ammonia in gases (*e.g.*, coal gas) by absorption in standard sulphuric acid may be effected with accuracy and economy of time by using washing vessels in which the gas enters the washing liquid through a sintered glass filter plate, which allows of efficient washing of a rapid stream of gas. The results of the application of this method to the control of ammonia washers are given. Sintered glass washing vessels may also be used in the determination of hydrogen sulphide in gas by absorption in iodine solution and for the saturation of a gas with the vapour of a liquid, but not for reactions in which precipitation occurs.

H. E. BLAYDEN.

Determination of tar fog in coal gas, using glass filters. H. BRÜCKNER (Gas- u. Wasserfach, 1931, 74, 183—184).—The most efficient separation of the tar is effected by passing the gas (at a rate of 80—120 litres/hr., according to the tar content) through a weighed dry filter consisting of a pad of cotton wool contained in a tube sealed on to a bulb containing two separated, sintered glass filters. The amount of gas passed through the filter is measured by a meter. The filter is finally dried to a constant weight by passing through it a current of dry air at 50—60°. The increase in weight of the filter gives the amount of tar separated. The filter is readily cleaned by the usual solvents or chromic acid mixture.

H. E. BLAYDEN.

The tetralin process [for gas]. G. WEISSENBARGER (Gas- u. Wasserfach, 1931, 74, 154—156).—For efficient action the tetralin process requires complete dispersion of the tetralin in the gas. Examples of two types of apparatus for this purpose are described. One type involves vaporisation of the tetralin (*e.g.*, by means of electrical heating elements immersed in the liquid tetralin contained in a suitable reservoir) and injection of the vapour into the gas mains; in the other type the liquid tetralin is injected as a fine spray into the gas-mains by means of an injector actuated by compressed gas. The amount of tetralin delivered to the mains is determined by the rate of heating in the one case and by the amount of suction at the injector in the other, the amount required being: $x = 5m(A + 8)/100,000$, where x is the amount of tetralin required in kg. per day, m is the quantity of gas in cub. m. per day, and A is the naphthalene content in g. per 100 cub. m.

H. E. BLAYDEN.

Simple waste-gas diagram for excess air. L. ZIPPERER (Gas- u. Wasserfach, 1931, 74, 199—200).—Directions are given for the construction of a diagram on the basis of the composition of the waste gas resulting from theoretically complete combustion of the gas under consideration. The excess of air corresponding to a given percentage of carbon dioxide in the dry

waste gas and the proportions of the individual constituents of the dry waste gas may be determined from the graph.

H. E. BLAYDEN.

Recovery of phenol from gas liquor. C. SCHÖNBURG (Brennstoff-Chem., 1931, 12, 69—71).—The liquor is extracted with tolyl phosphate, and the phenol is recovered by distillation in steam under reduced pressure. Tolyl phosphate possesses the advantages over benzene of a higher solubility for phenol (the distribution coefficient of phenol between tolyl phosphate and water being about 20 times that between benzene and water), a lower solubility in water or gas liquor, and a much lower vapour pressure (b.p. 280—285°/10 mm.). Moreover, the method of recovering the phenol is simpler, involving only a distillation instead of an extraction with sodium hydroxide solution. Economically considered, these advantages greatly outweigh the increased cost of the solvent.

A. B. MANNING.

Tar removal by electrostatic precipitation (Simon-Carves system). V. F. GLOAG and J. P. V. WOOLLAM (Fuel, 1931, 10, 137—141).—The plant comprises a transformer, a static copper oxide rectifier, and a precipitating chamber built up of 6-in. steel tubes down the centres of which hang the high-tension electrodes. The tar is precipitated on the sides of the steel tubes, which are earthed, and collects at the bottom of the chamber. The power consumption is less than 1 kw. per 100,000 cub. ft. of gas, and the back-pressure thrown by the plant is less than $\frac{1}{4}$ in. W.G.

A. B. MANNING.

Mechanism of the action of the electrical discharge on methane. K. PETERS and O. H. WAGNER (Brennstoff-Chem., 1931, 12, 67—68; cf. B., 1930, 848).—By suitably varying the experimental conditions it is possible to produce ethylene, ethane, and higher hydrocarbons, in addition to acetylene, by the action of the electrical discharge on methane under reduced pressures. The maximum efficiency of production of these hydrocarbons, however, is low. As the load is increased the colour of the discharge changes suddenly from pale blue to yellow. Before this change occurs the spectrum of the discharge shows the CH bands, and also, owing to the presence of nitrogen, the CN bands; after the change the C:C bands (Swan spectrum) and C⁺ bands are observed in addition. The mechanism of the reaction is discussed in relation to these phenomena.

A. B. MANNING.

Sakhalin crude oil. S. S. NAMETKIN and S. S. NIFONTOVA (Nef. Choz., 1930, 19, 421—422).—A Chakrui asphalt-base crude oil, containing no gasoline and little kerosene, *d* 0.943, *E*₅₀ 4.38, and a Lyangri crude oil, *d* 0.951, *E*₅₀ 3.6, are described.

CHEMICAL ABSTRACTS.

Distillation of heavy bottom oils by the Pengu-Gurvich-Nersesov method. G. TER-GRIGORYAN (Azerbaid. Nef. Choz., 1930, No. 11, 74—82).—The plant is described, and yields and composition of products are recorded.

CHEMICAL ABSTRACTS.

Significance of the Edeleanu refining process as a source of transformer, switch, and turbine oils. F. FRANK (Erdöl u. Teer, 1930, 6, 357—358, 375—376,

392—399; Chem. Zentr., 1930, ii, 3882—3883).—The oils may be refined and the decomposition controlled so as to convert oils not formerly applicable for all purposes (such as those of American origin) into valuable transformer or turbine oils. A number of oils from widely differing origin were treated by the process and the resulting oils of high value investigated. The results are summarised graphically and in tables. Special attention is directed to the ageing phenomena produced in these oils by the usual methods, and the relation of these phenomena to the behaviour of the oil in practice is discussed.

H. E. BLAYDEN.

Significance of the Edeleanu refining process for users of transformer, switch, and turbine oils. F. FOERSTER (Petroleum, 1931, 27, 60—65).—Objection is raised to the adoption of Edeleanu oil for transformer purposes on the basis of insufficient evidence of its merits. The investigations of Frank (cf. preceding abstract) are criticised adversely. It is considered that the method of comparison used by this author is open to objection. Revision of Frank's results of examination of the effect of catalysts, such as lead, copper, etc. indicate that the Edeleanu oil is inferior in some respects to the Russian oil with which it was compared.

H. E. BLAYDEN.

Refining of motor benzols and other fuels. The Instill process. ANON. (Gas World, 1931, 94, Coking Sect., 26—30).—In the Instill process, which endeavours to eliminate the use of large amounts of sulphuric acid, naphthalene and wash oils are removed by distillation, and the bases by sulphuric acid (*d* 1.30) in a continuous pyridine scrubber. The base-free spirit passes to the washer, and is heated to 55°, during which period 2—3% by wt. of "Instill refining medium" is added to the charge. Agitation is continued for 90 min. The benzol is then run through a filter and continuous neutraliser to the still and rectified. The extra plant required for the process is described. The refining medium consists of a mixture of ferric sulphate, absorbent earth, and free sulphuric acid. The benzol obtained conforms to N.B.A. specifications. In motor trials Instill benzol gave superior results to acid-washed spirit obtained from the same crude spirit; it contains more unsaturated hydrocarbons and less free sulphur. Cost sheets of the Instill and acid process are given.

A. H. EDWARDS.

Removing naphthenic acids [from oil]. Y. EMMUIL (Azerbaid. Nef. Choz., 1930, No. 11, 90—95).—In the apparatus described 85—90% of the naphthenic acids may be extracted from the oil by means of a caustic solution. The naphthenic acid contents of various fractions of Baku petroleum are recorded.

CHEMICAL ABSTRACTS.

Lacquer diluents.—See XIII. Coal as fertiliser.—See XVI.

PATENTS.

Coal-washing machines. G. NORTON (B.P. 344,082, 7.12.29).—A machine of the washer-box type is fitted with one or more air-compressing cylinders which control directly the supply of air to or from the chambers of the box. Suitable compressor designs and mountings are described in detail.

R. H. GRIFFITH.

Drying and pulverising of coal. W. RUNGE and E. A. PACKARD, Assrs. to INTERNAT. COMBUSTION ENG. CORP. (U.S.P. 1,775,324, 9.9.30. Appl., 15.1.26).—Two separators, two fans, a feeder, and a mill are arranged in two circuits so that coarse or already pulverised coal can be dried in waste flue gases (diluted, if need be, with fresh air) and, after grinding if necessary, transported away in fresh air. B. M. VENABLES.

Production of fuel to selected specifications. A. A. ROBERTS (U.S.P. 1,770,627, 15.7.30. Appl., 28.6.29).—Blocks of artificial fuel are prepared by subjecting moist mixtures of powdered carbonaceous materials (e.g., peat, lignite, coal, or wood waste), small amounts of a cementing material (such as a hydraulic cement), and an accelerator of combustion (e.g., magnesium chloride) to pressure in a cold mould, preferably slightly conical. The hardness and porosity of the block are under control. H. E. BLAYDEN.

Obtaining a [finely-divided] carbonaceous product. G. ANTONOFF and J. FREEDLAND (B.P. 342,653, 23.10.29).—Organic matter, such as wood shavings, is heated in an autoclave with dilute sulphuric acid for a short time, under a pressure of a few atm. The product, after washing, is oxidised by nitric acid, chlorine, or a similar reagent, after which it will dissolve in ammonia. Addition of acid to the filtered solution precipitates a moist colloidal material, which is then mixed with a large excess of phosphoric acid and carbonised at 400–450°. Treatment with water then separates an extremely finely-divided charcoal or carbon, which may have an apparent density as low as 0.078. Modification of the process may involve pretreatment with alkali and drying in admixture with sodium carbonate or sulphur in place of phosphoric acid. R. H. GRIFFITH.

Low-temperature carbonisation. J. Y. JOHNSON. From I. G. FARBERIND. A.-G. (B.P. 343,435, 11.11.29 and 11.8.30. Addn. to B.P. 301,975; B., 1929, 119).—Bituminous material is carbonised by contact with hot gases, the process being carried out by passing a stream of gas through small apertures in a number of superimposed grates mounted in a vertical furnace. The raw material is fed to the top grate and is gradually carried across it to a sluice through which it passes to a lower level; in this way it is continually agitated by the rising gas and gradually subjected to rising temperatures. The tars and gases produced at different levels may be withdrawn and condensed separately, or may be led into a common offtake. R. H. GRIFFITH.

Retorts for carbonisation of coal and similar materials. CHAMBER OVENS, LTD., A. H. LYMN, and N. J. BOWATER (B.P. 342,720, 4.11.29).—Superheated steam is raised, in coke-oven and similar carbonising apparatus, by a tubular system which is built inside the brickwork, at the top or in the intermediate walls of the setting. The steam thus provided is employed in making water-gas in the retorts; provision is also made for cooling the charging floors. R. H. GRIFFITH.

Apparatus for the carbonisation of fuel. E. RAMMELKAMP, Assr. to CHEM.-TECHN. GES.M.B.H. (U.S.P. 1,775,570, 9.9.30. Appl., 10.9.27. Ger., 21.9.26).—

Narrow, vertical heating and distillation chambers are arranged radially about a vertical axis and inside a closed chamber. The material to be carbonised (e.g., coal) falls from a hopper above the chamber into a charging space containing a vertical cylinder which rotates about an eccentric axis so as to push the coal through the distillation chambers. The solid and gaseous products escape through an annular space surrounding the heating and distillation chambers and may be suitably collected. H. E. BLAYDEN.

Extracting values from coals and the like. F. C. GREENE and I. F. LAUCKS, Assrs. to OLD BEN COAL CORP. (U.S.P. 1,775,280, 9.9.30. Appl., 9.4.19).—A vertical, cylindrical, externally heated retort is provided internally with a helix mounted on a rotating tubular shaft, the diameter of which increases gradually to a maximum at the middle of the retort, and then decreases. The material to be distilled is carried from the top to the bottom of the retort, is compressed in the reduced space at the middle of the retort while in a plastic condition, and is discharged at the bottom of the retort. The products of distillation pass through holes in the tubular shaft and are collected. The solid products may be subjected to a secondary distillation. H. E. BLAYDEN.

Distillation of solid carbonaceous material, and manufacture of gas. H. NIELSEN and B. LAING (B.P. 342,817, 22.11.29. Addn. to B.P. 292,060; B., 1928, 593).—The process of the prior patent is applied to a coking coal, ranging in size from $\frac{1}{2}$ cub. in. to 2 cub. in., after preliminary oxidation; the resulting semi-coke is used as a source of water-gas. R. H. GRIFFITH.

Low-temperature distillation of carbonaceous material. A. KATH (B.P. 342,983, 6.5.30).—An inclined rotary kiln is provided with a large number of tubes passing down its length, through which powdered coal or similar material is carried by gravity. Heating of the charge is effected by circulation of gases through the annular spaces between the tubes and the outer shell of the kiln, and also by other gases which pass independently through the coal. Means are provided for regulating the flow of materials through the system, and for controlling the temperature of the internal and external gas streams. R. H. GRIFFITH.

Low-temperature distillation or carbonisation of carbonaceous material. C. HONNAY (B.P. 344,301, 23.5.30).—An endless conveyor of wire gauze or perforated metal sheet is fitted with rows of transverse scrapers, mounted in a zig-zag fashion, which pass through and over a thin layer of coal heated on the grate of a gas-fired horizontal oven. In this way the coal is carried continuously forward, with thorough stirring, and the gases or vapours produced in the distillation escape in an upward direction. Dust particles are thus largely removed from the crude gas by passage through the lower part of the gauze, and the sensible heat of the distillation products is employed in a pre-treatment of fresh coal which is carried into the hot zone on the upper part of the same conveyor. R. H. GRIFFITH.

Apparatus for destructive distillation of cereal husks and other vegetable waste. P. (GRAF) VON

RADOLIN, ASSR. to G. SAUERBREY MASCHINENFABR. A.-G. (U.S.P. 1,770,636, 15.7.30. Appl., 19.5.23).—Cereal husks etc. are passed between compression rollers into an airtight chamber, where they are dried by an opposing current of hot distillation gases; the product falls on a heated rotating drum provided with flanges which carry the resulting carbonised material to the lower part of the chamber, where it may be discharged without allowing air to enter the apparatus. An off-take pipe connected to the chamber withdraws the gaseous distillation products, a portion of which is recirculated in order to dry the material to be carbonised. The carbonised product may be combined with the tarry products of distillation to produce briquettes.

H. E. BLAYDEN.

Smoke-generating apparatus and compositions therefor. C. BOULANGER (B.P. 343,023, 7.11.29. Fr., 10.11.28).—A composition of hexachloro-benzene, -ethylene, and -toluene, carbon tetrachloride, powdered zinc, and sodium nitrate, and an accelerating composition containing also calcium silicide, are claimed.

W. J. WRIGHT.

Production of carbon and hydrogen chloride. J. P. BAXTER, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 343,477, 10.10.29).—Hydrogen chloride and carbon are obtained by treating a partly or wholly chlorinated hydrocarbon at a high temperature with a hydrocarbon, a chloro-derivative thereof, or chlorine. The proportions of the various reactants should be chosen so that the numbers of gram-atoms of chlorine and of hydrogen are approximately equal. (Cf. following abstract.)

R. H. GRIFFITH.

Production of carbon [black]. J. P. BAXTER, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 343,676, 7.1.30).—Hydrogen chloride, which is produced when chloro-derivatives of hydrocarbons react with hydrocarbons, is recovered and used for preparing fresh quantities of chlorinated hydrocarbons. This may be effected by electrolytic production of chlorine, or by an indirect method in which cuprous chloride is converted into the cupric compound and the latter reacts with a hydrocarbon (cf. preceding abstract).

R. H. GRIFFITH.

Purification of carbon black. J. P. BAXTER, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 343,108, 10.10.29).—Crude carbon, obtained by the interaction of chlorine or a chlorinated hydrocarbon with a hydrocarbon, is purified by heating in a stream of gas. The solid is admixed by injector action of the gas, and the mixture is passed vertically through a heated zone at such a rate that deposition of carbon by gravity does not occur. If the gas is inert the temperature may be as high as 900°, and the time of treatment is correspondingly very short, but with gases containing combined oxygen the temperature must not exceed 500°. If free oxygen is present the maximum permissible is only about 150°.

R. H. GRIFFITH.

Manufacture of adsorbent carbons. O. L. BARNEBEY (U.S.P. 1,774,585, 2.9.30. Appl., 6.11.24. Renewed 14.12.27).—Adsorbent carbon is manufactured by partly carbonising carbonaceous materials (*e.g.*, coal, oil shales, wood waste) at 350–900°, extracting the product with a suitable solvent (*e.g.*, pyridine), heating the

residue with oxygenated gases at 500–900°, and extracting a substantial proportion of ash constituents by treatment with caustic soda solution (*e.g.*, 5% solution) and with dilute (2%) hydrochloric acid.

H. E. BLAYDEN.

Destructive hydrogenation of coal, tar, mineral oils, and the like. J. Y. JOHNSON. From I. G. FARBERIND. A.-G. (B.P. 344,165, 31.1.30).—Waste gases obtained in cracking or destructive hydrogenation of tars, oils, etc. are passed through an electric arc (cf. B.P. 294,494 and 332,057; B., 1928, 738; 1930, 893) and thus serve as a source of the hydrogen required for the hydrogenation. The crude reaction gas is freed from carbon dioxide and hydrogen sulphide, and passed through a suitable arc furnace; steam or carbon dioxide may be added, and useful by-products such as acetylene, ethylene, or carbon black may be obtained as well as hydrogen.

R. H. GRIFFITH.

Extraction of oils from solid residues obtained in the destructive hydrogenation of coal and the like. K. GORDON, H. HARPER, W. I. JONES, and IMPERIAL CHEM. INDUSTRIES, LTD. (B.P. 342,840, 18.12.29).—Residues from destructive hydrogenation processes are treated with a countercurrent stream of hot inert gas, or steam, while passing through a vessel heated externally by another stream of gas. The temperature of the gas in contact with the oily mixture is regulated to about 350° by diluting it with cool gas that remains after condensation of oils leaving the plant. In a continuous process about 80% of the oil may be recovered.

R. H. GRIFFITH.

Gas-producing oven. C. OTTO (U.S.P. 1,770,285, 8.7.30. Appl., 5.3.29. Ger., 25.11.25).—The vertical heating flues of a horizontal oven are provided with fuel-gas inlets at various heights above the bottom of the flues. Air is supplied at the bottom of the flue and the distribution of heat in the flue may be controlled by supplying gas independently or conjointly to the various inlets. Producer or coke-oven gas may be used as the fuel gas.

H. E. BLAYDEN.

Gas producers. C. WHITFIELD (B.P. 342,646, 3.8.29 and 1.1.30).—The grate of a gas producer is constructed so that the quantity of air supplied to different parts of it is separately controlled, *e.g.*, by altering the openings to a number of independent air chambers built under various sections of the fuel bed.

R. H. GRIFFITH.

Gas producer plant. W. CLIME and J. E. DUNLOP (B.P. 343,065, 13.8.29).—A cylindrical, vertical gas producer is fitted with a rotary cover plate which carries a circular toothed rake resting on the top of the fuel. This rake is supported by tubes through which water circulates, and is slidable in sleeve tubes and water-cooled; differences in the level of the fuel bed are thus allowed for. Fresh fuel is supplied by a wide central duct associated with a hopper, and water-seals are provided for the rotary cover and for the mechanism which admits fresh fuel.

R. H. GRIFFITH.

Manufacture of producer gas. J. U. MACDONALD (U.S.P. 1,771,133, 22.7.30. Appl., 15.1.23).—The producer consists of a suitable refractory chamber enclosing

a vertical column of coke through which the air for combustion passes downwards either from ports at the top of the producer or from an inlet pipe communicating with a heat exchanger. The resulting gases pass through a centrally placed, vertical outlet pipe at the bottom of the producer. The outlet pipe may be rotated on a vertical axis to agitate the fuel, and is furnished with a water-seal. The lower part of the producer is provided with a water-sealed ash-pan and the coke column is maintained by gravity feed from a hopper. Provision is made for the introduction of steam or oil to the coke column.

H. E. BLAYDEN.

Manufacture of water-gas. HUMPHREYS & GLASGOW, LTD., Assees. of C. S. CHRISMAN (B.P. 344,205, 25.2.30. U.S., 6.5.29).—In a process for the complete gasification of coal, the whole of the water-gas is made by steaming in an upward direction, and its sensible heat is all available for the treatment of uncarbonised coal. This is made possible, without excessive cooling of the bottom of the generator, by admitting the steam through a central tuyère at an appreciable distance above the base of the fuel bed. During the blow period air is admitted at the fire bars and also through the projecting tuyère, so that the fuel bed is heated through a larger zone than is normally the case.

R. H. GRIFFITH.

Production of a mixed gas containing carbon monoxide and hydrogen. GUTEHOFFNUNGSHÜTTE OBERHAUSEN A.-G. (B.P. 343,160, 15.11.29. Ger., 15.11.28).—A generator for the production of mixtures of carbon monoxide and hydrogen consists of a column of coke placed between the poles of a high-frequency electric generator to which steam is supplied. The composition of the resulting gas can be controlled by varying the current frequency and voltage, and also by the quantity of steam added; the amount of carbon monoxide formed is appreciably less than that produced in a normal water-gas plant.

R. H. GRIFFITH.

Manufacture of [coal] gas. HUMPHREYS & GLASGOW, LTD., and A. R. GRIGGS (B.P. 342,958, 8.4.30).—In a system for the complete gasification of coal, the carbonisation section is surrounded by a recuperator, which is connected to the gasification section by pipes and valves. The recuperator is heated by burning blow-gases in it, and then serves to superheat steam, passed in a reverse direction, on its way to the fuel bed. An additional external heat-storage vessel may be used as a carburettor or, if this is not required, as a further source of superheated steam and for preheating circulation gases.

R. H. GRIFFITH.

Recovery of hydrogen from gas mixtures containing hydrocarbons. GES. F. LINDE'S EISMASCHINEN A.-G. (B.P. 317,731, 19.8.29. Ger., 20.8.28).—Gases containing hydrocarbons, such as coal gas, are used for the production of hydrogen by a combined process of catalysis and refrigeration. Initial purification and condensation remove ammonia, hydrogen sulphide, benzol, etc., and a further cooling operation yields a mixture of liquid methane and its homologues. This is expanded, mixed with 4 vols of steam, and passed over a nickel-alumina catalyst at 500°; 75% of the gas is converted into hydrogen and carbon dioxide.

After removal of the latter, the unchanged hydrocarbon is separated by further cooling and returned to the catalyst vessel; pure hydrogen is drawn off from the refrigerating plant.

R. H. GRIFFITH.

Removal of ammonia and hydrogen sulphide from gases. C. J. HANSEN, Assr. to H. KOPPERS A.-G. (B.P. 343,493, 19.11.29. Ger., 10.1.29).—Gases containing these impurities are cooled, and then scrubbed with a solution containing enough metal thiosulphate to react with all the ammonia to form ammonium thiosulphate and metal sulphide. The surplus hydrogen sulphide is next removed by a further quantity of the solution, precipitation of the dissolved metal as sulphide being completed by the addition of aqueous ammonia; the necessary ammonia is obtained by the primary cooling of the crude gases. The metal sulphide, e.g., iron sulphide, which is formed in the process is withdrawn and treated with sulphurous acid for the regeneration of a fresh scrubbing solution, and ammonium salts which remain in the spent liquor are converted into sulphate.

R. H. GRIFFITH.

Production of a gas-purifying material. E. J. MURPHY, Assr. to BARTLETT HAYWARD Co. (U.S.P. 1,771,136, 22.7.30. Appl., 6.12.23. Renewed 26.12.29).—The efficiency of iron oxide purifying materials (e.g., iron oxide ores) is increased by crushing the materials to pass 100- or 200-mesh and heating them at 200–400°. Hydrogen sulphide is removed from gas by passing the gas through the 100-mesh material or through an aqueous suspension of the 200-mesh material (e.g., containing 3% of the treated material).

H. E. BLAYDEN.

Purification of gases. E. C. UHLIG and E. J. MURPHY, Assrs. to BARTLETT HAYWARD Co. (U.S.P. 1,771,153, 22.7.30. Appl., 6.12.23).—Hydrogen sulphide is removed from gases by passing them upwards through a mechanical scrubbing tower against a countercurrent of a continuously agitated suspension of prepared iron oxide (cf. U.S.P. 1,771,136, preceding abstract). The used scrubbing liquid is revived by passage down a tower through which a current of air ascends. The temperature within the revivifying tower may be varied, but is approx. 71°. The revived liquid is returned to the scrubbing tower.

H. E. BLAYDEN.

Apparatus for indicating the presence of inflammable vapours or gases. H. T. RINGROSE (B.P. 344,287, 9.5.30).—The combustion of inflammable gases which diffuse through the porous walls of an apparatus containing an ignition filament can be observed through glass panels fitted to the side of the vessel. A visual check of a roughly quantitative kind depending on the intensity of the glow is thus provided for the movement of any indicator attached to the instrument.

R. H. GRIFFITH.

Aqueous dispersions of bituminous material. H. D. ELKINGTON. From N.V. DE BATAAFSCHE PETROLEUM MAATS. (B.P. 343,427, 9.10.29).—Substances such as asphalt, pitch, etc. are mixed with a dispersing agent which is suspended in water to yield a stable emulsion of the bituminous material. For this purpose bentonite or similar clayey material is added in amounts less than 10% by wt. of the asphalt, at a temperature about

75° and preferably not much above the m.p. of the bituminous substance. The thick suspension which is formed is then beaten mechanically in order to reduce its viscosity. R. H. GRIFFITH.

Pitch composition. BARRETT Co., Assees. of C. R. ECKERT (B.P. 343,265, 13.1.30. U.S., 23.1.29).—Mica is ground to pass 60–100-mesh and added to pitch or asphalt for use in waterproofing compositions. The best results are given with 3–10 wt.-% of mica, and the product does not flow when raised considerably above the m.p. of the untreated pitch. It is also free from brittleness at low temperatures, and thus more resistant to extreme weather conditions. R. H. GRIFFITH.

Pyrolysis of hydrocarbons. IMPERIAL CHEM. INDUSTRIES, LTD., and D. BINNIE (B.P. 343,881, 12.11.29).—Gases which are to be used as a source of acetylene are diluted with a water-soluble gas or vapour before being rapidly passed through a furnace at 1400–1450°. A substance such as hydrogen chloride is useful for this purpose, and reacts only slightly with the other gases present; the yield of acetylene is appreciably increased by this method, and the diluent gas is easily removed from the products by washing with water. R. H. GRIFFITH.

Decomposition, under the action of heat, of a mixture of methane or other hydrocarbons and water vapour. UNION CHIM. BELGE, SOC. ANON. (B.P. 343,172, 3.9.29. Belg., 22.6.29. Cf. B.P. 341,393; B., 1931, 331).—A mixture of carbon monoxide and hydrogen is obtained by the interaction of methane, or a similar hydrocarbon, with steam in a hot chamber. The process is carried on intermittently, as the necessary heat is supplied by burning some of the hydrocarbon gas in the reaction vessel. Two recuperators are also provided, which are heated by escaping gases and in which air for combustion, or the mixture to be decomposed, can be preheated. R. H. GRIFFITH.

Motor fuel. M. MÜLLER-CUNRADI and W. WILKE, ASSE. to I. G. FARBENIND. A.-G. (U.S.P. 1,765,692, 24.6.30. Appl., 21.10.24. Ger., 14.1.24).—Knocking in engines using liquid fuel is prevented by additions of 0.1–1% of iron acetylacetonate to the fuel. H. E. BLAYDEN.

Storage of [volatile] organic liquids. R. LANT (B.P. 342,742, 9.8.29).—Such liquids from storage of which fire hazards may arise are kept in vessels containing a highly absorbent material which prevents accidental escape of the fuel. A higher fatty acid ester of cellulose, or a simple derivative of it, which is insoluble in the organic liquid, is best for this purpose. R. H. GRIFFITH.

Vertical gas retorts and extractors therefor. E. WEST, and WEST'S GAS IMPROVEMENT Co., LTD. (B.P. 344,860, 12.12.29).

Gas producers [for gas engines]. R. F. CLAYTON and D. J. SMITH (B.P. 343,466, 18.11.29).

Heating viscous liquids. Extracting liquid [from coal etc.]. Dryers. Crushers. Jigs. Petrol filter. Purification of liquids. Gas analysis. Testing gases.—See I. Hydrogen-nitrogen.—See VII. Asphalt filler. Roads.—See IX. Fatty acids from wax.—See XII. Fireproof paste.—See XIII.

III.—ORGANIC INTERMEDIATES.

Analysis of technical solvents. II. Colour tests for benzene, nitrobenzene, toluene, and xylene.

H. H. WEBER (Chem.-Ztg., 1931, 55, 201–203; cf. B., 1930, 232).—The colour reactions of polynitro-derivatives of benzene and its homologues with alkali and certain higher alcohols (cf. Hantzsch and Picton, A., 1909, i, 467; van Urk, A., 1924, ii, 356) are sufficiently characteristic to enable these hydrocarbons to be detected in presence of each other and of other solvents. The test suspension is prepared by shaking the solvent (0.5–5.0 c.c.) with nitric acid (1 c.c.) and pure sulphuric acid (2 c.c.) and adding 0.1 c.c. of the acid layer to 1 c.c. of water. The suspension (0.5 c.c.) with *iso*amyl alcohol (1 c.c.) is neutralised with 2*N*-sodium hydroxide and shaken with sodium hydroxide (1–2 g.). A blue or violet coloration on subsequent addition of acetone indicates benzene or nitrobenzene. When the suspension (0.5 c.c.) with benzyl alcohol (1 c.c.) is made alkaline with 2*N*-sodium hydroxide and shaken, toluene is detected by the appearance of a reddish-brown colour in the alcohol layer. Similarly, using *cyclohexanol*, *m*-xylene gives an intense green colour. The smallest proportion of each hydrocarbon which can be detected in presence of the others has been determined. Higher homologues do not interfere. H. E. F. NOTTON.

Phenol.—See II. Acetic acid.—See V. Honey acids.—See XIX.

PATENTS.

Manufacture of organic halogen compounds [methylene dichloride]. H. DREYFUS (B.P. 341,878, 19.7.29).—Methyl alcohol is treated with sulphur chloride and chlorine at 60–100° in a closed vessel to give methylene dichloride. Other alcohols and other halides or oxyhalides of sulphur or phosphorus may be used, and the halogen may be omitted if desired. Variation in proportions or conditions leads to other di- and polychloro-compounds. C. HOLLINS.

Manufacture of alkylene derivatives [glycols, glycol esters and ethers] from alkylene oxides. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 342,022, 11.11.29).—An alkylene oxide is led continuously with water, an alcohol, or a carboxylic acid through a hot tube, *e.g.*, at 180°/30 atm., without a catalyst. The preparation of glycol monoethyl ether (from ethylene oxide and ethyl alcohol), propylene glycol monomethyl ether, ethylene glycol, glycol monoacetate, glycol monophenyl ether, and γ -chloropropylene glycol monomethyl ether (from epichlorohydrin) is described, together with a suitable apparatus. C. HOLLINS.

Manufacture of lactic acid or its esters. IMPERIAL CHEM. INDUSTRIES, LTD., and W. R. H. HURTLEY (B.P. 341,961, 25.10.29 and 12.2.30).—The condensation of acetaldehyde with hydrogen cyanide is effected below 60° in presence of an alcohol and/or a lactic ester together with the necessary amount of water. Hydrogen chloride (or other mineral acid) is then added, and hydrolysis to lactic acid or hydrolysis and esterification to the lactic ester is carried out at 60–100°. C. HOLLINS.

Production and application [as wetting agents] of sulphonated amides and the like. H. T. BÖHME

A.-G. (B.P. 318,542, 19.7.29. Ger., 5.9.28).—The amides, anilides, or other *N*-substituted amides, of hydroxylated or unsaturated fatty acids above C_8 are sulphonated, *e.g.*, with sulphuric acid, oleum, or chlorosulphonic acid, in presence or absence of anhydrous organic acids, acid anhydrides, or acid chlorides, to give wetting or dispersing agents. The products are useful as addenda to liquids or plastics for treatment of textiles, leather, and paper, as softening agents for textiles and leather, as auxiliary agents in dyeing (enabling weak alkali to be used in vat dyeing or in padding for ice colours), in spinning, in ink manufacture, in fat splitting, as dust-binding agents, and as addenda to boring oils and to ceramic masses. C. HOLLINS.

Manufacture of derivatives of 3-nitro-4-hydroxybenzamide. A. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 341,970, 25.10.29, 15.11.29, and 9.7.30).—A 3-nitro-4-acyloxybenzoyl halide is condensed with a primary or secondary amine carrying substituents suitable for azo dye formation, or with an aminoazo compound. The acyloxy-group is hydrolysed (usually during condensation); the 3-nitro-group may subsequently be reduced. 3-Nitro-4-acetoxybenzoyl chloride, m.p. 55°, with *m*-phenylenediamine-4-sulphonic acid gives 3-nitro- and, after reduction, 3-amino-4-hydroxybenzoic 3-amino-4-sulphoanilide. 3-Nitro-4-acetoxybenzoyl chloride is similarly condensed with 2:5-diamino-4'-hydroxy-3'-carboxydiphenylsulphone, benzidine-3-sulphonic acid, H-acid, J-acid, γ -acid, S-acid, *N*-ethyl-H-acid, *m*-aminobenzoyl-J-acid, 2-nitro-4-amino-phenol-6-sulphonic acid, 3-nitro-5-aminosalicylic acid, 2-nitro-*p*-toluidine, mono-oxalyl-*m*-phenylenediamine, 5-aminosalicylic acid, 5-*p*-amino benzamido-3-sulphosalicylic acid, and 4-amino-4'-hydroxyazo-benzene-3'-carboxylic acid. C. HOLLINS.

Manufacture of [3:4:6-trisubstituted] aniline-*o*-sulphonic acids. W. W. GROVES. From I. G. FARBENIND. A.-G. (B.P. 341,612, 13.11.29).—Anilines carrying in positions 3, 4, and 6 alkyl, alkoxyl, aryloxy, aralkyloxy, aroyl, arylsulphonyl, nitro-, sulphonic, carboxylic, or halogen substituents are sulphonated with chlorosulphonic acid, preferably in a solvent (carbon tetrachloride, *o*-dichlorobenzene, nitrobenzene, tetrachloroethane), in absence of moisture. The sulphonation of a variety of such amines is described. C. HOLLINS.

Manufacture of sulphonic acids of 2-halogeno-3-chloro-4-amino-1-methylbenzene [2-halogeno-3-chloro-*p*-toluidines] and separation into their constituents of mixtures of 2:3- and 2:5-halogenochloro-4-amino-1-methylbenzene [-halogenochloro-*p*-toluidines]. I. G. FARBENIND. A.-G. (B.P. 318,837, 9.9.29. Ger., 7.9.28).—2-Halogeno-3-chloro-*p*-toluidines are sulphonated with sulphuric acid at 180–200° or with weak oleum at 100–130° to give the 5-sulphonic acids, or with excess of high-strength oleum to give the 6-isomeride, separable from the small amount of 5-sulphonic acid also formed by dissolution in water containing sodium chloride. 2-Halogeno-5-chloro-*p*-toluidines are not sulphonated under these conditions and sulphonation may be used to remove the 2:3- from the 2:5-isomeride. The 5-sulphonic group is readily eliminated by heating with 80% sul-

phuric acid. The sulphonation of 2:3-dichloro- and 3-chloro-2-bromo-*p*-toluidines, and the separation of 2:3- and 2:5-dichloro-*p*-toluidines, are described. Pure 2:3-dichloro-*p*-toluidine has m.p. 55–58°.

C. HOLLINS.

Manufacture of benzoic acid [from phthalic anhydride]. H. E. POTTS. From MONSANTO CHEM. WORKS (B.P. 341,902, 21.8.29).—Molten phthalic anhydride below 350°, preferably at 220–285°, is treated with steam in presence of a decarboxylating catalyst, *e.g.*, chromic and sodium phthalates. The benzoic acid may be distilled off in steam at intervals (cooling to 140–170°) or continuously. C. HOLLINS.

Manufacture of derivatives of carbazole. A. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 341,905, 14.9.29).—The process of B.P. 320,641 (B., 1930, 233) is extended to the preparation of other carbazole derivatives by removal of sulphonic groups from substituted carbazolesulphonic acids by heating with water or dilute acid under pressure. 4:6-Dihydroxycarbazole (*N* = 5), m.p. 211–212°, is obtained from its 2:8-disulphonic acid; 4-amino-8-hydroxycarbazole, m.p. 215–216°, from its 2:8-disulphonic acid; 4-chlorocarbazole, m.p. 125°, 4-bromo- and 4-iodo-carbazoles, from their 2:6:8-trisulphonic acids; 2-aminocarbazole, m.p. 258°, from its 4:8:6-trisulphonic acid; 4:4'-dicarbazolyl sulphide, m.p. 228–230°, from its 2:2':6:6':8:8'-hexasulphonic acid (product gives a blue indophenol with *p*-nitrosophenol); 2-hydroxycarbazole from its 4:6:8-trisulphonic acid; 4-hydroxycarbazole-6-carboxylic acid, m.p. 284–285°, from its 2:8-disulphonic acid; 3-hydroxycarbazole, m.p. 275–276°, from its 8(?)sulphonic acid; and 4-hydroxycarbazole from its 2:7-disulphonic acid. C. HOLLINS.

Hydrogenation of pyridine, quinoline, and homologues thereof. SCHERING-KAHLBAUM A.-G. (B.P. 342,010, 5.11.29. Ger., 29.11.28).—Pyridine and quinolines are hydrogenated in presence of nickel by nascent hydrogen provided by cyclohexanol, tetrahydronaphthalene, or other suitable hydrogenated compound; the latter may be produced or regenerated *in situ* by introducing hydrogen. Pyridine and cyclohexanol (3 mols.) at 210–230° give piperidine and cyclohexanone. Piperidine is also produced by hydrogenating pyridine in presence of 10% of tetrahydronaphthalene or cyclohexanol at 160–180°/50 atm. A mixture of pyridine and phenol absorbs hydrogen at 120°, with production of cyclohexanol; on now raising the temperature to 160–180° piperidine and cyclohexanone are obtained.

C. HOLLINS.

Manufacture of menthenes. SCHERING-KAHLBAUM A.-G. (B.P. 341,997, 31.10.29. Ger., 15.11.28).—Menthadienes having one of the double linkings semicyclic or in a side-chain are reduced to menthenes by partial hydrogenation in presence of nickel at 40–80°. The preparation of Δ^3 -menthene from β -terpinene, Δ^1 -menthene from sylvestrene, Δ^2 -menthene from β -phellandrene, and carvomenthene from dipentene, is described.

C. HOLLINS.

Manufacture of homogeneous halogen derivatives of 1-chloronaphthalene. I. G. FARBENIND.

A.-G. (B.P. 341,926, 23.10.29. Ger., 24.10.28).—1-Chloronaphthalene-8-sulphonic acid is converted by chlorine at 25° into 1:4-dichloronaphthalene-8-sulphonic acid, from which 1:4-dichloronaphthalene, m.p. 71–72°, is obtained by hydrolysis with 50% sulphuric acid. At 90–100° 1:4:8-trichloronaphthalene, m.p. 130°, is produced. Bromination of 1-chloronaphthalene-8-sulphonic acid at 15° gives 1-chloro-8-bromonaphthalene, m.p. 87–88°, and 1-chloro-4-bromonaphthalene-8-sulphonic acid, from which 1-chloro-4-bromonaphthalene, m.p. 66–67°, is obtained by hydrolysis, or 1-chloro-4:8-dibromonaphthalene, m.p. 96–97°, and 1:8-dichloro-4-bromonaphthalene, m.p. 114–115°, by appropriate halogenation. 1:4-Dichloronaphthalene-8-sulphonic acid gives 1:4-dichloro-8-bromonaphthalene, m.p. 112–113°, on bromination. C. HOLLINS.

Manufacture of homologues of anthraquinone. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 341,553, 19.8.29. Addn. to B.P. 327,128; B., 1930, 706).—The products from *p*-benzoquinone and two different $\alpha\gamma$ -butadienes, or their isomerides, or the hexa- and tetra-hydroanthraquinones obtained from these, are converted into anthraquinones by ferric chloride (etc.) in acid medium. The preparation of 2-methyl- and 2:3-dimethyl-anthraquinones is described. (Cf. B.P. 340,509; B., 1931, 336.) C. HOLLINS.

Volatile liquids.—See II. **Heterocyclic compounds.**—See XX. **Products for destroying animals.**—See XXIII.

IV.—DYESTUFFS.

PATENTS.

Manufacture of vat dyes of the benzanthrone series. I. G. FARBENIND. A.-G. (B.P. 341,400, 4.10.29. Ger., 26.10.28. Addn. to B.P. 305,679; B., 1930, 755).—The process of the prior patent is applied to α -1-benzanthronylaminoanthraquinones having in the anthraquinone residue an aliphatic acylamino-group and a free 2-position. 4-Acetamido-1-(2-benzanthronylamino)anthraquinone is converted by chlorosulphonic acid at 20–25° into a yellow-green vat dye. The 4-benzamido-compound gives a similar product, from which the benzoyl group may be removed by hydrolysis, leaving a dark green vat dye (grey after hypochlorite treatment); elimination of the amino-group from this product gives a dark green vat dye fast to chlorine. C. HOLLINS.

Production and use of benzanthrone derivatives [vat dyes of the dibenzanthrone series]. I. B. ANDERSON, R. F. THOMSON, J. THOMAS, and SCOTTISH DYES, LTD. (B.P. 341,389, 5.7.29).—3:3'-Dibenzanthronyl is nitrated with mixed acid, and the resulting mono- or di-nitro-compound is reduced in acid medium, e.g., with zinc dust and aniline sulphate at 140–180°, to give mono- or di-aminodibenzanthrone. Nitrated 4:4'-dibenzanthronyl is similarly reduced to a vat dye. C. HOLLINS.

Manufacture of a vat dye [from 2-thiol-1-methyl-anthraquinone]. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 341,432, 15.7.29).—2-Thiol-1-methyl-anthraquinone gives an orange-yellow vat dye when

heated with sulphur at 250–260°. The same product is obtained by heating 2-chloro-1-methylantraquinone with sodium sulphide and sulphur at 250–260°. [Stat. ref.] C. HOLLINS.

Manufacture of monoazo dyes [for lakes]. MAJOR & CO., LTD., H. H. HINCHLIFFE, and W. J. DARBY (B.P. 341,969, 25.10.29).—An arylaminesulphonic acid, e.g., *p*-toluidine-3-sulphonic acid, is diazotised and coupled in alkaline solution with the product obtained from 2:3-hydroxynaphthoic acid and toluene-*p*-sulphonyl chloride. C. HOLLINS.

Manufacture of monoazo [acid] dyes. A. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 341,397 and 341,461, [A] 11.9.29, [B] 16.9.29).—(A) 4-Aminoacetanilide-3-sulphon-alkyl- or -dialkyl- or -arylalkyl-amides are diazotised and coupled with a β -naphthylaminesulphonic acid. The same dyes are obtained by diazotising the corresponding 4-nitroaniline-2-sulphonamides, coupling with a β -naphthylaminesulphonic acid, reducing the nitro-group, and acylating. Examples are: 4-nitroaniline-2-sulphonethylanilide \rightarrow γ -acid, reduced, acetylated (bluish-red); 4-aminoacetanilide-3-sulphonethylanilide \rightarrow γ -acid (bluish-red), *N*-methyl- γ -acid (red-violet), or 2:7-naphthylaminesulphonic acid (red). (B) The *N*-chloroacetyl (or other halogeno-acyl) derivatives of aminonaphtholsulphonic acids are used as coupling components for monoazo acid dyes fast to fulling. Examples are: *N*-chloroacetyl-*H*- or -*K*-acid with diazotised aniline, *o*- and *p*-toluidines, *m*-aminobenzaldehyde, 2-amino-4-acetethylamidotoluene; *N*-chloroacetyl- γ -acid or *N*- β -chloropropionyl-*H*-acid with diazotised aniline. C. HOLLINS.

Manufacture of azo-dye components [hydroxynaphthylguanidines]. KALLE & CO. A.-G. (B.P. 341,549, 19.10.29. Ger., 19.10.28).—Coupling components specially suitable for diazo-types are obtained by condensing an aminonaphthol or its sulphonic acid with cyanamide or dicyanodiamide. 1:7-Aminonaphthol and cyanamide yield 7-hydroxy-1-naphthylguanidine, m.p. 225–226° (decomp.) (hydrochloride, m.p. 113–114°). 5-Hydroxy-1-naphthylidiguanidine, m.p. 143–144° (decomp.) (hydrochloride, m.p. 216–217°), the 7:1-isomeride [hydrochloride, m.p. 235–237° (decomp.)], and the 7:2-isomeride (hydrochloride, m.p. 218–219°) are similarly prepared from dicyanodiamide. C. HOLLINS.

Manufacture of [direct dis- and tris-]azo dyes. W. W. TRIGGS. From E. I. DU PONT DE NEMOURS & CO. (B.P. 341,898, 18.7.29).—A non-phenolic, sulphonated arylamine or aminoazo compound is diazotised and coupled with a non-phenolic arylamine; the product is condensed with a nitrobenzoyl chloride, reduced, diazotised, and coupled with a non-phenolic arylamine; the resulting dis- or tris-azo dye is acylated, e.g., with benzoyl or *p*-nitrobenzoyl chloride; in the latter case the nitro-group may subsequently be reduced. Examples are: 2-naphthylamine-6:8-disulphonic acid \rightarrow *m*-toluidine or Cleve acid, *p*-nitrobenzoylated, reduced, \rightarrow *m*-toluidine, benzoylated (bright yellow), or acetylated (redder), or *p*-aminobenzoylated (developed with β -naphthol, reddish-yellow); sulphanilic acid \rightarrow *m*-toluidine, *p*-nitrobenzoylated, reduced, \rightarrow Cleve acid,

p-aminobenzoylated (yellowish-orange; developed with β -naphthol, orange-brown). C. HOLLINS.

Derivations of 3-nitro-4-hydroxybenzamide.—See III.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Flax wax and its extraction. W. H. GIBSON (Inst. Chem. Eng. Advance proof, Mar., 1931, 3—6).—The "pouce" or fine dust separated from flax fibre by combing and drawing may contain 6—10% of wax resembling beeswax. This dust may be pressed into blocks and extracted by solvents to give a residue suitable for insulating or building materials and a wax which may be used for polishes. This residue contains about 1.4% N, and may have manurial value.

T. McLACHLAN.

Denaturation of wool by carbamide. W. RAMSDEN (Nature, 1931, 127, 403—404).—The apparently typical thiol reaction obtained with a carbamide extract of sheep's wool (A., 1930, 1604) is due to a reaction between carbamide and a derivative of sodium nitroprusside which is formed on keeping a solution of the latter. The reaction occurs only in solutions which are not too strongly alkaline and in the absence of ammonia, which changes the red colour to yellow. Saturated solutions of carbamide reveal a sulphide in wool when they are alkaline above a certain degree.

L. S. THEOBALD.

Wood chemistry. VI. Proximate compositions of two new pulp woods. Y. UYEDA and H. SHŌZI (J. Cellulose Inst., Tokyo, 1931, 7, 16—17; cf. B., 1929, 552).—The woods "*Doronoki*" (*Populus Maximowiczii*) and "*Ezoyanagi*" (*Salix rorido*), which may be of use in making paper pulp, have the following percentage compositions, respectively: loss on drying 16.33, 10.74; benzene extract 0.96, 1.48; alcohol extract 1.04, 1.78; cellulose 53.79, 55.07; lignin 21.05, 27.44; soluble pentosans 4.01, 2.62; galactans 0, 0.52; ash 1.48, 0.87; and pentosans 16.47, 13.74. Their cellulose and lignin contents are similar to those of other pulp woods used industrially, but they differ from the latter in their deficiency in mannans.

B. P. RIDGE.

Change in lignin content of spruce wood according to climatic conditions. P. KLASON (Cellulosechem., 1931, 12, 36—37).—Lignin determinations on 222 samples of spruce wood from different parts of Sweden show that the average lignin content is 28.1% (max. 28.4%, min. 27.8%), and that climatic conditions have no apparent effect. Wood from the trunk contains 28.2% of lignin, and from the branches 27.9%. A very tall tree examined throughout its length was found to contain 27.1—27.9% of lignin. The age of the tree has no influence on the lignin content of the wood.

T. T. POTTS.

Purified wood fibre. Paper-making characteristics of wood fibre high in α -cellulose. G. A. RICHTER (Ind. Eng. Chem., 1931, 23, 266—272).—The relationship between the time of beating, the degree of hydration of the cellulose, and the strength of the paper produced is shown graphically for a number of types of wood pulp and various purified wood-fibre products.

Wood fibre containing a high percentage of α -cellulose hydrates more slowly than ordinary sulphite pulp and forms a paper with increased tearing resistance and folding endurance, in this respect resembling that from the better grades of rag stock. Examination of commercial papers shows that purified wood fibre and rag papers are both superior to others in strength and toughness, but the presence of purified wood pulp imparts weakness to the paper. F. R. ENNOS.

Solubility and physical strength of cellulose derivatives in relation to constitution. M. HAGEDORN and P. MÖLLER (Cellulosechem., 1931, 12, 29—33).—Esters prepared by methods involving minimum effect on micelle size have been employed. It is confirmed that tri-esters are the highest form obtainable. The simple esters are all insoluble in water, but may exhibit slight swelling, or, in films, shrinkage or expansion. Water-resistance increases with carbon content. Excepting the formate, all esters are soluble in chlorinated hydrocarbons. The behaviour towards other solvents is shown to be largely dependent on the nature of the acid radical of the ester; also solubility of a given ester increases for solvents in the order alcohol, ether, ketone, ester. Cellulose esters are more soluble in chlorinated hydrocarbons than in the hydrocarbons themselves. The solubility of mixed esters is determined to some degree by the solubilities of the simple esters of the acids used. Strength of ester films decreases with increasing length of chain of the esterifying acid, stretch increasing. The cellulose esters of unsaturated acids do not conform to classification to the same degree as do those of the saturated acids. Ethers formed by the treatment of alkali-cellulose with alkyl chlorides all have solubilities, strengths, and elongations of the same order.

T. T. POTTS.

Solubility of nitrocellulose. M. UCHIDA (J. Cellulose Inst., Tokyo, 1930, 6, 253—263).—The solubility in ether-alcohol of 5 varieties of nitrocellulose has been determined for the temperature range -20° to 30° and the nitrogen contents of the dissolved and undissolved parts have been found. The following conclusions are drawn. Sample A (13.23% N): The solubility increases with falling temperature and the maximum for the solvent containing ether-alcohol = 2:1 is twice as great at -20° as at the ordinary temperature. Solvent of this composition gives maximum solubility at any temperature. Variation of solubility with temperature is greatest for the solvent giving maximum solubility. The nitrogen content of the dissolved part increases with falling temperature, and it is inferred that guncotton begins to dissolve at 0° . Sample B (12.69% N): Dissolution is the better at the lower temperature; its solubility in solvents containing 14—50% of alcohol varies from 60 to 100%, whilst the nitrogen content of the dissolved part is constant. Samples C and D (12.24 and 11.50% N, respectively) are very soluble and the solubility appears to increase as the temperature falls; the former is the more soluble in ether-rich, and the latter in alcohol-rich, solvents. The solubility of sample E (10.97% N) increases with rise in temperature, and a 1:1 mixture (by vol.) of ether and alcohol is a very good solvent.

B. P. RIDGE.

Acetic acid recovery in the cellulose acetate industry. H. R. S. CLOTWORTHY (Ind. Chemist, 1931, 7, 111—114).—The acid may be recovered in the form of glacial acetic acid (i) by conversion first into acetates, (ii) by extraction with an immiscible solvent. The first method is uneconomical, but the second gives successful results if a solvent having a b.p. above that of acetic acid is used. Two examples of this latter type of process are described, viz., the Suida process and that devised by Les Distilleries des Deux-Sèvres (abstracts of which have already appeared). These processes yield acid of 99.8—99.9% concentration. For reabsorption into the cycle of operations in the cellulose acetate factory, a part of the glacial acid is converted by known methods into acetic anhydride, any dilute acid formed being returned to the plant for concentration.

F. R. ENNOS.

Determination of alkali-cellulose. O. SCHWARZKOPF (Cellulosechem., 1931, 12, 33—36).—A mathematical analysis of the direct method of determination of alkali in the products of mercerisation.

T. T. POTTS.

Factors during spinning which influence the physical properties of rayon. II. P. C. SCHERER, JUN., and R. E. HUSSEY (Ind. Eng. Chem., 1931, 23, 297; cf. B., 1930, 812).—A maximum in the physical properties (tensile strength and elongation) of viscose rayon occurs at some definite temperature of the spinning bath for each time of contact with the bath.

F. R. ENNOS.

Detection of strained viscose silk. A. J. HALL (Rayon Record, 1930, 4, 1347).—A new reagent for detecting strain in viscose threads, which is superior to that previously described (B., 1930, 1145) since it forms no precipitate when heated and can be used either neutral or alkaline, consists of glycerin 10 c.c., 20% ferric sulphate solution 5 c.c., 10% caustic soda solution 0—40 c.c., and water 85—45 c.c. Stretched viscose silk when immersed for a few minutes in the reagent at 100°, then rinsed with water, and immersed in dilute potassium ferricyanide acidified with sulphuric acid develops a blue colour which deepens as the alkalinity of the reagent is increased, but which is proportional to the degree of stretching. The reagent is equally suitable for detecting oxycellulose in overbleached cotton materials.

A. J. HALL.

Paper mulch for soils.—See XVI.

PATENTS.

Wet treatment [washing] of artificial silk [during manufacture]. GLANZSTOFF-COURTAULDS GES.M.B.H. (B.P. 344,279, 29.4.30. Ger., 29.4.29).—Cakes of artificial silk yarn (produced by centrifugal spinning) are mounted on supports and arranged in vertical columns; water is led into the central space of each cake so that it rises and then flows over the top of each cake, thereby causing the cake to extend upwards and loosening the yarn so that the water can pass outwards through the cake itself.

A. J. HALL.

Drum-type mill for paper and pulp manufacture. U. KIRCHNER and G. STRECKER (B.P. 343,364, 27.3.30. Ger., 10.4.29).—In a mill comprising a drum rotating in one direction and internal mullers rotating at centri-

fugal speed in the opposite direction, the mullers are connected to each other and to the shaft by linkwork which ensures that when one muller is pressed inwards by a large or hard piece all the others follow suit. With such an arrangement the rotating system remains in balance and the centrifugal weight of all the mullers is available to crush a piece under one of them.

B. M. VENABLES.

[Spinning funnels for] manufacture of artificial silk. BRYSLKA, LTD., F. W. SCHUBERT, and W. A. ENTWISTLE (B.P. 344,560, 19.9.29. Addn. to B.P. 296,856; B., 1928, 852).

Apparatus for manufacture of films and foils. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 344,485, 29.11.29).

Suction chamber for machines for production of pulp sheets, and for removal of water from cellulose, or the like. E. KRAMER (B.P. 345,023, 28.1.30. Czechoslov., 30.1.29).

Heat insulation. Separating particles from water.—See I.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Turkey-red dyeing. L. R. PARKS (J. Physical Chem., 1931, 35, 488—510).—Data are recorded showing that sulphonated oils, and, to a slight extent, alumina, are adsorbed by cotton. Turkey-red oil and soap form colloidal solutions. Alumina adsorbs soap from solution and *vice versa*. In the absence of calcium the alizarin anion is adsorbed by alumina, whilst sodium sulphate, but not sodium chloride, tends to strip the dye from the alumina. Sodium alizarate and calcium acetate yield insoluble calcium alizarate, which is peptised by an excess of the former. Cotton adsorbs a soap-alumina colloid which is fixed on the fibre by boiling water. Alizarin "G" produces the fiery-red colours. The colour is brightened by boiling in distilled water, but the brilliancy of Turkey-red is produced by mordanting the dyed fibre with an alumina-soap mordant and heating. A quick method of mordanting with alumina is proposed. The results are discussed and interpreted in relation to the process of Turkey-red dyeing.

L. S. THEOBALD.

Alkali-cellulose. Detecting strain in silk.—See V.

PATENTS.

Bleaching of cellulose products. R. H. MCKEE, E. H. MORSE, and P. E. ROLLHAUS, Assrs. to PILOT LABORATORY, INC. (U.S.P. 1,767,543, 24.6.30. Appl., 15.2.28).—Cellulose artificial silk is bleached at slightly above ordinary temperatures without deterioration as regards strength, elasticity, and lustre by treatment with dilute aqueous solutions or soap emulsions of peroxidised organic acids or organic peroxides (e.g., benzoyl, phthalyl, acetyl, succinyl, maleic, and fumaric peracids or peroxides).

A. J. HALL.

Coloration of textile and other materials [containing cellulose esters or ethers with leuco-vat dyes]. BRIT. CELANESE, LTD., G. H. ELLIS, H. C. OLPIN, and R. C. STOREY (B.P. 341,408, 4.7.29).—Acetate silk etc. is dyed with the free leuco-compounds of vat or sulphide dyes or of aminoanthraquinones in

aqueous suspension, preferably from a bath having pH 4–8, and the colour is developed by oxidation with air, black liquor, soap, and sodium perborate, and especially with soap and hydrogen peroxide. Examples are Ciba blue G, Caledon jade green, 1-benzamido-4-hydroxy-anthraquinone, indophenol from *p*-aminodimethylaniline and α -naphthol. C. HOLLINS.

Printing of acetate silk or materials containing a cellulose ether or ester. SOC. CHEM. IND. IN BASLE (B.P. 341,419, 14.10.29. Switz., 12.10.28).—Acetate silk etc. is printed with aminoanthraquinonesulphonic acids, *e.g.*, sulphonated 4-benzylamino-1-methylamino-anthraquinone (blue), 1-amino-4-*p*-acetamidooanilino-anthraquinone-2-sulphonic acid (blue), 1-amino-4-anilinoanthraquinone-3-sulphonic acid (blue), 4:8-diaminoanthrarufin-2-sulphonic acid (blue), 1:4-di-(2'-sulpho-*p*-toluidino)anthraquinone (green), 1-amino-4-hydroxyanthraquinone-5-sulphonic acid (red-violet), and 1-aminoanthraquinone-5-sulphonic acid (orange). These colours do not sublime during the process.

C. HOLLINS.

Manufacture of [low-lustre] materials made of or containing organic derivatives of cellulose. BRIT. CELANESE, LTD. (B.P. 344,093, 12.12.29. U.S., 27.12.28. Addn. to B.P. 318,467; B., 1931, 346).—The lustre of cellulose acetate silk is reduced by precipitation of zinc sulphide therein; the zinc salt necessary is introduced into the silk in the presence of a swelling agent, or the solution of the zinc salt (*e.g.*, zinc chloride) is itself used also as a swelling agent. A. J. HALL.

Waterproofing of gut. R. LANT and W. KORESKA (B.P. 343,117, 16.10.29).—Gut threads are impregnated with cellulose distearate dissolved in xylene.

A. J. HALL.

Dyeing of regenerated cellulose materials. E. I. DU PONT DE NEMOURS & Co. (B.P. 318,892, 27.8.29. U.S., 11.9.28).—See U.S.P. 1,755,119; B., 1930, 986.

Dyeing and like machines. C. S. BEDFORD (B.P. 344,587, 9.1.30).

Wetting agents.—See III. Dibenzanthrone vat. —See IV.

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

Increasing the purity of common salt. T. B. BRIGHTON and C. M. DICE (Ind. Eng. Chem., 1931, 23, 336–339).—The objectionable odour of some brands of crude salt is removable by heating to above 210° , but this treatment causes discoloration owing to oxidation of clay in the salt or charring of organic matter. By washing the salt with brine and then roasting at 225° , a pure white product is obtained. W. J. WRIGHT.

Water-solubility of the phosphoric acid of calcium phosphates. W. KLEBERGER (Z. Pflanz. Düng., 1931, 19A, 309–313).—The decomposition of monocalcium phosphate in concentrated superphosphate solutions (Stollenwerk, B., 1930, 710) was not confirmed.

A. G. POLLARD.

Bauxite. H. JORDT (Chem.-Ztg., 1931, 55, 211).—Alumina, relatively free from iron, may be obtained by heating certain types of bauxite with coal tar in a

graphite crucible and washing the ignited mass with dilute hydrochloric acid; contact with air or oxygen during the washing should be avoided. The residue is ignited in an oxidising atmosphere. The method of magnetic separation proposed by the U.S. Department of Commerce is considered useless. H. F. GILLBE.

Technical importance of hydrolytic decomposition of aluminium salts at higher temperatures. J. Z. ZALESKI (Przemysl Chem., 1931, 15, 104–110).—Ammonium alum solution on being heated under pressure deposits $(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 3Al_2O_3 \cdot 15H_2O$ as crystals which on further heating yield $(NH_4)_2SO_4 \cdot 3Al_2(SO_4)_3 \cdot 10Al_2O_3 \cdot 56H_2O$. Under optimal conditions of temperature and concentration 94% of the aluminium originally in solution is precipitated in 5 hrs. The addition of silica gel greatly accelerates the process, whilst precipitation is inhibited by sulphuric acid. The precipitate is readily filterable, and does not sinter on heating; it constitutes a convenient source of aluminium oxide for the manufacture of aluminium. Under analogous conditions aluminium chloride solution does not deposit basic salts, whilst aluminium sulphate gives 43% yields of a salt, $2Al_2(SO_4)_3 \cdot 4Al_2O_3 \cdot 9H_2O$. Ammonium iron alum is practically quantitatively converted into the salt $(NH_4)_2SO_4 \cdot 2Fe_2(SO_4)_3 \cdot 3Fe_2O_3 \cdot 9H_2O$, and potassium alum and ammonium chrome alum are similarly almost quantitatively precipitated, whilst potassium chrome alum does not under these conditions deposit basic salts. R. TRUSZKOWSKI.

Extraction of [pure] beryllium, caesium, and rubidium [oxides] from beryl. C. JAMES, H. C. FOGG, and E. D. COUGHLIN (Ind. Eng. Chem., 1931, 23, 318–320).—The finely-ground raw material is fused with lime in a blast furnace. The resultant slag is ground, decomposed with sulphuric acid, heated to dehydrate the silica, treated with hot water, and the liquor filtered, the filtrate being concentrated so that, on cooling, potassium, caesium, and rubidium alums crystallise out. The mother-liquor is treated with ammonium sulphate and cooled to separate aluminium as ammonium alum, and iron is removed by oxidising the solution with, *e.g.*, potassium bromate or nitric acid, and carefully precipitating with dilute ammonia solution, the last traces of iron being eliminated by treatment with hydrogen sulphide under slight pressure. Beryllium is finally obtained as the basic carbonate by addition of ammonium hydroxide or carbonate, from which a pure white oxide is obtained on ignition. The mixed alums, as described above, on being fractionally crystallised accumulate the caesium and traces of rubidium in the soluble portion. These are separated by further fractionation and/or precipitation of caesium antimony chloride and crystallisation of rubidium acid tartrate. W. J. WRIGHT.

Storage of carbon monoxide. O. H. WAGNER (Brennstoff-Chem., 1931, 12, 87–89).—The possibility of storing large quantities of carbon monoxide under pressure in steel cylinders containing a suitable absorbent has been investigated. No suitable liquid solvent could be found; for the best solvents, ether and pentane, Ostwald's coefficient (*i.e.*, the ratio of concentration of gas in liquid to that over liquid) amounted only to

0.5 at 100 atm. Under 40 atm. pressure a cylinder filled with activated charcoal took up 1.4 times the amount which could be compressed under the same pressure into the empty cylinder, but at 150 atm. and higher pressures the volume of the adsorbed gas was less than the volume of gas displaced by the charcoal. By the action of carbon monoxide under high pressure on solid cuprous chloride and bromide additive compounds ($\text{Cu}_2\text{Hal}_2\cdot 2\text{CO}$) have been prepared. These can be utilised for the storage of the gas; thus, under 150 atm. pressure, a cylinder packed with solid cuprous chloride would take up 4 times the amount of carbon monoxide as would be compressed into the empty cylinder. To recover the gas at atmospheric pressure the compound must be heated to about 50° .
A. B. MANNING.

Magnesia in minerals.—See VIII. **Lead tungstate.**—See XIII.

PATENTS.

Manufacture of potassium nitrate. LE NITRO-SEL SOC. ANON., and J. MARGOLES (B.P. 343,287, 23.1.30).—A potassium ore is caused to interact with saturated sodium nitrate solution, and the mixture oxidised by means of a peroxide, persulphate, or current of hot air. The solution, freed from its impurities, is evaporated at a high temperature, pure sodium nitrate being thus separated continuously; the solution, after crystallisation, yields potassium nitrate of 90% concentration.

W. J. WRIGHT.

Apparatus for manufacture of acid phosphate.

T. J. STURTEVANT, ASSR. to STURTEVANT MILL CO. (U.S.P. 1,773,287, 19.8.30. Appl., 18.5.27).—Devices for automatically moulding the mixture of sulphuric acid and phosphate rock into a solid porous block, for removing this block rapidly from the mould, and for feeding it into the disintegrator are claimed.

A. R. POWELL.

Manufacture of barium carbonate and sodium sulphhydrate [hydrogen sulphide]. J. B. PIERCE, JUN., ASSR. to BARIUM REDUCTION CORP. (U.S.P. 1,774,523, 2.9.30. Appl., 29.1.27).—Carbon dioxide is passed into a hot solution made by mixing equimolecular amounts of barium and sodium sulphides, each in 15–20% solution, until all the barium is precipitated as carbonate. The precipitate, after washing and drying, is a dense, white powder weighing 67 lb./ft.³ (cf. U.S.P. 1,634,338; B., 1927, 777). The solution is evaporated for the recovery of sodium hydrogen sulphide.

A. R. POWELL.

Production of thiocyanogen salts. E. HENE (B.P. 343,178, 19.11.29. Ger., 19.11.28).—Metal sulphides, hydrosulphides, polysulphides, or thiocarbonates are heated above 300° with dicyanodiamide or thiourea, with or without sulphur.

W. J. WRIGHT.

Utilisation of greensand. W. VAUGHAN and W. M. BRUCE, ASSRS. to PERMUTIT CO. (U.S.P. 1,774,533, 2.9.30. Appl., 3.6.27).—Waste greensand, finer than 50-mesh, is treated with 2 vols. of 20% hydrochloric acid and 1 vol. of concentrated sulphuric acid is added slowly with stirring until decomposition of the sand is complete. The gelatinous silica so obtained is separated from the acid solution, washed, and dissolved in sodium hydroxide solution to yield a solution of water-glass

(d 1.38), which may be used in the manufacture of water softeners. The acid solution is cooled to crystallise out potassium alum, and the mother-liquor is evaporated for a second crop of crystals. The alum is recrystallised for purification and the final mother-liquors are distilled for the recovery of the hydrochloric acid. The residual liquor deposits a third crop of alum, and the remaining solution is evaporated and heated to obtain a red pigment from its content of ferric sulphate.
A. R. POWELL.

Manufacture of carrier bodies for catalytic agents. VER. F. CHEM. U. MET. PROD. (B.P. 343,285, 22.1.30. Ger., 22.1.29).—Natural materials with a high content of silicic acid, e.g., kieselguhr, excluding base-exchange materials, are heated with silicate-forming metallic oxides or salts, the basic constituent being then removed by treatment with a mineral acid.

W. J. WRIGHT.

Apparatus for subliming sulphur. E. F. WHITE (U.S.P. 1,773,562, 19.8.30. Appl., 13.11.24).—A flat rectangular retort in which the sulphur is to be vaporised contains a pipe terminating in a nozzle just above the level of the liquid sulphur. A current of cold inert gas at high pressure is blown through this nozzle, so that the sulphur vapour is swept rapidly into a large, narrow, vertical condensing chamber in which flowers of sulphur are formed by the rapid cooling action of the large surface and the gas stream. The gas is compressed and returned to the nozzle continuously.

A. R. POWELL.

Recovery of sulphur [from roaster gases]. R. C. BENNER and A. P. THOMPSON, ASSRS. to GEN. CHEM. CO. (U.S.P. 1,771,480—1, 29.7.30. Appl., [A] 2.3.26, [B] 30.6.26).—(A) The roaster gases are introduced with coal into the upper part of a combustion chamber the temperature of which is maintained at 700 – 800° by the combustion of part of the coal by the air in the gases; in this way the coal is suddenly converted into a light porous coke and the hydrocarbons evolved reduce the sulphur dioxide to sulphur, a process which is completed by passing the gas mixture through the bed of glowing coke at the lower part of this chamber. The issuing gases are mixed with a further quantity of roaster gas and passed over a bauxite catalyst at 500° to oxidise any unchanged hydrocarbons, hydrogen sulphide, etc. and thence to a condenser to recover sulphur. (B) The sulphur dioxide is reduced with gaseous hydrocarbons, carbon monoxide, or hydrogen in the presence of a bauxite catalyst heated at 500° (cf. U.S.P. 1,773,293—4; B., 1931, 295).

A. R. POWELL.

Manufacture of phosphorus compounds. VICTOR CHEM. WORKS, ASSEES. of H. F. NOYES, R. WEIGEL, and H. W. EASTERWOOD (B.P. 343,390, 22.4.30. U.S., 29.4.29).—The gases produced by the reduction of phosphorus ore in a blast furnace pass through a separator and dust remover into a rectangular combustion chamber. This chamber is connected to a number of equidistant regenerators, so that the conditions of distribution to these of the gases containing phosphorus pentoxide are the same. The gas flow is controlled so that as soon as one regenerator is heated to the desired temperature the gas is diverted to another.

W. J. WRIGHT.

Production of mixtures comprising hydrogen and nitrogen. H. RITTER (B.P. 343,054, 7.11.29. Ger., 9.11.28).—Steam and a gas containing hydrocarbons are passed over a nickel catalyst at 850°, the reaction taking place in an annular vessel of high-grade steel. The mixture is treated with preheated air and passed over a nickel catalyst at 950–1200°, reaction being effected without additional external heating. Complete conversion of methane into hydrogen and carbon monoxide is thus ensured, and the latter may be removed by any desired process. W. J. WRIGHT.

Recovery of iodine [from natural brines]. C. W. GIRVIN, Assr. to GEN. SALT CO. (U.S.P. 1,774,882, 2.9.30. Appl., 8.2.27).—The brine is treated with a reagent which liberates iodine from the iodides in solution, the iodine is absorbed in charcoal, and the charcoal is treated with a solution of sodium hydrogen sulphite to convert its iodine content into hydriodic acid. Iodine is then regenerated from the acid solution by addition of oxidising agents and the purified charcoal is returned to the adsorption vessel. A. R. POWELL.

Machines for handling superphosphate or like material. A/S. DANSK SVOVLSYRE- & SUPERPHOSPHAT-FABRIK, Assees. of K. WARMING (B.P. 344,679, 24.3.30. Denm., 20.9.29).

Crystallisation. Flaker. **Synthetic ammonia.**—See I. **Hydrogen chloride.** **Mixed gas.** **Hydrogen, sulphur, ammonia, and hydrogen sulphide from gases.**—See II. **[Acid-resisting] alloy.**—See X. **Zinc white.**—See XIII. **Manures.**—See XVI.

VIII.—GLASS; CERAMICS.

Heat balances of some ceramic kilns. H. H. MANSUR (J. Amer. Ceram. Soc., 1931, 14, 89–124).—Six kilns (round, downdraught, muffle, horizontal draught, semi-continuous, and continuous) were investigated. The details of instruments, methods, procedure, and results are recorded. J. A. SUGDEN.

Mullite formations in ceramic bodies. L. SOLODOVNIKOVA (Trans. Ceram. Res. Inst., Moscow, 1930, No. 25, 45–56).—The size and quantity of the mullite formations depend on the temperature, duration of firing, and porosity. Crystallographic data for mullite needles are given. CHEMICAL ABSTRACTS.

Organic compounds as electrolytes and their effect on the properties of clay slip and on the life of plaster moulds. C. W. PARMELEE and C. G. HARMAN (J. Amer. Ceram. Soc., 1931, 14, 139–147).—Piperidine, tetramethylammonium hydroxide, or ethylamine may replace the usual mixture of sodium silicate and carbonate as the casting-slip electrolyte, and do not possess the disadvantages of the latter, viz., adverse effect on the life of the moulds and possible formation of vitreous patches on the fired ware. The deflocculating power of the organic compounds decreases in the order given. Measurements of the viscosity and surface tension of several clay slips were made and also transverse strength tests of plaster. J. A. SUGDEN.

Determination of the refractoriness of clay. P. A. ZEMYATCHENSKI and F. A. ZENKOVICH (Trans. Ceram. Res. Inst., Moscow, 1930, No. 24, 1–29).—

When cones did not fuse, fluxes were added (ferric oxide and lime being the best) and the relative refractoriness was obtained by the use of tables.

CHEMICAL ABSTRACTS.

Kaolin as raw material for refractories. E. KÖHLER (Trans. Ceram. Res. Inst., Moscow, 1930, No. 25, 1–44).—By firing at high temperatures, it is possible to prepare very resistant products which show no deformation at a pressure of 2 kg. per cm.² above 1550°.

CHEMICAL ABSTRACTS.

Volumetric determination of magnesia and alumina in minerals and refractory bricks. H. ECKSTEIN (Chem.-Ztg., 1931, 55, 227).—For the determination of magnesia the filtrate from the ammonia precipitate in the ordinary course of analysis is boiled with 3–5 g. of ammonium chloride, 2 c.c. of ammonia, and 15 c.c. of 3% 8-hydroxyquinoline solution, the yellow precipitate is collected, washed with hot very dilute ammonia, redissolved in hydrochloric acid, and reprecipitated as before, the second precipitate is dissolved in dilute hydrochloric acid, and the solution titrated with 0.1N-potassium bromide-bromate, using a 1% solution of indigo-carmin as indicator (1 c.c. of 0.1N-KBr-KBrO₃ = 0.000504 g. MgO). Alumina may be determined in refractories by fusing 0.5 g. of the finely-ground material with 5 g. of fused borax, dissolving the fusion in dilute hydrochloric acid, diluting to 250 c.c., and treating 25 c.c. with ammonia to neutrality, a few drops of hydrochloric acid, 5 g. of sodium acetate, water to 100 c.c., and 3% 8-hydroxyquinoline solution in slight excess to precipitate the alumina. The washed precipitate is dissolved in hydrochloric acid and the solution titrated as for magnesia (1 c.c. = 0.000425 g. Al₂O₃). A. R. POWELL.

Glass standards for varnish.—See XIII.

PATENTS.

Lehrs. L. MELLERSH-JACKSON. From BALL BROS. Co. (B.P. 343,445–6 and 343,457, 12.11.29).—Component parts of a continuously operated lehr are described: (A) deals with heat insulation, (B) with a feeding device, and (C) with a method of preventing the transport rollers from sagging. B. M. VENABLES.

Ultra-violet [light] transmitting glass. W. C. TAYLOR, Assr. to CORNING GLASS WORKS (U.S.P. 1,774,854, 2.9.30. Appl., 15.10.27).—Primary or vein quartz, after treatment to remove titaniferous and ferruginous impurities, is used as the main ingredient in making glasses of this type. A typical batch composition is: SiO₂ 75, Na₂O 15, CaO 4, ZnO 5, and Al₂O₃ 1%; such a glass will transmit approx. 87% of the radiation at 302 mm. in thicknesses of 2 mm.

C. B. MARSON.

Furnace lining. G. D. EVANS, Assr. to AMER. SMELTING & REFINING CO. (U.S.P. 1,775,161, 9.10.30. Appl., 14.3.28).—A lining for copper-refining furnaces consists of silica particles bonded in a matrix of oxides of copper and absorbed silica. The lining is built up by forcing finely-divided silica against the wall while the charge is being withdrawn. Treatment of the lining by this method increases considerably the working life of the furnace. C. B. MARSON.

Lehr. L. J. HARTLE (U.S.P. 1,775,281, 9.9.30. Appl., 10.12.26).—Flues are arranged in close heat-exchanging relation with the tunnel for the goods and a proportion of the used gases is returned to the flues at points distributed over the length of the kiln.

B. M. VENABLES.

Refractory brick. A. J. JACKMAN and C. L. JONES, Assrs. to VESUVIUS CRUCIBLE Co. (U.S.P. 1,775,396, 9.9.30. Appl., 31.5.28).—Composite bricks comprising a body of relatively poor heat-conducting material such as fireclay or silica have embedded therein rods of relatively good, heat-conducting, non-metallic, refractory material, *e.g.*, a silicon carbide-graphite mixture. The rods are placed in a direction normal to the face of the brick which is to be exposed to furnace heating. Bricks so constructed are less liable to spalling.

C. B. MARSON.

Furnace wall.—See I. **Wetting agents.**—See III. **Mirrors.**—See X. **Adhesive.**—See XIII.

IX.—BUILDING MATERIALS.

Solubility of cement. D. WERNER (Tekn. Tidskr., 1930, 60, No. 37, Kemi, 57—64, 68—72; Chem. Zentr., 1930, ii, 3835).—The removal of constituents of various cements by shaking with water was examined; the results are expressed graphically. The use of acid addenda to diminish the solubility of calcium is discussed.

A. A. ELDRIDGE.

Hygroscopicity of wood after various drying processes. C. G. SCHWALBE and K. BERNDT (Kolloid-Z., 1931, 54, 314—326).—The experiments were conducted with fir and pine wood. When air-dried wood is exposed to air which is 92% saturated with moisture, it takes up water rapidly at first and then more slowly, reaching a water content of 20%. Wood dried in a vacuum at the ordinary temperature takes up less water (18.4%), and only 17.6% of water is taken up by wood dried in air at 105°. In all cases the maximal absorption is reached after about 14 days. The hygroscopicity of wood is reduced by heating at 105° in oxygen or in nitrogen and the effect is therefore not due to an oxidation process. When wood is allowed to swell in water and then kept in moist air the rate of loss of water is slower than the regain of dried specimens, and at equilibrium the wood contains about 1.2% more water than do specimens which have previously been dried. The hygroscopicity is also increased by allowing the wood to swell previously in air saturated with water vapour. Swelling and shrinkage are reversible and exhibit hysteresis. Measurements of hygroscopicity can be taken as a measure of swelling, and a simple method for technical purposes is described. Extraction of wood with alcohol or benzene does not alter the hygroscopicity or swelling of the wood in water.

E. S. HEDGES.

Flax residues.—See V. **Plaster moulds.**—See VIII. **Waste pine wood.** **Kauri timber.**—See XIII.

PATENTS.

Asphalt filler [for pavings etc.]. H. L. MEAD, Assr. to AMER. CYANAMID Co. (U.S.P. 1,774,608, 2.9.30. Appl., 9.5.25).—The use of phosphatic slimes and finely-divided dusts and silts, obtained in hydraulic

mining operations and suitably pretreated, is claimed. The fineness of the added material is such that 90% passes 200-mesh, 75% 300-mesh, and 40% 400-mesh.

C. B. MARSON.

Surface treatment of roads. F. C. RANDS and T. F. N. ALEXANDER (B.P. 343,523, 20.11.29).—Road surfaces which contain bituminous substances, and especially those having an excess of this component, are prepared for re-surfacing by treatment with an oily solvent such as kerosene, creosote, etc.

R. H. GRIFFITH.

Rotary kilns. Drying wood etc.—See I. **Bituminous dispersions. Pitch composition.**—See II. **Refractory brick.**—See VIII. **Adhesive.**—See XIII.

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

Explanation of the slag problem in the basic open-hearth furnace. R. BACK (Stahl u. Eisen, 1931, 51, 317—324, 351—357).—The amounts of iron and manganese which pass by oxidation into the slag during the melting down of a charge in the basic open-hearth furnace and during the subsequent "boiling" are shown, by continuous analyses of metal and slag during 19 fusions, to increase with an increase in the CaO : SiO₂ ratio (*V*), but the manganese losses during melting are liable to be somewhat variable (*cf.* Schleicher, B., 1931, 250). In order to ensure the maximum return of manganese to the metal bath during the deoxidation stage, the slags produced should have *V* = 1.5—2. More acid slags with *V* = 1.2—1.4 also give a good return of manganese, whereas highly-basic slags with *V* = 2.5—2.8 give, contrary to expectation, only a poor return of manganese; this behaviour is probably due to the high content in highly basic slags of ferrosilicic oxide, which has a powerful oxidising action on manganese in the metal bath. The "slag test" is shown to be a useful method of determining the correctness of the operations; a good slag button should have a completely smooth, glistening, black surface and a beautiful matt-black fracture free from any trace of lustre.

A. R. POWELL.

New cyanide furnace [for steel hardening]. R. F. JAMES and G. COLEY (J. Franklin Inst., 1931, 211, 327—334).—The chromium-nickel heating elements used for steel hardening from a bath of molten cyanide have a short and uncertain life owing to corrosion and finally to burning out. Experiments showed that this effect was associated with the presence of cyanide vapour, which cannot in practice be altogether excluded from the element chamber. The corrosion increases with the working temperature. It is concluded that it was probably due to the formation of complex cyanides, and that the provision of adequate air circulation, which oxidises cyanides to inert cyanates, would prevent it. A furnace was therefore designed with a baffle on the air intake which directed the air on to the heating elements during the heating period and against the cyanide pot during the cooling period. The size of the elements was increased in order to lower the element temperature without loss of heat capacity. This furnace has been run for 1800 working hours without appreciable

deterioration, which is a great improvement on usual practice. C. IRWIN.

Chemical reactions in the acid steel processes and in the deoxidation of steel with manganese and silicon. H. SCHENCK (Arch. Eisenhüttenw., 1930—1, 4, 319—332; Stahl u. Eisen, 1931, 51, 292—294).—Curves have been constructed showing the relation between the ferrous oxide content of molten iron at various temperatures and the manganese and silicon contents, and from these curves ternary diagrams have been developed to show the equilibria conditions between the silicon and manganese contents of the metal and the composition of the ferrous manganous silicate slag and the amount of free ferrous oxide in the slag. High temperatures tend to increase the silicon and manganese contents of the metal, this tendency being also favoured by the greater solubility of the hearth silica in the slag. At 1527° for metal containing 0.3% Mn and 0.05% Si the composition of the slag in equilibrium is 8.6% FeO, 40% MnO, and 51.4% SiO₂; the slag contains 0.8% of free ferrous oxide, and the metal 0.008% FeO (\equiv 0.0017% O). In order to obtain a slag of sufficient fluidity for good deoxidation it is essential that the manganese content of the metal exceed a definite minimum value, dependent on the silicon content; thus for 0.05% Si, at least 0.13% Mn is necessary at 1527°; for 0.1% Si, 0.22% Mn; for 0.2% Si, 0.35% Mn; and for 0.5% Si, about 0.5% Mn. A. R. POWELL.

Reduction of magnetite and limonite by methane. O. MEYER and W. EILENDER (Arch. Eisenhüttenw., 1930—1, 4, 357—360; Stahl u. Eisen, 1931, 51, 294—295).—Reduction of limonite by methane commences at about 700°, and takes place more rapidly than that of magnetite at a somewhat higher temperature. At constant temperature the rate of reduction of both oxides increases with increasing gas velocity to a maximum and [then decreases at higher velocities; at constant gas velocity the rate of reduction increases linearly with rise of temperature, the deposition of carbon on the iron particles preventing sintering of the mass. The shape of the reduction curves indicates that methane itself is not an active reducing agent, but that reduction is brought about by the carbon and hydrogen produced by its thermal dissociation; for this reason it is impossible to obtain an iron sponge sufficiently low in carbon and phosphorus to justify the use of methane as a reducing agent for iron ores in an externally heated furnace. On the other hand, quite good sponges may be produced by a regulated partial combustion of the methane inside the reducing chamber in such a way as to produce the heat necessary for the reaction and sufficient hydrogen and carbon monoxide to effect the reduction; the consumption of methane in this procedure may, under favourable conditions, be as low as 300 m.³ per ton of iron produced. A. R. POWELL.

Effect of certain elements on the segregation of cementite, and its relation to the modification process [in steels]. J. H. ANDREW (J. Roy. Tech. Coll. Met. Club, 1929—30, No. 7, 16—17).—The influence of certain elements, notably manganese, has been studied. Specimens of steels, containing (a) 0.08% Mn, 0.22% C,

and (b) 0.60% Mn, 0.21% C, have been subjected to prolonged treatment at 1100—1300° followed by rapid cooling in air. The carbide in (a) was largely present as films in the grain boundaries, whereas in (b) carbide occurred only as a constituent of pearlite. The effect of manganese in this case is compared with that of sodium in producing the modification of aluminium-silicon alloys. E. H. BUCKNALL.

Scheme for research on steel-production methods on physico-chemical principles. H. SCHENCK (Stahl u. Eisen, 1931, 51, 197—202).—The importance of a thorough knowledge of the chemical reactions which occur in the manufacture of steel is emphasised and several promising lines of research are indicated. Finally a scheme of co-operation between works, research laboratories, and colleges for further examination of the metallurgical processes in steel manufacture is outlined. A. R. POWELL.

Large-scale tests in pig-iron analysis. K. DAEVES (Stahl u. Eisen, 1931, 51, 202—204).—The results of daily analyses of pig-iron from three blast furnaces over a period of three months' working are collated and frequency curves are constructed for each element present, showing the distribution of the results between the maximum and minimum values. A further series of curves showing the relation between the content of each pair of the elements silicon, manganese, sulphur, and phosphorus indicates that there is some connexion between the amounts of these elements in the pig iron irrespective of the conditions of operating the furnace. A. R. POWELL.

Hair-line cracks [in steel]. T. M. SERVICE (J. Roy. Tech. Coll. Met. Club, 1929—30, No. 7, 9—15).—Ingots of steel (C 0.24—0.29%, Ni 3.4—3.8%, Cr 0.52—0.82%, Mn 0.40—0.58%, S + P < 0.35%) have been cast and subjected to hot-working. Ingots forged hollow have yielded material free from cracks, but solid-forged ingots were markedly affected by cracking. This was especially the case when the temperature of final annealing was above the Ac₃ point. Similarly, forged material annealed below the Ac₁ point were sound, even though the original ingot was badly cracked. The defect arises from stresses set up in cooling after forging, and not from unsoundness of the ingot, as was previously believed. E. H. BUCKNALL.

Vibration fatigue strength [of steel]. W. SCHNEIDER (Stahl u. Eisen, 1931, 51, 285—292).—The importance of a knowledge of the fatigue strength of constructional steels is emphasised and modern ideas on the mechanism of fatigue are discussed. The effect of surface irregularities, notches, bends, and variations in the cross-section on the behaviour of metal subjected to high loads is considered, and it is shown that the fatigue strength of such metal is improved if it is first subjected to a high static load above the yield point. A. R. POWELL.

Sensitivity of mild ingot steel to overheating. E. POHL, E. KRIEGER, and F. SAUERWALD (Stahl u. Eisen, 1931, 51, 324—326).—Specimens of electrolytic iron (0.05% C, 0.11% Mn, 0.10% Cu, 0.013% P, and 0.03% S), mild steel (0.07—0.14% C, 0.46—0.52% Mn, 0.2% Cu, 0.025—0.044% P, and 0.03—0.075% S),

and molybdenum steel (0.16% C, 0.48% Mn, 0.14% Cu, 0.3% Mo, 0.011% P, and 0.02% S) were annealed for 1 hr. and for 5 hrs. at 950–1400° and the increase in grain size and depth of penetration of the oxide layer measured. Grain growth in the electrolytic iron proceeded regularly with rise in annealing temperature from 900° to 1400°, but in the other steels grain growth was slow up to 1100°, above which it proceeded rapidly to 1300°, and then ceased; in two cases a slight decrease in grain size occurred at temperatures just above the Ac₃ point. Burning of the metal commenced at 1300° in the case of electrolytic iron and at 1350–1400° in the steels; above 1400° all the steels showed an overheated structure. In 5 hrs. oxidation had penetrated to a depth of 0.3 mm. into electrolytic iron at 1150° and of 0.8–0.9 mm. into the steels at 1300°. Apparently the variable sulphur and phosphorus contents of the steels had little effect on the grain growth or tendency to oxidise. Bending tests at 1200–1250° showed that normalised steel behaves satisfactorily owing to its fine-grained structure, whereas coarse-grained recrystallised steel rapidly develops intercrystalline cracks.

A. R. POWELL.

Volume changes of steel under elastic and plastic stresses. H. HANEMANN and R. YAMADA (*Arch. Eisenhüttenw.*, 1930–1, 4, 353–356; *Stahl u. Eisen*, 1931, 51, 225–226).—The increase in volume of annealed and worked steels during the application of the load in the tensile test has been measured. The load-increase in volume graph for any specimen is a straight line within the elastic range, but becomes curved in the plastic range; for all the samples tested the points at which this deviation occurred lay in a smooth curve bending slightly towards the volume axis, i.e., plastic flow produces an abnormal increase in volume. Steel the state of which is represented by a point in the field below this curve is in a metastable condition and will revert to its normal volume after prolonged keeping or after gentle heating.

A. R. POWELL.

Determination of the creep limit [of steel] by an accelerated test. A. POMP and W. ENDERS (*Stahl u. Eisen*, 1931, 51, 157–162).—The apparatus comprises a furnace the temperature of which may be maintained practically constant for very long periods while the creep of the specimen is measured automatically on a photographic recorder. The creep of four steels with 0.06–0.61% C, three cast steels, and a 13% Cr steel at 300, 400, and 500° has been followed over periods up to 2400 hrs. From the results obtained it is suggested that the creep limit or endurance strength of a steel at any temperature should be taken as the highest load which the specimen will withstand without undergoing an elongation of more than 0.003%/hr. between the fifth and the tenth hours of the test. To determine the endurance strength at any temperature the elastic limits (0.01, 0.1, and 0.2%) at that temperature are determined in the usual tensile machine and 10-hr. tests under these loads are made in the apparatus mentioned above; from the rates of extension found in the period 5–10 hrs. the load corresponding with a 0.003%/hr. rate is obtained by interpolation.

A. R. POWELL.

Tensile properties of alloy steels at elevated temperatures as determined by the "short-time" method. W. KAHLBAUM, R. L. DOWDELL, and W. A. TUCKER (*Bur. Stand. J. Res.*, 1931, 6, 199–218).—The proportional limits of the following steels have been investigated by the "short-time" test, i.e., by determining the stress-strain curve at the desired temperature during $\frac{1}{2}$ hr.: plain carbon steel, and alloys of chromium-vanadium, chromium-vanadium-tungsten (also with additions of aluminium and silicon), chromium-tungsten, nickel-molybdenum, and austenitic steels containing nickel and chromium and in some cases tungsten. Addition of 1.5–2% of tungsten to a chromium-vanadium steel improves the tensile properties at high temperatures; further additions of aluminium or silicon produce no marked improvement. A marked increase in tensile strength of a steel brought about by heat treatment is maintained at high temperatures only if the temperature of testing is kept below that of tempering. "Short-time" tests cannot satisfactorily replace "flow" tests at high temperatures.

C. W. GIBBY.

Iodometric determination of vanadium in special steels and in ferrovanadium. W. WERZ (*Z. anal. Chem.*, 1931, 83, 161–164).—The method described previously (*B.*, 1930, 1156) is modified as follows: the steel (1–3 g.) is boiled with 25 c.c. of phosphoric acid (d 1.7) and 200 c.c. of water and, when the metal is completely dissolved except for a small amount of chromium carbide, the solution is oxidised with nitric acid (d 1.4), using an excess of 5 c.c. Red fumes are expelled by boiling, the solution is filtered through a porcelain filter crucible, and the filtrate boiled for 35 min. with 10 c.c. of 5% ammonium persulphate solution. A further 25 c.c. of phosphoric acid are added and, after cooling, 2–10 c.c. of 0.2*N*-potassium iodide. After 5 min. the iodine liberated is titrated with thiosulphate. For ferrovanadium, 1 g. is dissolved in 50 c.c. of 1:1 nitric acid and the solution diluted to 500 c.c.; 50 c.c. are then mixed with 50 c.c. of phosphoric acid, 150 c.c. of water, and 5 c.c. of nitric acid (d 1.4), and the analysis is finished as above.

A. R. POWELL.

Metallurgical considerations in autogenous welding [of steel]. F. RAPATZ (*Stahl u. Eisen*, 1931, 51, 245–253).—For mild steels electric welding with a clean welding rod connected to the negative pole gives the strongest joints, but the method is unsuitable for steels with a high content of carbon and alloy metals. With the welding rod connected to the positive pole it is difficult to get the welding metal to burn into the work, but this arrangement is the most suitable for spot-welding or for building up worn parts on high-carbon steels. Uncoated wires do not give satisfactory welds with alternating-current arcs, but cored wires can be used in many cases. Coated rods can always be used with alternating-current, but with direct-current arcs they should be connected to the positive pole. The effect of the composition of the welding rod and the welding conditions on the composition of the metal in the welded joints is discussed at some length with reference to many examples. The metal surrounding the weld usually shows several zones of different heat

treatment; immediately surrounding the weld is an overheated zone, then a normalised zone, a less well-annealed zone, and finally, in many cases, a zone of metal showing "blue brittleness." The extent of these zones is greatest with gas welds and least with electric welds made with uncoated rods. In the case of alloy steels there may be zones of air-hardened metal. The existence and extent of these various zones play a considerable part in determining the strength of the weld. A. R. POWELL.

Pickling and etching [of metal surfaces]. H. KURREIN (Chem.-Ztg., 1931, 55, 133—134, 150—151).—The composition, purpose, and method of action of pickling baths for iron and steel are discussed and the function of inhibitors is explained. The production of matt, coloured, and etched surfaces on copper alloys by treatment with concentrated acids etc., and on aluminium and light alloys by means of alkaline reagents is also described and details of the composition and method of using numerous etching baths are given. A. R. POWELL.

Importance of the crystal structure for the determination of the elastic limit and endurance strength of electron. W. SCHMIDT (Z. Metallk., 1931, 23, 54—57).—From crystallographic considerations it is deduced that it is not permissible to compare the behaviour of hexagonal and cubic metals on the basis of their conventional elastic limits. The true elastic limit of a hexagonal metal can be deduced only from a consideration of the whole load-extension curve. Values for the static and dynamic endurance strength and for the hysteresis of electron are recorded. A. R. POWELL.

Corrosion of early Chinese bronzes. W. F. COLLINS (Inst. Metals, Mar., 1930. Advance copy. 25 pp.).—Numerous Chinese bronzes ranging in age from the earliest known periods of the Chinese bronze age up to 906 A.D. have been analysed and the nature of the patina and patination or surrosion deposits thereon has been determined in many cases. As has been found to occur in the case of copper exposed to atmospheric corrosion, the corrosion products on Chinese bronzes which have been buried for many hundreds of years in the loess of Central China approximate in composition and characteristics to natural minerals. Many of the bronzes have a high content of lead which in some cases appears to replace the tin almost entirely. A. R. POWELL.

Debismuthising lead with calcium. R. F. COHN (Trans. Amer. Electrochem. Soc., 1931, 59, Preprint 2, 13—18).—The bismuth content of lead may be reduced to below 0.05% by treating the molten metal with calcium at 480°, cooling to just above the m.p. of lead, and removing the dross, which resembles that produced in the Parkes process for desilverising lead, and consists of a ternary bismuth-calcium-lead compound. This treatment eliminates also the last traces of arsenic, antimony, copper, and silver; the excess calcium is removed by blowing air, steam, or chlorine through the molten metal. Calcium may be added to lead as a lead-calcium alloy produced by electrolysis of fused calcium chloride, using molten lead as the cathode, or by heating lead with calcium carbide at 870°. A. R. POWELL.

Influence of pressure and temperature on the extrusion of metals. C. E. PEARSON and J. A. SMYTHE (Inst. Metals, Mar., 1931. Advance copy. 25 pp.).—Lead can be extruded into smooth rods below 325°, cadmium at 100—260°, bismuth at 30—250°, and tin at 16—223°. The rate of extrusion (R) of all four metals is connected with the extrusion pressure P by the equation $\log R = a \cdot \log P + \log b$, where a and b are constants having distinct values for every temperature and metal. The value of a decreases in a smooth curve with increase of temperature in the cases of lead, bismuth, and cadmium, being greatest for bismuth and least for cadmium. For tin the value of a reaches a minimum at about 160°, but in all cases the curves are approximately hyperbolæ. The values of b at different temperatures are really the rates of extrusions produced by a load of 1 ton at these temperatures. Numerous photographs of the etched macrostructure of extruded rods of these metals are reproduced, showing the flow lines and zones of recrystallisation, and the causes of certain defects in extruded rods are briefly discussed. A. R. POWELL.

Electrothermic zinc. A. WALTER (Trans. Amer. Electrochem. Soc., 1931, 59, Preprint 4, 27—31).—The development of electrothermal zinc during the last 30 years is reviewed. In modern practice the roasted ore is smelted with coke in a Héroult arc furnace, whereby most of the zinc distils, leaving in the furnace a bottom layer of lead covered with a thin layer of copper matte and a thicker layer of slag containing 2% Zn. The vapours from the furnace pass to a condenser, and thence to a rotating drum which causes the condensed particles to coalesce into liquid zinc. About 95% of the distilled zinc is collected as crude liquid metal and 5% as "blue powder." The crude zinc contains 93—95% Zn, 2% Fe, and 5—3% Pb, and is redistilled from a small closed retort heated by an indirect arc, whereby 99.7% Zn is obtained, leaving a pool of lead and an iron alloy in the refining furnace. Current consumption is about 2000 kw.-hrs. per ton of ore and 1250 kw.-hrs. per ton of crude zinc. In addition to the zinc, 94—96% of the lead, about 95% of the gold and silver, and about 80% of the copper in the ore may be recovered from ores containing more than 1% Pb, 1% Cu, and 0.5 g. Au per ton. The zinc dust obtained as a by-product contains 96% Zn and has a reduction efficiency of 20% above that of ordinary "blue powder." A. R. POWELL.

Influence of small quantities of foreign metals on the properties of refined zinc. [O. BAUER and P. ZUNKER (Z. Metallk., 1931, 23, 37—47).—Addition of up to 3% of tin, cadmium, magnesium, or antimony to zinc reduces appreciably the pipe formed in cast ingots; copper, lead, and iron, however, have no action in this respect. Tin, antimony, lead, and cadmium have no effect on the hardness or impact strength, magnesium and iron make zinc hard and brittle, and copper renders it hard and increases the tensile strength. The variations in hardness, impact strength, and percentage contraction on solidification for zinc alloys with 0—3% of each of the above metals are shown in a series of graphs and tables. A. R. POWELL.

Hot-galvanising with zinc and cadmium. ANON. (Chem.-Ztg., 1931, 55, 225—226).—An account is given of the methods used in galvanising iron and steel sheets by the hot-dipping process and in the preliminary cleaning of the metal in pickling baths. Cadmium or cadmium-zinc alloys are now replacing zinc in the galvanising bath when a higher resistance to corrosion is required; these baths can be operated at lower temperatures, e.g., at 220° for the alloy with 29% Cd and 71% Zn, or at 300° for the alloy with 17% Zn and 83% Cd, do not take up nearly as much iron as does the ordinary zinc bath, and hence may be melted in iron pots.

A. R. POWELL.

Some properties of metallic cadmium. C. H. M. JENKINS. **X-Ray investigation of cold- and hot-rolled cadmium.** G. D. PRESTON (Inst. Metals, Mar., 1931. Advance copy. 32 pp. [with appendix]).—The physical properties of cadmium have been investigated by means of tensile and ball-hardness tests and by electrical conductivity measurements on "aged" and heat-treated specimens in the cast, forged, and rolled conditions. Hardness changes in rolled material which occur at room temperature are markedly affected by slight changes in the conditions of working, such as the temperature produced during rolling, or according as rod or sheet is the subject of examination. At the commencement of cold-working the metal hardens; on continued working it softens. By maintaining cadmium cold during rolling, the material produced possesses properties markedly different from those of metal which is allowed to become warm during the process. In the short-time tensile tests worked material is found to be stronger than cast material, but under prolonged stress the cast alloys are inferior to rolled samples. Microscopical examination of the various specimens shows that in the cold-rolled condition the material appears to be completely recrystallised and of fine grain size, but prolonged ageing over a period of years results in appreciable grain growth. After slight straining, the microstructure of cadmium is rendered complex, and full account must be taken of the effect of the methods of preparation for this work. Density determinations of variously-aged specimens have also been made.

The X-ray examination of samples of hot- and cold-worked cadmium does not indicate an allotropic modification at room temperature and ordinary pressures, but there are marked differences in properties which suggest a preferred orientation.

O. J. WALKER.

Deformation of metals under prolonged loading. I. **Flow and fracture of aluminium.** D. HANSON and M. A. WHEELER (Inst. Metals, Mar., 1931. Advance copy. 29 pp.).—The microstructure of polished specimens of aluminium subjected to static stresses at various temperatures has been examined in order to follow the changes which occur during deformation by slow creep. Prolonged application of a load which will ultimately cause fracture causes a slow elongation at first, the rate of which slowly diminishes; this is followed by a stage in which movement is almost or quite at a standstill, and finally by a period in which flow commences again at a rate which continuously increases until fracture

ensues. Flow in the first period is due to slip within the crystals, and its retardation is caused by the accompanying hardening effect of this slip. Failure under creep may be caused by intercrystalline cracking, characterised by a low elongation and reduction in area, by resumption of slip within the original crystals leading to fracture of the normal tensile type, and by the removal of strain-hardening due to recrystallisation, leading to fracture with a high elongation and reduction in area at the break. Aluminium fails by creep at the ordinary temperature by shear along the slip planes, and polycrystalline aluminium by intercrystalline cracking at 250°. The behaviour of single-crystal specimens of aluminium under creep conditions has been examined at temperatures up to 400°: in the third stage of flow slip occurs only on some of the surfaces that had previously slipped during the primary flow, and when the rate of flow is slow slip is distributed over such a large number of slip surfaces that a polished surface of the metal may show only traces of slip bands. Lead fails under prolonged stress at the ordinary temperature with a large elongation and a point fracture, but at 200° it fails by the development of intercrystalline cracks.

A. R. POWELL.

Dimensional stability of heat-treated aluminium alloys. J. D. GROGAN and D. CLAYTON (Inst. Metals, Mar., 1931. Advance copy. 28 pp.).—Serious dimensional changes occur during the machining of many aluminium alloys after quenching in cold water; in the case of "Y"-alloy and duralumin these changes may be prevented by quenching in boiling water. No secular changes occur in these alloys after completion of the normal age-hardening process.

A. R. POWELL.

Electrodeposition of gold from alkaline cyanide solutions. E. T. DUNSTAN (J. Chem. Met. Min. Soc. S. Afr., 1930, 31, 118—127).—Attempts to recover the gold from pregnant cyanide solutions, with simultaneous regeneration of free cyanide, by electrolysis in a cell with a rotating cathode showed that the recovery of gold was much more difficult than by precipitation with zinc. The current efficiency with solutions containing less than 10 dwt. of gold per ton was much below 1%, and no regeneration of cyanide whatsoever was obtained.

A. R. POWELL.

Microstructures of fifteen silver Greek coins (500—300 B.C.) and some forgeries. C. F. ELAM (Inst. Metals, Mar., 1931. Advance copy. 10 pp.).—Photomicrographic investigation of some ancient Greek coins and of some forgeries shows that the structure varies considerably, although coins from the same mint and period resemble one another. All the genuine coins were struck between dies, whereas the forgeries, with one exception, were made by casting only. Analyses indicate that the earlier coins were made of nearly pure silver, and that in the others copper was included. The forgeries contained copper and, in two cases, zinc.

O. J. WALKER.

Silver alloys resistant to tarnishing and capable of being age-hardened. J. A. A. LEROUX and E. RAUB (Z. Metallk., 1931, 23, 58—63).—The solid-solubility of copper in α -zinc-silver solid solution is approximately the same as that in pure silver, but the rate of diffusion

is much greater. Hence, although these alloys undergo age-hardening after appropriate heat treatment, the reproduction of definite mechanical properties by this treatment is difficult, and is rendered more so by the tendency which the ternary alloys show to develop a very coarse crystal structure. The solid-solubility of nickel in the ternary alloys is less than 0.1% at the ordinary temperature and somewhat above 0.3% at 700°, but alloys with satisfactory working properties may be obtained with up to 1.5% Ni. Such alloys containing 83.5% Ag and the remainder copper and zinc in the ratio 1:3 may be age-hardened at 280°, after quenching from 600–700°, without developing a coarse crystalline structure. The optimum mechanical properties are obtained after tempering for 3 hrs. at 280°; the hardness then exceeds 90 and the tensile strength 42 kg./mm.² with an elongation of 25%. Almost as good results are obtained under similar heat-treatment conditions with the plain copper-silver alloy with 83.5% Ag, but the replacement of the greater part of the copper by cadmium destroys the capacity for age-hardening, and it is not restored by addition of nickel.

A. R. POWELL.

Nature and causes of efflorescences on electrolytic silver coatings. H. MOSER, K. W. FRÖHLICH, and E. RAUB (*Z. angew. Chem.*, 1931, 44, 97–100).—Silver-plated brass or nickel-silver articles frequently become covered with small white to yellow spots sometimes shortly after plating and sometimes after the lapse of many weeks. The spots appear to spread outwards from small nuclei. Experiments indicate that these nuclei are small hollows in the plate filled with the solution used for plating. At the base of these hollows is usually either a speck of cuprous oxide derived from the annealing of the base metal or a particle of polishing material driven into the surface of the base metal by too heavy buffing before plating. In the early stages of plating silver fails to deposit on the impurities, but when the plate thickens it grows over the inclusions, thus forming a hollow which includes part of the plating solution. On subsequently burnishing the deposit the minute hole at the centre of this hollow may be closed up, imprisoning the solution contained therein, this subsequently works its way by chemical or electrolytic action through the relatively thin film of silver covering it and then spreads over the surrounding metal, causing the characteristic efflorescences.

A. R. POWELL.

Electric melting of non-ferrous alloy. K. OKIMORO (*J. Fuel Soc. Japan*, 1931, 10, 11–12).—The cost of operating an oscillating, direct-arc type of electric furnace in the melting of phosphor-bronze, brass, and nickel is compared with the cost of using a coke crucible furnace. Melting losses were 0.2 and 1.4%, respectively, and melting costs were in the ratio 35:60.

A. R. POWELL.

Cathodic protection of metals in neutral solutions. U. R. EVANS (*Metals & Alloys*, 1931, 2, 62–64).—A rapid method of determining the value of protectors is to apply an adjustable *E.M.F.* through a resistance (40,000 ohms) which is high compared with that of an experimental cell. A constant small current is allowed to pass between the zinc anodes and the iron specimen to be studied. The liquid, containing 0.1% of potassium

ferricyanide as indicator, is run in, 2 c.c. each 15 sec., thus gradually increasing the area covered and decreasing the current density (*C.D.*). When the *C.D.* passes below the protective value a blue discoloration appears around the specimen. Remarkable variation between individual specimens was observed without any reference either to the nature or concentration of the neutral solution. Sulphuric acid induced increased corrosion by destroying the primary skin, but carbon dioxide and calcium bicarbonate allow protection at *C.D.* lower than those needed with other salts. The present work shows that the low *C.D.* recommended by Bauer and Vogel only slightly reduced the attack, which is still serious even at 5 times that value if the solution is stirred.

C. A. KING.

Adhesion of electroplated coatings. W. BLUM (*Metals & Alloys*, 1931, 2, 57–59).—The best adhesion of plated coatings may be expected when the metal surface is absolutely clean of all foreign materials, including grease, oxide, alkali, or soap. All metals show a tendency to contract during deposition, and the adsorption of hydrogen produces strains not only during deposition, but later as the gas is escaping gradually. It may be predicted that relatively soft ductile coatings will be deposited under conditions of low cathode polarisation and high efficiency. Chromium for abrasion-resistance is usually applied directly to the steel. For cleaning the steel it is best to make it anodic in the chromic acid bath just before plating.

C. A. KING.

Testing chromium plate for resistance to abrasion. H. C. WOLFE (*Metals & Alloys*, 1931, 2, 60–61).—A plated specimen rests horizontally, under the influence of a determined load, on a Norton 120J alundum wheel (diam. 2 in., face $\frac{1}{4}$ in.). The wheel is rotated at a linear speed of 10 ft./min. and is cleaned continuously. A dial gauge measures the depth of the cut directly to 0.0001 in. Increased accuracy was obtained by the use of a copper wheel rotating in a mixture of levigated alumina, but the operation is longer and the abrasive mixture soon becomes contaminated with particles of chromium. The results of comparisons of the quality of different chromium plate were quite satisfactory, but were not so when compared with the abrasive resistance of other metals.

C. A. KING.

Resistance of chromium-plated plug gauges to wear. H. K. HERSCHMAN (*Bur. Stand. J. Res.*, 1931, 6, 295–304).—Within the limits used in chromium deposition, no material differences in the hardness of chromium deposited directly on hardened steel (1% C) were found. Microscopic cracks increased in number and resistance to wear of unlapped chromium plate decreased with increased thickness of deposit. The wear-resistance of lapped chromium plate was increased by preheating to 300°. “Milky” and “frosty” deposits, subsequently lapped, were more resistant than bright deposits similarly lapped. Preliminary copper plating of the steel improved the wearing properties of “milky” and “frosty” deposits of chromium, but not of bright ones.

C. W. GIBBY.

Steam boilers.—See I. **Varnish for tins.**—See XIII. **Tinned insulations.**—See XIV.

PATENTS.

Blast furnace. R. FRANCHOT and K. P. McELROY, Assrs. to FERRO CHEMICALS, INC. (U.S.P. 1,775,955, 16.9.30. Appl., 6.8.28).—An iron blast furnace is provided with wide, refractory, heat-insulated conduits for withdrawing gas containing cyanide vapour from the hot zone of the furnace, just above the tuyères. The gases in each conduit pass through a narrow jet-like constriction into a collecting chamber in such a way that a swirling stream of expanded gas, which is thereby cooled, is produced in the chamber and the saline content of the gas is deposited. Cooling of the gases is also produced by the injection of cold gas through the constriction, and the chambers are provided with refractory filtering material so as to clean the gases before they pass through a common flue into a heat exchanger in which they preheat the air feed to the tuyères. A. R. POWELL.

[Regenerative] open-hearth [steel] furnace. T. T. McENTEE (U.S.P. 1,775,367, 9.9.30. Appl., 13.12.21).—The ends of the furnace are each provided with a throat opening into the hearth, an uptake communicating with the throat, a nozzle extending through the wall of the uptake and towards the throat, a second stationary uptake connecting with the nozzle which is supported by a carriage to admit of its being moved in the throat, and a water-seal between the nozzle and the stationary uptake flue to prevent escape of gases in any position of the nozzle. A. R. POWELL.

Open-hearth furnace construction. (A—H, K—P) G. L. DANFORTH JUN., (I, J) E. J. McDONNELL, (Q) R. S. A. DOUGHERTY, (R, S) A. T. KELLER, (T, U) F. ORTH, (V) H. E. SMYTHE, and (W) R. H. STEVENS, Assrs. to OPEN HEARTH COMBUSTION CO. (U.S.P. 1,769,209—1,769,213, 1,769,366—8, 1,769,446—7, 1,769,492—6, 1,769,678, 1,769,826, 1,769,842—3, 1,769,853—4, 1,769,863, and 1,769,866, [A—W] 1.7.30. Appl., [A] 27.12.21, [B] 28.1.22, [C] 2.2.22, [D] 15.3.22, [E, H] 6.4.22, [F] 8.10.21, [G] 28.11.21, [I, J] 16.5.21, [K] 26.9.21, 9.10.22, [M—O] 4.4.30, [P] 10.7.22, [Q] 8.5.22, [R, S] 5.12.21, [T] 7.2.21, [U] 6.9.24, [V] 9.1.22, [W] 22.9.21. Renewed [L] 11.4.30).—Various arrangements of the ports, air uptakes, flues, valves, and dampers governing the admission of air and gas to regenerative open-hearth steel furnaces are claimed. A. R. POWELL.

[Metallurgical and like] furnaces. MELDRUMS, LTD., and S. N. MELDRUM (B.P. 343,001, 2.8.29).—In a furnace provided with a mechanical stoking device liable to be damaged by radiated heat, such device is separated from the furnace proper by a water-cooled collar. [Stat. ref.] B. M. VENABLES.

Electrothermic zinc furnace. E. C. GASKILL (U.S.P. 1,775,591, 9.9.30. Appl., 17.9.28).—The furnace comprises a shaft made up of a series of separately supported spaced sections to provide for expansion and contraction and for openings through which the zinc vapours can escape. The upper part of the furnace contains three electrodes spaced at angles of 120° to one another round the shaft and the lower part contains three corresponding electrodes which are displaced at 180° with respect to the corresponding electrodes at the top of the furnace so that the current passes down the

shaft diagonally. Each of the three pairs of electrodes has its own current supply from a single-phase alternating-current transformer. The shaft is supplied continuously with a mixture of zinc oxide and coke, which is heated to the required reducing temperature by the resistance of the column to the current; the issuing zinc vapours are condensed to metal or burned to zinc oxide. A. R. POWELL.

Sintering machine [for blast-roasting sulphide ores]. C. H. MACE (U.S.P. 1,773,916, 26.8.30. Appl., 25.5.28).—The apparatus comprises a laterally inclined hearth surmounted by a movable, refractory-lined hood into which is directed one or more oil-fired burners in such a way that the flame passes round the inside of the hood and downwards over the inclined bed of ore. A. R. POWELL.

Crucible for aluminothermic reactions. H. SCHULTZ (U.S.P. 1,774,816, 2.9.30. Appl., 24.7.29. Ger., 31.8.28).—The crucible comprises a conical sheet iron casing with a thick refractory lining surmounted by a heavy cast iron annulus which is bolted to the lower casing by means of external lugs. The crucible is especially adapted for welding iron or steel by the aluminothermic process; the cast iron top resists the action of the slag formed and thus prolongs the life of the refractory-lined portion in which the metal formed by the reaction collects. A. R. POWELL.

Treating [oxidised copper] ores [preparatory to flotation]. J. M.² CALLOW, Assr. to UNION CARBIDE SALES CO. (U.S.P. 1,774,786, 2.9.30. Appl., 15.1.27).—Coarsely crushed, oxidised copper ores are made into a thick paste with water and the paste is fed by means of a screw conveyor into a wet ball mill with a short feed aperture in which the thick paste as it passes into the mill forms a continuous gastight plug. Calcium carbide is added to the mill so that on grinding the ore the particles of copper mineral are coated with copper acetylide. The discharge from the mill passes into a water-sealed classifier from which the coarser particles are returned for regrinding and the water passes to a vacuum apparatus in which the excess acetylene is recovered and from which it is returned to the mill. A. R. POWELL.

Reduction of ores of reducible oxides [e.g., iron ores]. T. F. BAILY (U.S.P. 1,775,713, 16.9.30. Appl., 3.1.24).—A mixture of finely-divided iron ore and an excess of carbon over that required for its reduction is allowed to fall in a regulated continuous stream through a closed shaft furnace provided with an annular gastight chamber containing granular carbon heated by electrical resistance and situated near the bottom of the furnace so as to form a constriction in the shaft. Through tuyères in the lower part of the furnace below the auxiliary resistance heater is passed a current of hot carbon monoxide which in passing up through the shaft effects reduction of the ore. The gases from the top of the shaft pass through a bed of hot coke to regenerate carbon monoxide for further use in the process. At the bottom of the furnace is a pool of molten iron containing an excess of carbon to form carbide. A. R. POWELL.

Production of sponge iron from its ores. F. KRUPP A.-G. FRIEDRICH-ALFRED-HÜTTE (B.P. 343,618, 29.11.29. Ger., 20.9.29. Addn. to B.P. 340,641; B.,

1931, 255).—The gas withdrawn from the blast furnace as claimed in the prior patent is cooled, freed from dust, and reheated before being returned to the furnace.

A. R. POWELL.

Uniting of iron with other metals and elements.

W. H. SMITH, ASSR. to GEN. REDUCTION CORP. (U.S.P. 1,775,358, 9.9.30. Appl., 23.9.29).—Finely-divided iron is mixed with carbon or other alloying element and the mixture is compressed into the desired shape and heated at a temperature below the m.p. of iron, but sufficiently high to cause the second element to alloy with the iron; further pressure is then applied to consolidate the article into a solid uniform mass. If desired, the proportion of alloying element may be varied in the different parts of the article when making the mixture, so as to confer special properties, e.g., great hardness, on certain parts.

A. R. POWELL.

[Cast-iron alloys. W. E. DENNISON (B.P. 343,745, 19.2.30).—Cast iron containing 3–3.5 (3.35)% C, 1.5–3 (2.25)% Si, 0.5–2 (0.7)% Cu, 0.25–0.75 (0.43)% Cr, 0.7% Mn, and the usual amounts of sulphur and phosphorus is claimed to be highly resistant to corrosion by dilute sulphuric acid.

A. R. POWELL.

Manufacture of alloy steels. C. ARNOLD (B.P. 343,700, 21.1.30).—The fluorine-containing slag used in the removal of sulphur and phosphorus from the iron is replaced by an alkaline-earth and/or magnesia metasilicate slag before addition of the alloying elements in the form of ferro-alloys. As the temperature falls the slag is rendered more fluid by the gradual addition of alkali metasilicate.

A. R. POWELL.

Steel alloys. F. KRUPP A.-G. (B.P. 343,464, 18.11.29. Ger., 20.12.28).—Molybdenum or vanadium steels with 0.5–5% Ti or Be and/or 0.75–4.9% Si are claimed to maintain their high strength at temperatures above 600°.

A. R. POWELL.

[Nickel-chromium] steels. C. K. EVERITT, and E. ALLEN & CO., LTD. (B.P. 343,997, 30.10.29).—Steels containing up to 2% Cu, 0.5–2% W, and/or 0.25–1% Mo, together with 8–20% Ni and 12–24% Cr are claimed. The nickel and chromium contents in any case exceed 32%.

A. R. POWELL.

Ferrous alloys [containing copper, silicon, and aluminium]. B. D. SAKLATWALLA (B.P. 344,167, 31.1.30).—The alloys comprise iron with 0.5–5% Cu, 0.5–6% Si, and 0.1–2.0% Al; they are claimed to resist scaling and corrosion at high temperatures.

A. R. POWELL.

Cobalt high-speed tool steel. OESTERREICHISCHE SCHMIDTSTAHLWERKE A.-G. (B.P. 343,508, 14.11.29. Austr., 14.11.28).—The steel contains 3.45–18.91% Co, 16.9–22.1% W, 0.13–1.06% Mo, 0.09–2.13% Ta, 0.51–1.74% V, and 0.88–1.21% C.

A. R. POWELL.

Purification of zinc ore. O. GERLACH, ASSR. to MATTHIESSON & HEGELER ZINC CO. (U.S.P. 1,773,991, 26.8.30. Appl., 31.12.27).—Roasted blende containing 3–5% S is mixed with a small quantity of water and spread in a 2-in. layer on a $\frac{1}{2}$ -in. layer of coarse sinter on the grate of a sintering machine in which it is heated at about 1500° by means of an oil flame containing excess of oil and steam introduced into a movable hood which travels over the grate. In this way the cadmium and

lead are partly volatilised and partly caused to enter the lower layers of the charge. The upper layers of the sintered material are scraped off and sent to the retort house, and the lower layers are returned to another grate for re-sintering.

A. R. POWELL.

Refining of lead bullion. G. K. WILLIAMS (U.S.P. 1,774,688, 2.9.30. Appl., 28.3.29. Austral., 11.4.28).—Molten lead containing gold and silver is fed, together with the requisite quantity of zinc for desilverising, into the top of a deep kettle the upper part of which is maintained at a temperature sufficient to cause alloying between the zinc and precious metals and the lower part of which is maintained just above the m.p. of the eutectic zinc-lead alloy. The feed to the kettle and the removal of desilverised lead from the bottom is continuous, whilst a steady temperature gradient is maintained from top to bottom of the kettle and the crusts are removed intermittently as they become rich in silver. The process may also be carried out in a series of kettles, the underflow from one passing into the top of the next and the temperature falling regularly throughout the series, that in each kettle, however, being maintained constant.

A. R. POWELL.

Removal of a lead coating from articles. DUDZEELE CORP. OF AMERICA, ASSEES. OF C. L. MANTELL (B.P. 343,793, 29.3.30. U.S., 29.3.29).—The article is immersed in a hot 15% sodium chloride solution containing 5% of sulphuric acid and 0.001–0.5% of nickel or platinum chloride as a catalyst.

A. R. POWELL.

Treatment of galvanised articles. H. B. NEWHALL, H. W. PLEISTER, and C. A. GIBLIN, ASSRS. to H. B. NEWHALL CORP. (U.S.P. 1,773,495, 19.8.30. Appl., 21.8.28).—The articles are transferred from the galvanising kettle to a rotary screen inside a closed chamber through which is passed a mixture of air and sulphur vapour or into which is blown sulphur dust while the temperature is maintained at 400–500°, the apparatus being rotated to remove excess zinc and to produce a bright non-oxidised surface on the articles.

A. R. POWELL.

Production of metal layers. B. LOEWE (B.P. 343,875, 11.10.29. Ger., 13.10.28).—Metallic layers of magnesium, aluminium, iron, calcium, mercury, or cobalt are produced on metallic or non-metallic articles by sublimation *in vacuo*, and a volatile compound of another metal, e.g., nickel, chromium, copper, arsenic, or tungsten, is caused to react with the first layer in order to effect an interchange of metals in the layer. The method is particularly applicable to the production of electric condensers, vacuum vessels, or electric resistances.

A. R. POWELL.

Manufacture of optical metal mirrors. J. Y. JOHNSON. From I. G. FARBERIND. A.-G. (B.P. 343,424, 12.8.29 and 23.1.30).—An alloy of 92.2% Ag and 7.8% Al is vaporised at a pressure of 10^{-4} – 10^{-5} mm. on to a heated surface of quartz or glass with a low alkali content.

A. R. POWELL.

Casting of metal. E. BORNAND and H. A. SCHLAEPFER (B.P. 343,648, 14.12.29. Fr., 21.12.28).—The upper part of the metal in the mould is heated by an immersed high-frequency induction unit to prevent the formation of shrinkage pockets.

A. R. POWELL.

Production of metal sponge. E. G. T. GUSTAFSSON (B.P. 343,954, 19.11.29. Swed., 28.11.28).—Oxidised ores of iron, nickel, cobalt, or chromium and iron are mixed with a slight excess of finely-divided, carbonaceous reducing agent and/or a thermal reducing agent and the mixture is briquetted. The briquettes are then heated in a stream of gaseous, liquid, or solid (dust) fuel mixed with a slight excess of air to burn away the excess reducing agent in the briquettes. The reduction is effected in shaft or rotary furnaces in which the gas stream is applied countercurrent to the movement of the charge.

A. R. POWELL.

Electrolytic cleaning of metal [iron or steel]. T. E. DUNN, ASSR. to BULLARD Co. (U.S.P. 1,775,671, 16.9.30. Appl., 1.11.26).—The article is made the cathode in an acid solution containing a lead salt and a high current is passed through the solution from a lead anode so that as the scale is removed from the iron or steel surface it is replaced by a protective coating of lead.

A. R. POWELL.

Electroplating. W. S. MURRAY, ASSR. to ONEIDA COMMUNITY, LTD. (U.S.P. 1,772,840, 12.8.30. Appl., 8.3.24. Renewed 28.7.27).—The bath contains a number of anodes and means for automatically changing the current from one to another and altering its density for uniform, predetermined periods while keeping the same cathode in the circuit so as to vary the coating deposited on different parts thereof in a regular manner.

A. R. POWELL.

Electroplating aluminium and its alloys [with zinc]. H. SUTTON and H. C. COCKS (B.P. 344,133, 10.1.30).—The surface of the article is cleaned in solvents which remove the oxide film, sand-blasted, and plated with zinc in a bath of p_H 3.5—5.5, e.g., one containing 144 g. of zinc sulphate crystals, 34 g. of sodium acetate crystals, and 1 g. of gum arabic, per litre.

A. R. POWELL.

Electrodeposition [of zinc] on aluminium and its alloys. H. SUTTON and H. C. COCKS (B.P. 343,685, 10.1.30).—The bath used comprises a solution of sodium zinc cyanide in dilute ammonia and is operated at 8 volts at 15—25°, using zinc anodes.

A. R. POWELL.

Casting of metals, ceramic masses, and other suitable materials [for dental plates etc.] by the centrifugal process. P. C. FRITZSCHE (B.P. 342,861, 6.1.30).

Heat-treatment furnaces. Regenerative furnaces. Heat insulation. Steel abrasives. Jigs.—See I. Roaster gases.—See VII. Furnace lining [for copper].—See VIII.

XI.—ELECTROTECHNICS.

Tar removal. Methane. Transformer oils etc.—See II. **Welding. Zinc. Gold. Electroplated coatings. Protection of metals. Non-ferrous alloy.**—See X. **Insulated conductors.**—See XIV. **Nutrient in soils.**—See XVI. **Conductivity.**—See XVII.

PATENTS.

Incandescence electric lamps [with reflecting bulbs]. J. VAN ECK and H. FEKKES (B.P. 344,611, 29.1.30. Belg., 9.8.29).

Mercury-vapour rectifiers. A.-G. BROWN, BOVERI & COE. (B.P. 344,901, 5.11.29. Ger., 8.11.28).

[Partition walls for] electrical accumulators. H. WEHRLIN (B.P. 344,709, 26.4.30).

[Hard-paper] insulators. INTERNAT. GEN. ELECTRIC CO., INC., ASSEES. of ALLGEM. ELEKTRICITÄTS-GES. (B.P. 345,090, 18.3.30. Ger., 19.3.29).

Scale removal. Gas cleaning.—See I. **Mixed gas.**—See II. **Casting metals. Cleaning metals. Zinc furnace. Zinc on aluminium. Metal layers. Electroplating.**—See X.

XII.—FATS; OILS; WAXES.

Detection of foreign fats in cacao butter. B. PASCHKE (Z. Unters. Lebensm., 1930, 60, 327—331).—Since, according to Amberger and Bauch (B., 1925, 105), cacao butter consists entirely of the glycerides of palmitic, stearic, and oleic acids, any addition of fat containing lower fatty acids may therefore be detected by isolation of the latter. Thus 21 g. of fat, 150 c.c. of 96% alcohol, and 3 c.c. of concentrated sulphuric acid are boiled briskly under reflux for 5—6 hrs. The solution is poured into 1 litre of water and the esters are extracted by means of light petroleum. The petroleum solution is washed several times with its own volume of water to remove sulphuric acid and alcohol, and dried over sodium sulphate. After removal of most of the solvent by distillation, the remainder is removed from the esters completely by heating on the water-bath for 2 hrs. The esters are then fractionated *in vacuo*, 50% being distilled over. The distillate is then redistilled, 3—3.3 g. being distilled over. The quantity of distillate is controlled by weighing the receiver. The saponification values of the residue and of the two fractions distilled are next determined, using 2.5 g. of esters and saponifying with 30 c.c. of 0.5N-alcoholic potash for 10 min. under reflux on the water-bath. If S_1 be the saponif. value of the first distillate, S_2 that of the second distillate, and S_3 that of the residue, then the weight of foreign fat, expressed as coconut oil, present in 100 g. of cacao butter is $(S_2 - S_1 - 5.5)/2$ or $(S_2 - S_3 - 9.5)/2$, the latter value being less accurate than the former. The value n_D^{25} of the fractions (Zeiss butyrefractometer) is also useful. W. J. BOYD.

"Scheiber" oil. G. G. SWARD (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 126—127).—The constants of 3 samples—unprocessed, blown, and heat-thickened—of "Scheiber" oil (the glyceride of dehydrated ricinoleic acid [cf. B.P. 306,452—3; B., 1930, 726, 871]) are reported. The unprocessed oil dries overnight to a frosty film. If 0.03% of cobalt be added in the form of drier, it dries with a clear film in 3—4 hrs. Their properties indicate that these oils could give satisfactory varnishes. S. S. WOOLF.

Oiticica oil. G. G. SWARD (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 120—125).—A review of the properties of oiticica oil and a bibliography are given, and the constants of two recent samples of the oil are reported. Spar varnishes made from these oils compare favourably with tung oil varnishes, both in appearance and character of film. Exposure tests are in progress. S. S. WOOLF.

Bodied pilchard oils. S. A. LEVY (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 139).—The constants of 4 samples of bodied pilchard oils, ranging in viscosity from 1.5 to 25 poises are tabulated. The oils were pale and had no pronounced odour. On refrigeration (8 hrs. at -15°), they showed opalescence, but did not deposit crystalline salts. S. S. WOOLF.

Physical constants of oil from seeds of *Ribes rubrum*, L. A. JERMSTAD (J. Pharm. Chim., 1931, 13, [viii], 243—244).—The seeds of Norwegian red currants (*Ribes rubrum*, L.) contain 20.4% of an oil having d_{20}^{20} 0.9311, n_D^{20} 1.4801, iodine value 176.3, saponif. value 193.3, and containing 1.8—2.3% of unsaponifiable matter of which 1% is phytosterol. F. O. HOWITT.

Flax wax.—See V. **Linseed.**—See XVI. **Coconut oil.**—See XIX.

PATENTS.

Refining of fatty acids obtained by oxidation of paraffin wax or other high-molecular organic compounds. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 342,670, 23.10.29).—The products of the destructive oxidation of paraffin wax (etc.) with nitrogen oxides are heated at temperatures not above 300° with gaseous reducing agents, e.g., carbon monoxide, hydrogen, water-gas, under pressure if desired. If hydrogen be used, e.g., with a catalyst, or nascent hydrogen or electrolytic reduction, lower temperatures (50 — 180°) may be employed. The reduced products are worked up by distillation etc. in the usual manner.

E. LEWKOWITSCH.

Modification of the physical properties of thickened fatty oils. L. AUER (B.P. 341,453, 8.7.29).—When thickened fatty oils (in which the disperse phase is in relatively high concentration) are used, simple dispersion of the modifying agent in the starting material is sufficient without prolonged heating. The modifying agents are those of the prior patents (for which see B., 1930, 652), particularly lithium carbonate or sulphite, *o*- and *p*-nitrophenols, benzoic acid, benzene-sulphonyl chloride, barium thiocyanate, chlorosulphonic acid, zinc bromide, naphthalene tetrachloride, 2:5-dichlorobenzenesulphonic acid. Dispersion is facilitated by using a solution of the modifying agent, e.g., in benzene, methyl ethyl ketone, etc. [Stat. ref.]

C. HOLLINS.

Manufacture of sulpho-derivatives of the higher fatty acids. I. G. FARBENIND. A.-G. (B.P. 342,761, 6.11.29. Ger., 6.11.28).—Lime- and acid-resistant derivatives of this type are prepared by refluxing the halogenated derivatives of fatty acids (or hydroxylated fatty acids), such as those described in B.P. 336,623 (B., 1931, 149), with aqueous sodium sulphite, preferably under pressure, and at temperatures of about 100 — 150° . The products are water-soluble and liquid or solid according to the conditions.

E. LEWKOWITSCH.

Flaker. Refining of oils etc.—See I. **Wetting agents.**—See III. **Varnishes.**—See XIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Extraction of terpene chemicals from waste pine wood. I. W. HUMPHREY (Inst. Chem. Eng., Mar., 1931. Advance proof. 11—16).—The stumps are

milled and extracted by the steam and solvent process to yield turpentine, pine oils, and resin. Known methods by which these products may be fractionated, purified, or converted into their derivatives are outlined.

T. McLACHLAN.

Turpentine in varnishes and paints. A. G. VAUDIN (Bull. Inst. Pin, 1931, 4).—The use of white spirit as a turpentine substitute is considered disadvantageous on the grounds of differences of distillation range, viscosity, solvent power, ease of working, drying power, surface tension, yield value, etc.

S. S. WOOLF.

[Measurement of] hiding power [of paint]. S. A. LEVY (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 135—136).—The linoleum used in the "brushout" test previously described (cf. Circ. 362; B., 1930, 569) has been modified to conform to the following definition (A.S.T.M.): "A contrasting background of black and white, the black to be less than 8% in brightness, and the white to be $80\% \pm 2$ in brightness." Using such a background, results of good concordance were obtained.

S. S. WOOLF.

Effect of wood grain on paint durability. H. A. GARDNER (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 128—130).—Exposure tests indicate that flat-grain heart-side, or flat- and angle-grain sap-side, woods are not satisfactory woods to paint compared with vertical-grain wood. When other than vertical-grain woods are employed, aluminium, chromate, or graphite primers give better results than do white primers.

S. S. WOOLF.

Red lead. A. V. BLOM (Farben-Ztg., 1931, 36, 1045—1046).—The behaviour of red lead with linseed oil is not controlled entirely by its content of free litharge and by its degree of dispersion. The actual constitution of the particles themselves is a variable to be taken into account, as is indicated by microscopical examination. The existence of 6 types of particle of different activities is suggested, and these are illustrated by diagrams.

S. S. WOOLF.

Lead tungate. H. A. GARDNER (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 133—134).—The preparation of lead tungate, by adding litharge and lead carbonate to heated tung oil fatty acids, is detailed and its solubility in various solvents and miscibility with oil, rosin, etc. are summarised.

S. S. WOOLF.

"Non-fastness to oil" of mineral umbers. A. EIBNER, R. SCHWARZ, and E. ROSSMANN (Farben-Ztg., 1931, 36, 962—964, 1006—1007, 1046—1049).—The question of saponification of fatty oils by basic pigments during the drying of oil paints is discussed at considerable length, the historical development of the conception of "soap-formation" in paints being traced, with special reference to lead pigments of different basicity. Experiments on the preparation of lead and zinc "soaps" at normal and raised temperatures are described, and the stoichiometry of the reactions is dealt with. Umbers are much less basic than litharge and zinc oxide, and their "non-fastness" is due to the formation of oleosols rather than to saponification. The formation of crystalline peroxides as intermediate products in the film formation of linseed and poppyseed

oils is deduced from a study of variously treated pastes of umbers in these oils. S. S. WOOLF.

Varnishes for preserve tins. G. HINARD (Peint. Fig. Ver., 1931, 8, 1394—1397).—The requirements of lacquers for tins intended to contain fruit, jam, vegetables, fish, etc. are described. Resistance to "tooling," "retorting," and the action of acids, and freedom from residual odour are important attributes. Tables of the approximate average content of malic and citric acid in fruits, and of oxalic acid in vegetables, are quoted. Fish, which is generally alkaline, is acidified with acetic or citric acid before tinning. Three proprietary preserve-tin lacquers were tested at 120° in 0.5*N*-solutions of lactic, tartaric, and the above-mentioned acids, and the results are described. Oxalic acid appears to be the most aggressive of the acids tested. Additions of common salt and sugar were tried without appreciable effect. It is pointed out that whilst any of the requirements of these lacquers can readily be met individually, a lacquer combining all the desiderata is necessarily expensive. S. S. WOOLF.

Organic reagents for rapid detection of metals used in the varnish industry. H. SCHEIBER (Farbe u. Lack, 1931, 36, 111—112).—Details are given of tests according to which iron, aluminium, manganese, cobalt, zinc, and magnesium may be detected by means of pyrogallol, alizarin, benzidine, 1-nitroso- β -naphthol, resorcinol, and tetrahydroxyanthraquinone, respectively. These tests are then incorporated in a suggested systematic group analysis. S. S. WOOLF.

Glass colour standards for varnish. S. A. LEVY (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 140).—The original 9 glass colour standards described in Circ. 367 have been increased to 18 for closer approximations. The equivalents of the whole range in terms of potassium dichromate-sulphuric acid solutions and iodine-nickel sulphate solutions are tabulated. S. S. WOOLF.

Alcohol-soluble nitrocellulose. H. WOLFF [with B. ROSEN] (Farben-Ztg., 1931, 36, 964—966).—A range of samples of "alcohol-soluble" nitrocellulose of German and American origin was examined. For solutions above 10% concentration, a solvent mixture such as alcohol 60, benzol 40, diacetone alcohol 10 pts. is necessary. Butyl phthalate and shellac were incorporated (to the extent of $\frac{2}{3}$ and $\frac{1}{3}$ of the weight of nitrocellulose, respectively). The hardness, abrasion-resistance, elasticity, and tensile strength of films obtained from the various solutions were determined. S. S. WOOLF.

[Nitrocellulose lacquer] solvents. T. H. DURRANS (J. Oil & Colour Chem. Assoc., 1931, 14, 65—76).—The behaviour of solvents of low-, medium-, and high-boiling types in nitrocellulose lacquers is discussed generally, attention being given to evaporation rates, formation and effects of azeotropic mixtures, significance of mol. wt. of solvent in conjunction with its vapour pressure from the viewpoint of retention of solvent in film, effect of diluents on viscosity, water as a diluent, etc. A method for producing a lacquer of predetermined properties (involving the use of triangular co-ordinates) is briefly described. S. S. WOOLF.

Lacquer diluents of the petroleum type. J. R. STEWART (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 378, 143—153).—The requirements of aliphatic lacquer diluents are: non-objectionable odour, high flash point, satisfactory solvent power, and evaporation rate similar to that of coal-tar diluents. The kauri-butanol, aniline-point, methyl sulphate, and dilution-ratio methods of determining solvent power are detailed and the results obtained with them on a comprehensive range of commercial "toluol substitutes" are tabulated, it being shown that the four methods give results that may be correlated. The boiling ranges and evaporation rates of some of these diluents are also given. S. S. WOOLF.

Recovery of gum from fossil kauri timber. R. G. ISRAEL (Inst. Chem. Eng., Mar., 1931, Advance proof, 7—10).—In northern New Zealand exist immense tracts of land covered by the kauri tree (*Agathis australis*) which produces the fossilised resin. Portions of the wood contain about 20% of gum, to remove which the wood, after milling, is extracted, first with benzene and then with alcohol, thereby splitting the gum into a brownish fraction (resin acids, soluble only in alcohol and efficient as a substitute for shellac) and a pale gum. The latter, which is the more valuable, consists of resenes soluble in benzene or in alcohol-benzene and is suitable for nitrocellulose lacquers, in which a large percentage may be used owing to its low viscosity. T. McLACHLAN.

Cativa resin. L. P. HART (Amer. Paint & Varnish Manufs.' Assoc., Feb., 1931, Circ. 377, 131—132).—A sample of Cativa resin (of the balsam type, from Panama—"Prioria copaifera Griseb") when dehydrated had acid value 113 and n_D^{25} 1.5098. A tung-oil varnish made therefrom gave soft films, but the resin has possibilities for varnish manufacture, either in conjunction with other resins or after esterification. S. S. WOOLF.

Nitrocellulose.—See V. "Scheiber" oil. Oiticica oil.—See XII.

PATENTS.

Manufacture of zinc white. J. M. H. CORNILLAT (B.P. 344,087, 10.12.29).—The furnace flame is caused to develop in a U shape, so as to obtain the maximum use of the heat produced, and the zinc vapours are carried along at a high velocity. Means are provided for causing carbon dioxide to react with the zinciferous vapours as they are evolved. When impure zinc is used, it may be melted in an auxiliary furnace and the molten metal then led through a channel into the main furnace. W. J. WRIGHT.

Manufacture of varnishes. L. AUER (B.P. 341,431, 8.7.29).—Linseed oil, or other fatty oil and/or resin used in varnishes, is heated with less than 10% of an amine soap formed by interaction of a primary aromatic diamine and/or high-molecular monoamine with an equivalent amount of an organic isocolloid containing high-molecular acids or derivatives; there is produced an improved varnish base. Linseed oil, e.g., is heated at 250° with the benzidine soap of tung oil acids, and the product, after melting with Albertol resin, is made up into a water-resistant varnish with turpentine or white spirit. C. HOLLINS.

Water-resistant varnishes. H. WADE. From BAKELITE CORP. (B.P. 342,737, 6.11.29).—The water-resisting properties of oleoresin varnishes, *e.g.*, spar varnishes from tung oil, ester gum, or synthetic resins, are improved by incorporating solid chlorinated naphthalenes (*e.g.*, "Halowax," a mixture of tri- and tetrachloronaphthalenes) at any stage during manufacture of the varnish before the diluting solvents have been added.

E. LEWKOWITSCH.

Adhesives. BRIT. CELANESE, LTD. (B.P. 342,674, 28.10.29. U.S., 27.10.28).—The adhesive comprises a mixture of cellulose derivative (ester or ether) and a soluble phenol-ketone resin (*e.g.*, the condensation product of diphenylolpropane and acetone), with or without additions of other compatible natural or synthetic resins; suitable low-boiling solvents, with or without admixed higher-boiling solvents and plasticisers are employed. The adhesive is suitable for all materials, including especially glass, stone, and asbestos.

E. LEWKOWITSCH.

Means [adhesive paste or plaster] for preventing fires and rendering substances incombustible. W. E. EVANS. From "S.A.I.G." (SOC. ANON. INVENZIONI GUADAGNIN) (B.P. 344,094, 13.12.29).—A fire-resisting composition for coating combustible materials or applying to metallic network consists of potassium or sodium silicate 50, asbestos 40, refractory earth 5, black lead 1, magnesium carbonate 1, and alum 3 pts.

W. J. WRIGHT.

Production of condensation products [plastics] from polybasic acids and polyhydric alcohols. H. A. BRUNSON, and CHEM. FABR. DR. K. ALBERT G.M.B.H. (B.P. 341,477, 11.10.29).—Soft, rubbery, plastic masses, suitable as plasticisers for cellulose esters (*e.g.*, nitrate), are obtained by heating glycerol (or other polyhydric alcohol) with an aliphatic dibasic acid having a normal chain of at least C₇, namely pimelic, suberic, azelaic, and especially sebacic acids. Glycerol and sebacic acid at 165–170° give in 4½ hrs. a thin syrup which after a further 15 min. changes to a soft, rubbery mass, still soluble in acetone, and finally after another ½ hr. to a soft, tough, flexible solid, insoluble in common organic solvents. Cellulose nitrate plasticised with this product adheres well to rubber. Ethylene glycol condenses with sebacic acid in 30 hrs. at 240°. A harder product is obtained by adding colophony to the melt. The soluble products may be incorporated with phenol-aldehyde and other synthetic resins in a common solvent.

C. HOLLINS.

Paint mills etc.—See I. **Wetting agents.**—See III. **Azo lakes.**—See IV. **Greensand.**—See VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

[Rubber] latex chemistry. Surface tension measurements with fresh latex and their relation to the non-crêpe constituents. P. SCHOLZ (Kautschuk, 1931, 7, 42).—Examination of latex from various trees within 4 hrs. of tapping shows that the difference between the proportion of total solids present and of crêped rubber obtainable by coagulation falls in the inverse order to the surface tension (*cf.* Hauser and Scholz, B., 1927, 947; 1928, 61).

D. F. TWISS.

Investigation of factice [rubber substitute]. LABORATORIUM DER FIRMA DEUTSCHE OELFABRIK DR. GRANDEL & Co. (Kautschuk, 1931, 7, 48–54).—A detailed description is given of the procedure adopted for tests as to the physical characteristics and chemical composition of rubber substitute of the vulcanised-oil type.

D. F. TWISS.

Reinforcing action of "pigment" mixtures on rubber compounds. D. J. BEAVER and J. W. MACKAY (Ind. Eng. Chem., 1931, 23, 294–296).—Mixtures of channel black or a "soft" carbon black with whiting, lithopone, or clay show additive physical properties. Mixtures of "soft" carbon black with zinc oxide also show additive properties, but mixtures of channel black and zinc oxide exhibit poorer resistance to abrasion, higher modulus, and higher tensile strength than would be expected from a purely additive effect. This is due probably to reaction between the zinc oxide and the acidic compounds in the rubber or on the black, the medium thereby becomes more alkaline with consequent decrease in the dispersion of the channel black. In mixtures containing a high proportion of zinc oxide with a smaller proportion of channel black it is consequently possible with advantage to replace the channel black and also even part of the zinc oxide by an equal volume of soft black.

D. F. TWISS.

Action of lead selenide in rubber mixtures. R. DITMAR and K. H. PREUSSE (Caoutchouc et Gutta-Percha, 1931, 28, 15,448–15,450).—In unaccelerated rubber mixtures lead selenide assists softening, but otherwise acts as an inert filler. In accelerated mixtures it is a powerful activator and effective reinforcing agent and causes a marked increase in the abrasion-resisting qualities. Lead selenide is resistant to vulcanisation with sulphur chloride.

D. F. TWISS.

Hard spots in vulcanised rubber compounds. J. H. HOWEY (Ind. Eng. Chem., 1931, 23, 287–290).—The hardness of different portions of a small vulcanised slab of motor-tread rubber shows greater variation than does a mixture of the same composition after vulcanisation in a motor tyre. Regions where maximum flow or displacement occur during moulding and vulcanisation coincide with areas of excessive hardness. This is attributed to alteration in the condition of dispersion of the reinforcing agents or to a local grain effect induced by the flow.

D. F. TWISS.

Testing of the tinning of rubber-insulated conductors. A. VAN ROSSEM and P. DEKKER (Kautschuk, 1931, 7, 42–47).—The effectiveness of the tinning on rubber-coated copper wire may be assessed by determining the amount of copper in a definite area of the stripped rubber coating. A more direct method of assessment is by exposing the tinned wire, after dipping it in a 3:1 mixture of oleic and stearic acids, to the air at the ordinary temperature for 24 hrs. and then determining the amount of copper which has passed into the fatty acid. Other known methods are described, but the two preceding tests are the most satisfactory.

D. F. TWISS.

PATENTS.

Manufacture of rubber-like products by modifying the physical properties of organic isocolloid

materials containing unsaturated carbon compounds. L. AUER (B.P. 341,490, 8.7.29. Addn. to B.P. 318,562; B., 1930, 8).—To the modified fatty oil emulsion of the prior patent are added non-rubber constituents of natural latex, *e.g.*, stearic acid, casein, peptone, starch, etc., which are then precipitated upon the globules of emulsified oil by addition of sodium sulphate, cadmium iodide, or other precipitant. The whole is then further modified by gas treatment, *e.g.*, with air, hydrogen sulphide, or substances producing gas, *e.g.*, barium peroxide. Emulsions of rubber-like products are obtained. C. HOLLINS.

Perforated rubber sheet.—See I. [Rubbery] plastics.—See XIII.

XV.—LEATHER; GLUE.

Hydration of goat skin. E. R. THEIS and A. GRYNKRAUT (J. Amer. Leather Chem. Assoc., 1931, 26, 134—143).—A distinction is drawn between the terms swelling and hydration used in tanning terminology. Hydration is measured by the contraction in volume of the skin and solution and is attributed to residual valencies. The hydration of dry-cured goatskin was measured in different solutions. It was shown that in water alone the hydration attained a maximum in 14 hrs., and with acids or alkalis in 20—24 hrs. The hydration was diminished by acids or alkalis. The hydration in formic acid solutions of different concentrations was a maximum at the isoelectric point and diminished as the concentration increased. The hydration was diminished and the swelling increased by rise in temperature. Two stages were noted in the hydration of dry goatskin: an initial slow period followed by a rapid period. Degeneration of the skin substance was practically stopped by formic acid solutions $> 0.0075N$, but the hydration was low in such solutions.

D. WOODROFFE.

Nature of the water-soluble [matter] in leather tanned with wattle bark extract. II. R. O. PAGE and H. C. HOLLAND (J. Amer. Leather Chem. Assoc., 1931, 26, 143—156; cf. B., 1929, 66).—Less water-soluble matter than tannin was combined with the hide in the early stages of tanning until the combined tannin amounted to 30 pts. per 100 pts. of hide substance, after which 30—60 pts. of combined water-soluble matter were found. This amount depended on the pretreatment of the hide, but was not increased by prolonged tanning, although the combined tannin could be increased to 60 pts. per 100 pts. of hide substance. The amount of combined water-soluble matter was diminished slightly and that of the combined tannin greatly increased by raising the temperature. The amount of combined water-soluble matter was independent of *pH* values between 3 and 8. The combined water-soluble matter was partly converted into combined tannin by treating the tanned leather with 0.2*N*-sulphuric acid at temperatures above 34°, and such converted water-soluble matter was replaceable by further tanning. It is suggested that combined water-soluble contents of 30 and 60, and amounts of combined tannin of 30, 60, and 90 pts. per 100 pts. of hide substance are definite compounds of collagen with tannin. D. WOODROFFE.

De-tanning and utilisation of chrome-leather waste. E. SAUER and W. ESCHMANN (Kolloid-Z., 1931, 54, 326—334).—For the manufacture of glue from chrome-leather waste the chromium content of the leather should be reduced as far as possible: complete removal is not possible and the resulting glue is always dark-coloured, through traces of chromium compounds. The chromium compounds in the tanned leather can be removed by treatment with acid or by oxidation to chromate. Alternate treatment with sodium hydroxide solution and dilute sulphuric acid is more effective than with acid alone. Treatment with a mixture of sodium hydroxide and hydrogen peroxide bleaches the leather and removes the chromium in the form of chromate.

E. S. HEDGES.

Wetting agents.—See III.

XVI.—AGRICULTURE.

Soil structure. P. EHRENBURG (Z. Pflanz. Düng., 1931, 19A, 44—77).—A discussion of the formation and structure of aggregate particles of soil. An extensive bibliography is included. A. G. POLLARD.

Physical chemistry of cultivated soils. V. Determination of the nutrient content of soils by direct-current electrolysis. R. A. HERZNER (Z. Pflanz. Düng., 1931, 19A, 93—110; cf. B., 1931, 132).—Simple apparatus and technique is described for the electrolysis of soils. Comparison is made of the base content of soils, so determined, with that obtained by purely chemical methods. Relationships between the electrically removable bases, soil acidity, and adsorption potential are discussed. A. G. POLLARD.

Preparation of soil profiles for exhibition and soil study. R. C. COLLISON and J. D. HARLAN (N.Y. State Agric. Exp. Sta. Tech. Bull., 1930, No. 173, 8 pp.).—Methods and equipment are described for obtaining profile samples as long narrow strips or as cylindrical cores for storage in celluloid cases.

A. G. POLLARD.

Mechanical analysis [of soils]. G. W. ROBINSON (Imp. Bur. Soil Sci., 1930, Tech. Comm. No. 17).—Preliminary work on the comparative examination of methods is discussed. The International method is inadequate for soils rich in gypsum. The Puri method fails in highly unsaturated organic soils. The value of soda for rapid and efficient dispersion is confirmed, and the substitution of soda for ammonia in the International method yields excellent results.

A. G. POLLARD.

Mechanical analysis of soils by the pipette method. P. KÖTTGEN and H. HEUSER (Z. Pflanz. Düng., 1931, 19A, 257—281; cf. B., 1929, 369).—The sampling device of the apparatus described has two opposite lateral inlets and withdraws a sample from a substantially uniform and thin layer, with less disturbance of the sedimentation of the surrounding particles than the pipette of Köhn (B., 1928, 583; 1929, 787). Analysis of the heavier particles may be made by the use of highly viscous liquids, sugar solutions being particularly suitable for the purpose. A. G. POLLARD.

Effect of drying soil on its adsorption capacity. A. I. ACHROMEIKO (Z. Pflanz. Düng., 1931, 19A, 36—43).

—Drying did not markedly affect the adsorptive capacity of soils except when they contained appreciable quantities of calcium carbonate. This phenomenon is examined. The state of aggregation of dried soils does not retard the leaching of adsorbed bases. Base exchange occurs both on the surface of and within the soil granules.

A. G. POLLARD.

Effect of burning on moorland soils. E. G. SVINHUFVUD (Wiss. Veröff. finn. Moorkulturvereins, 1929, No. 10, 95; Bied. Zentr., 1931, 60, 56—57).—During the burning of moorland, ammonia is produced both from the actually burning layer of peat and from that immediately beneath it. Most of this ammonia is reabsorbed by the unburnt peat. A mobilisation of mineral matter and also a reduction of soil acidity result from the burning. Soil bacteria generally are not injured, and in some cases are stimulated to increased activity. On land so treated the use of fertilisers is largely unnecessary.

A. G. POLLARD.

Action of frost on soils. E. JUNG (Z. Pflanz. Düng., 1931, 19A, 326—333).—Aggregation of soil particles by frost is not merely a mechanical effect of the expansion of water in freezing, but is controlled by the nature and course of the crystallisation of the soil solution. The phenomena therefore depend on the freezing temperature and the rate at which the soil solution freezes. With slow cooling there is a deposition of ice crystals in the tension-free pore spaces, and the possibility of the growth of these crystals at the expense of "bound" water in the soil is discussed. The effect of electrolytes on the freezing process is considered.

A. G. POLLARD.

Heat of wetting of soils. H. JANERT (Z. Pflanz. Düng., 1931, 19A, 281—309).—Apparatus and technique are described for determining the heat of wetting of soils. The heat of wetting decreases slightly with falling temperature of measurement, but does not become negative below 4°. Values obtained are influenced by the proportion of soluble matter in soils and by the degree of saturation with calcium. A hyperbolic relationship exists between the heat of wetting and the maximum saturation capacity of the soil for calcium. Deformation of soil blocks during drying was apparent only in soils with high heats of wetting. Relationships exist between the heat of wetting of soils and their clay contents, hygroscopicity, and other physical properties. The value of determinations of heats of wetting in the general examination of soil is indicated.

A. G. POLLARD.

Buffer power of moor soils. T. ARND [with W. SIEMERS and W. HOFFMANN] (Z. Pflanz. Düng., 1931, 19A, 334—342).—Types of moor soils are sharply differentiated by their buffer powers (Jensen). High-moor soils are strongly buffered towards bases and weakly towards acids, whereas low-moor soils are well buffered to acid and poorly to bases. Transitional types occupy an intermediate position. In moor soils the buffer power is closely related to acidity, base content (notably calcium), and the degree of saturation with bases.

A. G. POLLARD.

Titanium in some New Zealand soils and pastures. H. O. ASKEW (New Zealand J. Sci. Tech.,

1930, 12, 173—179).—The titanium contents of a number of soils are recorded. Soils reputed to be "bush sick" were characterised by low proportions of titanium. Heavy loams and clays contained more titanium than did sands. The titanium contents of pastures varied from 1.0 to 8.5 mg. per 100 g. of dry matter, and in no case were they sufficiently high to interfere with the phosphate assimilation of animals by precipitation of the insoluble phosphate. Variations in the iron and titanium contents of soils showed a general similarity. No relationship existed between titanium and manganese contents.

A. G. POLLARD.

Mineral soil acidity. M. TRÉNEL (Z. Pflanz. Düng., 1931, 19A, 238—241).—A discussion of current views of exchange acidity in soils in the light of the author's recent researches (cf. Trénel and Wunschik, B., 1930, 832).

A. G. POLLARD.

Determination of the acid point of a soil, at which easily-soluble or exchange acidity appears. S. GOY [with O. ROOS] (Z. Pflanz. Düng., 1931, 19A, 31—36; cf. B., 1929, 335).—The soil sample is shaken with *N*-potassium chloride and a measured amount of acid or alkali. After settling, the clear liquor is decanted and methyl-red added. By varying the proportion of acid or alkali used, a value is obtained at which the extract just causes the requisite colour change in methyl-red. This point marks the appearance of exchange acidity, and lies in the p_H range 4.7—5.5.

A. G. POLLARD.

Soil acidity in relation to electrolyte content of soil suspensions. A. TERÄSVUORI (Valiion Maat. Julkaisuja, 1930, No. 29, 7—200).—Except in a few cases, where the change seldom exceeded $p_H \pm 0.2$, keeping soil in dry air did not affect the acidity or the soluble electrolyte content. When much ferrous iron or other reducing substance was present, however, appreciable changes were observed. Heating soil samples at 100—110° for 3 hrs. generally increased the electrolyte content and lowered the p_H . The effect of various degrees of humidity are recorded. Changes in the p_H of fertilised soil do not indicate change in acidity.

CHEMICAL ABSTRACTS.

Source of error in Trénel's quinhydrone acidimeter [for soil suspensions etc.] and its removal. P. PFEFFER (Z. Pflanz. Düng., 1931, 10B, 57—63).—A new type of electrode is described by which the errors recorded by Laufer (B., 1928, 27) are obviated.

A. G. POLLARD.

Changes in the colloid clay content of soils under the influence of cation exchange; centrifugal determination of colloidal clay. E. UNGERER (Z. Pflanz. Düng., 1931, 19A, 111—118).—Colloidal clays of mean diam. $< 0.2 \mu$ are separated centrifugally and examined. The dispersion of clay by univalent ions was in the order of the lyotropic series $K < NH_4 < Na < Li$.

A. G. POLLARD.

Neutral salt decomposition by humus soils. T. ARND (Z. Pflanz. Düng., 1931, 19A, 90—93).—Acidity developed in humus soils by treatment with neutral salts is not an adsorption interchange (cf. Behrens, B., 1930, 999), but is the result of direct double

decomposition of the neutral salt by organic acid, yielding insoluble organic salts and free mineral acid.

A. G. POLLARD.

Distribution of fertilisers in soil by cultivation.

E. VOLZ (Z. Pflanz. Düng., 1931, 10B, 73—80).—Prior to its application the fertiliser is treated with a solution of anthracene in benzene, or other solvent in which the fertiliser is insoluble, and dried. The distribution of fertiliser after any cultural operation is observed by photographing a soil sample by ultra-violet light, the fluorescent anthracene particles being readily visible. Suitable sampling boxes are described.

A. G. POLLARD.

Lime requirement of soils.

A. GEHRING (Z. Pflanz. Düng., 1931, 10B, 40—57).—Loams and clay soils of which the degree of saturation with calcium was less than 70 (Hissink) responded to liming. Results with light sandy soils were less definite, but in nearly all soils the maximum yields corresponded with applications of lime calculated to bring the calcium saturation to 70°. Larger applications reduced yields. Heavy soils of low organic content and with calcium saturation > 70 sometimes produced greater crops after liming, but the effect was due, not to any specific action of lime, but to improved mechanical condition which could be attained equally well by admixture with sand. Highly organic soils with calcium saturation > 70 produced smaller crops after liming. In general, marl, quick and slaked lime, and defecation lime were equally effective, but the fineness of grinding of the material was of prime importance. Potato scab appeared in soils with calcium saturation of 40 approx., and increased in intensity with added lime.

A. G. POLLARD.

Soil reaction and lime requirement. P. E. TURNER (Imp. Bur. Soil Sci., 1930, Tech. Comm. No. 17).—A summary and discussion are given of a paper already abstracted (B., 1931, 82).

A. G. POLLARD.

Determination of exchangeable bases and lime requirement [in soils]. ANON. (Imp. Bur. Soil Sci., 1930, Tech. Comm. No. 12).—Details of existing methods and recent modifications are given together with an extensive bibliography.

A. G. POLLARD.

Solubility of the adsorptively bound bases in soils in relation to their lime condition and degree of saturation. A. GEHRING, O. WEHRMANN, and A. WOLTER (Z. Pflanz. Düng., 1931, 19A, 77—90).—The solubility of adsorptively bound potash in soil increases with the degree of saturation of the soil with potassium, with calcium, or with ammonium, the effect, in the case of the last two bases, being greatest where the proportion of adsorbed potassium is high. Neubauer tests confirm these results in soils in which the degree of saturation with calcium reaches 60—70%. Above this point unsatisfactory factors intervene to injure the seedlings. Increasing saturation of soil with calcium tends to increase the solubility of adsorbed magnesium, but the degree of saturation with ammonium or potassium does not appreciably influence magnesium solubility. The solubility of adsorbed potassium is not markedly affected by changes in the degree of saturation with magnesium or sodium. The effect of calcium in increasing the solubility of potash is almost eliminated by pre-

treatment of the soil with 0.05N-hydrochloric acid to remove adsorbed basis.

A. G. POLLARD.

Phosphate status of soils. L. MEYER (Landw. Jahrb., 1931, 73, 119—138).—Comparison of the phosphate requirement of numerous soils as determined by (a) the seedling method, (b) field trials, and (c) von Wrangell's water-extraction method (B., 1930, 833, 1166) confirmed the satisfactory nature of method (c). This method not only indicates the immediate phosphate requirement of soils, but gives information as to its general phosphate status. Changes in the phosphate contents of soils following cropping or fertilisation are accurately reflected in the water extracts.

A. G. POLLARD.

Causes of the action of basic slag [in soils].

A. WILHELMJ (Z. Pflanz. Düng., 1931, 19A, 129—238).—The active phosphatic constituent of basic slag is soluble in water at p_H 7.0. Its solubility is somewhat depressed by weak acids and considerably reduced in water containing appreciable quantities of lime. In successive, neutral, aqueous extracts of slag, phosphate appears conjointly with calcium and silica. Slags containing 74% of soluble silicic acid show a relatively high phosphate solubility in initial extracts. Differences in the soluble silica contents of slags are reflected in marked differences in phosphate assimilability in Neubauer tests. In culture tests on acid soils slags were superior to superphosphate or Rhenania phosphate, the best results being produced by slags having the highest proportions of soluble silica. On loams containing chalk, slags with high soluble silica contents were as effective as was superphosphate or Rhenania phosphate, but low-silica slags were definitely inferior. The percentage utilisation of phosphate was greatest in slags of high soluble silica content, especially when the after effects on succeeding crops were included. Only the water-soluble phosphate of slags is utilised by plants, but the rate of dissolution is sufficient to satisfy the plants' needs. Slag forms a satisfactory top-dressing, provided sufficient moisture is present to dissolve its phosphate contents. Tetracalcium phosphate is as effective a source of phosphorus for plants as monocalcium phosphate. The former is decomposed by water to give dicalcium phosphate and calcium hydroxide, hence its retarded solubility in successive water extracts. The active phosphatic constituent of slag is the double salt of tetracalcium phosphate and calcium metasilicate, which is decomposed into its constituent salts by water, and plants utilise the aqueous solution of dicalcium phosphate finally produced. The rate of action of slag depends primarily on the rate of decomposition of the double salt, and this is conveniently measured by extraction with 2% citric acid solution.

A. G. POLLARD.

New fertiliser "Nolitt." E. BLANCK, F. GIESECKE, and F. KLÄNDER (J. Landw., 1931, 79, 55—68).—Chemical analysis of and culture trials with "Nolitt" are recorded. Increased crop growth produced by the fertiliser does not exceed that attributable to its nutrient contents. It has no other specific action. A mixture of powdered stone, ammonium sulphate, crude potash salts, and basic slag has similar properties.

A. G. POLLARD.

Evaluation [as fertiliser] of the phosphoric acid of Rhenania phosphate. H. NIKLAS, A. STROBEL, W. SCHROPP, and K. SCHARRER (Agric. Chem. Inst. Hochsch. Landw. u. Brauerei, 1930; Bied. Zentr., 1931, 60, 59—61).—Pot-culture experiments with numerous crops and varied soil types showed that the citrate-soluble phosphate of Rhenania phosphate is practically as efficient as the water-soluble phosphate of superphosphate and superior to the citric acid-soluble phosphate of basic slag. Distinct and superior qualities are attributed to the citrate-soluble phosphate of Rhenania phosphate as compared with the citric acid-soluble portion.

A. G. POLLARD.

Comparative pot experiments with "Nitrophoska I.G. III." K. ENTRES (Z. Pflanz. Düng., 1931, 10B, 103—108).—In pot trials with oats on both weakly acid and weakly alkaline soils, Nitrophoska proved as efficient as other complete fertiliser mixtures in which the nitrogen was supplied as ammonium sulphate, calcium cyanamide, urea, or any of the commonly used nitrates.

A. G. POLLARD.

Fertilising action of phosphorites and their direct use in agriculture. U. PRATOLONGO (Giorn. Chim. Ind. Appl., 1931, 13, 1—6).—The results of five years' field and pot experiments show that acidity of the soil, richness in organic constituents, and a plentiful supply of water, either separately or in conjunction, are not sufficient to ensure that phosphorites may exert fertilising action comparable with that of the soluble phosphates, either technically or economically. In soils of high acidity, the phosphorites exert an appreciable fertilising action, but this is always surpassed by that of soluble phosphates, such as superphosphate and basic slag. In neutral and especially in alkaline soils, phosphorites exhibit scarcely any direct fertilising action (cf. Tommasi and di Delupis, B., 1931, 215).

T. H. POPE.

Measuring [soil]-absorbed phosphates and nitrogen. W. J. SPILLMAN (Science, 1931, 73, 215—216).—A method for determining the amounts of phosphate apparently absorbed by soil and held in a condition unavailable to a growing crop is described. In accurate work, an amount of fertiliser equal to this quantity should be applied to the control plot.

L. S. THEOBALD.

Influence of the C : N ratio of various organic substances on the nitrogen cycle in soil. H. ENGEL (Z. Pflanz. Düng., 1931, 19A, 314—325).—The mineralisation of the nitrogen of fresh yard manure proceeds slowly, no nitrate formation being apparent in 4 months. With green manures the change is more rapid and the amount of nitrate formed exceeds that corresponding to the ammoniacal nitrogen content of the original material. Nitrogen losses during mineralisation are greater in the case of green manures than for cattle manure. Delayed nitrification of cattle manures is attributed to the difficulty of decomposition of some of the organic nitrogenous constituents and not to any particular C : N ratio in the manure tending to inhibit the activity of the organisms. The part played by denitrifying organisms in the process is discussed.

A. G. POLLARD.

The potash reserve of field soils after unbalanced manuring, as determined by the *Aspergillus*

method of Niklas, Poschenrieder, and Trischler. E. KIESSLING (Z. Pflanz. Düng., 1931, 19A, 241—250).—Results of the *Aspergillus* method for determining the available potash in soil (B., 1931, 37) were generally as anticipated. Applications of nitrogenous and phosphatic fertilisers affect the yields of mycelium obtained. Seasonal variations in the potash reserve of soils indicated by this method are greater in soils rich in potash than in those of moderate or small potash contents.

A. G. POLLARD.

Dependence of the physiological reaction of potash salts on hydrogen-ion concentration. M. GÓRSKI and O. DĄBROWSKA (Poln. Jahrb. Land- u. Forstwirtschafts., 1930, 24, 46; Bied. Zentr., 1931, 60, 64—65).—Potassium chloride solutions, the p_H values of which were adjusted by means of potassium carbonate or hydrochloric acid, were physiologically acid to plants in the range p_H 7.1—5.7 and physiologically alkaline at p_H 4.4. Hydrogen-ion concentration affects the physiological reaction of salt solutions directly, and also indirectly through its effect on the intake of anions by plants.

A. G. POLLARD.

Influence of potash sources and chlorine content of fertilisers on yield of cotton. J. J. SKINNER (J. Amer. Soc. Agron., 1931, 23, 13—21).—Kainite is not so good a source of potassium as potassium chloride or sulphate; the chlorine in the quantity used is not unfavourable. The chlorine endurance limit for cotton is about 118 lb. Cl per acre. CHEMICAL ABSTRACTS.

Potash fertiliser experiments [on tobacco]. ANON. (Conn. Agric. Exp. Sta., Bull. 311, 1930, 207—215).—In experiments using different potassium salts at rates to give up to 300 lb. of potash per acre, it was found that, even on a soil containing an enormous reserve of potash, the percentage of potassium in tobacco leaf is appreciably affected by the quantity applied to the soil in the fertiliser. Potassium deficiency in the leaf was very pronounced on the no-potash plots, especially after two years; the application of 200 lb. of potash per acre remedied the deficiency. Decrease in the leaf potassium is accompanied by an increase in both calcium and magnesium. The fire-holding capacity of leaf, as measured by the strip test, increases as the ratio of potassium to calcium and magnesium increases. The source of potash had little effect on the quality of the tobacco raised, except that the use of the sulphate resulted in an increase of sulphate in the leaves, which is injurious to burn.

E. HOLMES.

Curing of yellow tobaccos. II. Changes in the nitrogenous compounds during starvation. A. I. SMIRNOV and V. P. IZVOSCHIKOV (U.S.S.R. State Inst. Tobacco Invest., 1930, Bull. 71, 21 pp.).—During the starving period (barn ripening), which is the first stage in the curing of tobacco, the protein content of the leaves diminishes by 23% (old leaves) or by 35% (young leaves), the proteins of the young leaves becoming richer in basic constituents and thus approaching in composition the proteins of the old leaves. At the same time the polypeptides soluble in hot water rapidly become poorer in bases and richer in amide nitrogen, the total amount of polypeptides increasing somewhat. Hydrolysis of the water-insoluble part of tobacco on prolonga-

tion of the starving period is accompanied by decrease, and that of the aqueous extract by increase, in the formation of melanin. Part of the amino-acids and bases liberated from the polypeptide complexes undergoes decomposition with formation of ammonia, but a proportion of this is used in the formation of amide nitrogen and, during the early stages of the starvation period, of bases. The nicotine content of the leaves diminishes.

T. H. POPE.

Boron as a regulator of the growth of tobacco, in relation to the reaction of the nutrient solution and the source of nitrogen. A. I. SMIRNOV (U.S.S.R. State Inst. Tobacco Invest., 1930, Bull. 70, 29 pp.).—Experiments with *Platana arcadia* show that cultivation of tobacco in solutions of common nutrient salts free from boron results in a characteristic depression of the normal development. The function of the boron in regulating the growth concerns mainly the stem and only slightly, if at all, the roots or leaves. The storage of nitrogen compounds by the plants is not influenced by the presence of boron in the solution and depends solely on the reaction of the nutrient solution and on the nature of the source of nitrogen.

T. H. POPE.

Effect of fertilisers on the growth and oil content of a variety of linseed (*Linum usitatissimum*, L.). A. MOHAMMAD (Agric. J. India, 1930, 25, 471–486).—The effects of sodium nitrate (82 lb. per acre), potassium sulphate (164 lb.), superphosphate (164 lb., grade not stated), and a mixture of these three, on a variety of linseed (T. 124) grown for 1 year in lysimeter pots are described in detail. Sodium nitrate and the complete fertiliser gave increase in height, number of basal branches, and yield of seed, whilst the oil content of the seeds, which in the same variety varies from year to year, was not appreciably affected by any treatment.

E. HOLMES.

Utilisation of coals as fertilisers. R. LIESKE (Brennstoff-Chem., 1931, 12, 81–85. Cf. Bottomley, B., 1920, 200 A; Olsen, B., 1930, 434; Kissel, B., 1930, 877).—The addition of small quantities of brown coal to a pure culture of duckweed (*Lemna major* and *L. minor*), and to the soil in which maize, oats, tobacco, and tomatoes were growing, greatly stimulated the growth of these plants. The optimum results were obtained with an addition of about 1% of brown coal to the soil. A further improvement was brought about by first treating the brown coal with ammonia. The effect of adding a bituminous coal was very much less marked. The cause of the fertilising action of brown coal is still obscure. Olsen attributed it to the presence of complex iron salts, but the results of his experiments cannot be regarded as conclusive. "Humunit" and "Kalkhumat," commercial fertilisers prepared from brown coal, have been shown to be very active in stimulating plant growth.

A. B. MANNING.

Paper mulch for the vegetable garden and its effect on plant growth, soil moisture, nitrates, and temperature. R. MAGRUDER (Ohio Agric. Exp. Sta. Bull., 1930, No. 447, 60 pp.).—Effects of mulching a number of crops with various papers are described. Crop yields were increased in many cases, and, in general, the quality of the crop was improved. Paper mulching

increased the average moisture content and temperature (by 3–4°) of the soil, but no consistent differences in nitrate content between cultivated and paper-mulched soils were observed.

A. G. POLLARD.

Residual effect of fertilisers. F. A. WYATT (Sci. Agric., 1931, 11, 387–396).—Cereal crops were not appreciably affected by the residual effect of fertilisers other than farmyard manure, but clover crops showed definite gains both in yield and in the percentage of phosphorus in the crop. When the clover was ploughed in, the beneficial residual effect was passed on to the subsequent crop.

A. G. POLLARD.

Establishment of grasses on very acid moorland. R. B. DAWSON and T. W. EVANS (J. Min. Agric., 1931, 37, 1188–1191).—A series of seed mixtures failed, with the exception of wavy hair grass (*Aira flexuosa*), to germinate on moorland soils of p_H about 4.0, whereas all mixtures germinated and became established almost as well on plots receiving lime at the rate of 1 ton per acre as when 8½ tons per acre were applied.

E. HOLMES.

Basis of chemical stimulation effects in higher plants. A. NIETHAMMER (Z. Pflanz. Düng., 1931, 13A, 343–352; cf. B., 1929, 694).—Freezing of seeds increased their germinative power and mechanically increased the permeability of the seed coat to chrysoidin. Exposure of seed to an atmosphere containing chloroform also improved germinative power and increased permeability. Prolonged exposure to light increased the percentage germination of old seed, but on new seed (1 and 2 yrs.) the effect was reversed, and the period of germination lengthened. Chemical stimulation depends on the nature and condition of the seed.

A. G. POLLARD.

Effect of various treatments on micro-organisms in the soil under a five-year rotation. P. E. BROWN and B. A. TOMLIN (Proc. Iowa Acad. Sci., 1929, 36, 79–85).—Manuring, liming, and addition of rock phosphate, superphosphate, and crop residues stimulate bacterial development, nitrification, and non-symbiotic nitrogen fixation; the increase in crop yield may therefore be partly due to this stimulation.

CHEMICAL ABSTRACTS.

Bacterial activity of soils variously treated. P. E. BROWN and D. I. AQUINO (Proc. Iowa Acad. Sci., 1929, 36, 87–91).—A direct relation between activity and numbers of bacteria and the crop-producing power of soil, as affected by manuring, is indicated.

CHEMICAL ABSTRACTS.

Chemical and microbiological processes in the decomposition of plant residues in soils. S. A. WAKSMAN (Z. Pflanz. Düng., 1931, 19A, 1–31).—A general review and discussion of recent work.

A. G. POLLARD.

Biological oxidation of sulphur. IV. Influence on ammonification and nitrification in activated sludge. C. V. R. AYYAR (J. Indian Inst. Sci., 1930, 13A, 165–171; cf. B., 1930, 295).—Suspensions of sulphur in activated sludge inhibit the production of nitrates, but after an initial lag period ammonification proceeds vigorously because of an increase in fungoid growths. The acidity gradually increases to p_H 2.4 and produces a floc which settled readily on keeping. The

effluent obtained after moderate aeration in the presence of sulphur contains less nitrogen than one from activated sludge alone, but the latter is not so effective in conserving plant nutrients in the sludge. C. JEPSON.

Straw manuring. W. JESSEN and E. GERDUM (Z. Pflanz. Düng., 1931, 10B, 97—102).—Reduction of crop yields following the ploughing-in of straw may be satisfactorily counteracted by applications of nitrogenous fertilisers. The requisite amount of nitrogen for the purpose cannot, however, be determined in advance.

A. G. POLLARD.

Effect of calcium cyanamide manuring on the yield, reaction, buffer capacity, and degree of saturation with bases of strongly acid soils. L. SCHMITT (Z. Pflanz. Düng., 1931, 10B, 1—40).—Contrary to general opinion, calcium cyanamide gave satisfactory results on some very acid soils with a number of crops. When used in conjunction with superphosphate and kainite on both limed and unlimed soils, higher crop yields were obtained than with ammonium sulphate. The favourable effects of cyanamide are attributed to its ability to improve reaction conditions, p_H , buffer capacity, and degree of saturation with bases of acid soils. In this respect it is superior to sodium nitrate or basic slag.

A. G. POLLARD.

Influence of the permanent level of farmyard manure applications on crop yield and fertiliser action. EICHINGER (Z. Pflanz. Düng., 1931, 10B, 81—97).—Collected data from numerous farms show that the average yield of oats increases with the level of permanent applications of farmyard manure, the latter being judged by the number of fully-grown cattle carried by the farm per unit area of arable land. The relationship is much more definite and regular on soils of good adsorptive capacity than on light sands. Crop yields from sandy soils, even when heavily manured, are consistently lower than those from good loams. In general, the efficiency of fertilisers decreases with a rising level of farmyard manuring.

A. G. POLLARD.

Rate of decomposition of some artificial manures. F. B. SMITH (Proc. Iowa Acad. Sci., 1929, 36, 69—73).—Adco reagent at first stimulates the production of carbon dioxide, which then falls to the normal value. With Iowa reagent there was a slight increase in carbon dioxide production and a considerable loss of nitrogen as ammonia.

CHEMICAL ABSTRACTS.

Factors influencing the effectiveness of organic mercury dusts in pea-seed treatment. L. K. JONES (J. Agric. Res., 1931, 42, 25—33).—Organic mercury dusts containing not less than 12% of mercury phenoxide were the most successful of those examined. Watering seed beds immediately after sowing considerably reduced the germination of untreated seed. Dusting improved germination at all soil-moisture contents.

A. G. POLLARD.

Removal of [arsenical] spray residues from apples. Wax-solvent method. J. R. NELLER (Ind. Eng. Chem., 1931, 23, 323—325).—The removal of arsenical residues from sprayed fruit by washing with dilute hydrochloric acid at moderate temperatures is not satisfactory when the fruit has also been oil-sprayed or has become waxy in storage. Pretreatment of the

fruit with a wax solvent reduced the residue by about 90%. Thus unwashed fruit having an arsenic residue of 0.035 grain/lb. (as As_2O_3) after ordinary treatment with dilute acid still retained 0.019 grain/lb. (tolerance limit 0.010 grain/lb.), but when dipped in acetone for 1½ min. and then treated with 0.1% hydrochloric acid at 20°, retained only 0.0018 grain/lb. Petroleum was unsatisfactory as a wax solvent, whilst under the same conditions diacetone alcohol and synthetic methyl alcohol gave residues of 0.0054 and 0.0041 grain/lb., respectively. A 75% solution of diacetone alcohol was not satisfactory. Another variety of waxy fruit, having in the unwashed state an arsenical load of 0.039 grain/lb., when dipped in methyl alcohol for 1 min. and then washed with 0.7% hydrochloric acid at 32° retained only 0.0034 grain/lb. Dilution of the methyl alcohol greatly reduced the efficiency of the treatment. The practical applications of the pre-dip treatment are discussed.

H. J. DOWDEN.

Methods of field experimentation. J. WISHART (Imp. Bur. Soil Sci., 1930, Tech. Comm. No. 17).

Flax residues.—See V. **Solubility of calcium phosphates.**—See VII.

PATENT.

Manufacture of phosphatic manures. B. BODRERO (B.P. 343,125, 8.11.29. Fr., 13.11.28).—If finely-powdered tribasic calcium phosphate is incorporated with a solution of colloidal sulphur, a product is obtained in which sulphur and calcium phosphate are uniformly distributed, acid monocalcium phosphate being absent, and in which the proportion of sulphate is insufficient to injure the soil.

W. J. WRIGHT.

XVII.—SUGARS; STARCHES; GUMS.

Pectin and "plus-sugar." COLIN, BILLON, and MIOSSEC (Bull. Assoc. Chim. Sucr., 1931, 48, 16—20).—Values for "plus-sugar" (the amount by which the sugar in the extracted juice exceeds that in the sugar-beet pulp before extraction) depend only on polarimetric measurements, and are obtainable when the extraction is carried out at temperatures up to 90—96°. It is suggested that under these conditions the pectic materials of the sugar beet are soluble and affect the rotations.

B. W. TOWN.

Causes of error in the determination of sugar in the beetroot. J. ZAMARON (Bull. Assoc. Chim. Sucr., 1930, 47, 455—459).—The author reviews the history of this subject and concludes that the methods of alcoholic extraction and hot aqueous digestion, with the limited amounts of basic lead acetate usually prescribed and not too prolonged heating, give the most trustworthy results at present obtainable.

J. H. LANE.

Determination of reducing sugars in presence of sucrose by potassium ferricyanide. R. HAMY (Bull. Assoc. Chim. Sucr., 1930, 47, 385—387).—In the method described by Jonescu and Vargolici (B., 1920, 829 A), the volume of 0.5% dextrose solution required by 10 c.c. of the reagent was found to be quite unaffected by the presence of sucrose at concentrations up to 30%. Applied to raw beet juices rich in invert sugar and to diluted beet molasses, after clarification with basic

lead acetate and removal of excess of lead, the method indicated percentages of reducing sugar before and after Clerget hydrolysis in close agreement with those found by Bertrand's method. According to Jonescu and Vargolici, 10 c.c. of their reagent correspond to 0.050 g. of dextrose, 0.0491 g. of invert sugar, 0.0637 g. of maltose, or 0.0676 g. of lactose. J. H. LANE.

Electrical conductivity and ash content of sugar factory products. K. ŠANDERA (Bull. Assoc. Chim. Sucr., 1930, 47, 446–449).—A description, with diagrams, of the author's conductivity apparatus in which the balancing of resistances is effected by comparison of the illumination from two electric lamps (cf. B., 1927, 312, 920; 1929, 695). J. H. LANE.

Adsorption from sugar solutions. III. Adsorption in the carbon layer: acetic acid. J. VÁCHA and J. VAŠÁTKO (Z. Zuckerind. Czechoslov., 1931, 55, 334–338).—The influence of temperature, pressure, and the nature of the solution on the velocity of flow, v , of water through activated charcoal has been determined for a number of different specimens. With increase of particle size v increases, whilst $1/v$ is related exponentially to the applied pressure; the influence of temperature is relatively greater at the lower pressures. Data are given of the relative rates of flow of water and aqueous solutions of sucrose, molasses, and crude sugar. Measurements of the adsorption of acetic acid by active carbon confirm Dèdek's theoretical views on the mechanism of the adsorption (cf. B., 1927, 920). With a constant ratio of adsorbent to solution the maximum adsorption is the same whether determined by the suspension or the layer method. H. F. GILLBE.

Mill sanitation and [sugar-]juice deterioration. R. H. KING (Sugar News, 1930, 11, 640–655).—The acidity of sugar-cane juice increases rapidly after 2 hrs., the p_H decreasing less rapidly. The changes are related to the quality of the cane and the maceration water. Decomposition is minimal when hot water is used at 3-hr. intervals, and bagasse and sediment are periodically removed. The use of deep, sloping pans and troughs, but not of chemicals, is recommended.

CHEMICAL ABSTRACTS.

Hydrolysis of inulin under pressure. E. C. KLEIDERER and D. T. ENGLIS (Ind. Eng. Chem., 1931, 23, 332–334).—Attempts have been made to hydrolyse pure inulin by heating with water alone, so as to avoid contaminating the syrup with the products of the hydrolytic catalysts. When heated at 100° for 40 hrs. in a sealed tube the extent of the hydrolysis, as indicated by the copper-reduction method, was about 12%, and on a steam-bath under reflux for a like period there was a 15% conversion. In order to improve the yield, carbon dioxide under pressure was then used to catalyse the hydrolysis. At 150° and 70–80 atm., hydrolysis was complete in 1 hr. and about 92% at 130° in 2½ hrs. The reaction is influenced more by temperature than by pressure, since changing the pressure from 70 to 20 atm. at 130° reduced the apparent conversion in 1 hr. from 65 to only 55%. When nitrogen was substituted for carbon dioxide the percentage hydrolysis was slightly reduced, being 86% in 1 hr. at 160° and 70 atm. Varying the pressure of nitrogen from 46 to 93 atm. had practically

no influence on the yield, with constant temperature. Sulphur dioxide at 3 atm. gave complete conversion in 30 min. at 145°, but there was serious corrosion of the reaction vessel. The syrups obtained had a satisfactory appearance and taste, but no attempt was made to produce crystalline *lævulose*. H. J. DOWDEN.

Measurement of foam. Molasses separator.—See I. Cane sugar in wine.—See XVIII. Water in foods.—See XIX.

XVIII.—FERMENTATION INDUSTRIES.

[Alcohol from] distillation of bananas. E. L. DE LAPERSONNE (Bull. Assoc. Chim. Sucr., 1931, 48, 28–32).—Details are given for the preparation of fermented liquors both from green and ripe bananas. The must from the ripe banana, after sterilisation, is fermented with barm from fermented cocoa. The green fruit, which consists mainly of starch, is fermented with a *Mucor* in symbiosis with a yeast; fermentation is rapid and a 97.5% yield of alcohol is obtained. B. W. TOWN.

Nitrogenous substances in beer. I. S. AYAI (J. Soc. Chem. Ind. Japan, 1931, 34, 72–74 B).—Japanese lager beer kept in bottle for two months remained bright, but became hazy when the time of storage was extended to 17 and 29 months. The contents of total nitrogen and protein nitrogen decreased during storage, whilst that of non-protein nitrogen remained almost constant. Expressing the contents of nitrogenous compounds as percentages of the total nitrogen, the coagulative protein nitrogen decreased during storage from 16.8 to 15.0%, the albumoses decreased from 27.0 to 23.7%, peptones increased from 39.8 to 42.6%, free amino-acid nitrogen increased from 4.5 to 10.0%, and amide nitrogen decreased from 11.6 to 8.5%. C. RANKEN.

Rôle of the iron in wine and other fruit products. A. HANAK (Z. Unters. Lebensm., 1930, 60, 291–297).—The deepening of the colour of wine on exposure to ultra-violet light is caused by the alternate reduction and oxidation of the iron present. Total iron in wine may be determined on the ash, or directly in the case of light-coloured wines. In the former case the wine residue is gently incinerated, the ash dissolved in hydrochloric acid, and iron determined in the filtrate by the usual colorimetric method. In the direct method 25 c.c. of wine are treated with 0.7–1.5 c.c. of 0.5% potassium ferrocyanide solution and acidified with dilute nitric acid, gum arabic solution being added to prevent the formation of a precipitate. To a second 25-c.c. portion of the same wine 0.7 c.c. of 0.5% potassium ferrocyanide solution, 1 drop of 1% ferric chloride, and a little mineral acid are added in the order given. If this second solution is not deeper coloured than the first it should be discarded and another prepared using 1 c.c. (or more if necessary) of the ferrocyanide solution. When the required depth of colour is attained, gum arabic is added to the solution and the whole is diluted to the same intensity of colour as that of the first solution, a dilution colorimeter being used for making comparisons. If necessary a solution of a suitable yellow dye may be added to the diluted solution to compensate for the coloration due to the wine itself. The volumes of the

two solutions are measured. The iron equivalent of the potassium ferrocyanide added to the second solution is calculated and from the volumes of the solutions the iron present in the first solution is found. In determining ferrous iron, 25 c.c. of wine are treated with 2 g. of potassium or ammonium thiocyanate and 1 c.c. of dilute (1:10) hydrochloric acid. To another solution similarly prepared a few drops of nitric acid are added. The second solution is diluted until the colour intensity is equal to that of the first. Then, if V_1 and V_2 be the volumes of the two solutions, V_1/V_2 = ferric iron/total iron. The method cannot be used for deeply coloured wines.

W. J. BOYD.

Rapid determination of volatile acidity in wine.

M. MARTIN (Ann. Falsif., 1931, 265, 36—37).—A new apparatus for steam-distillation is described consisting of a device for bubbling steam through 10 c.c. of the sample in such a way that the volume is kept constant, the supply being cut off automatically after 20 min. The fixed acidity is determined on the residue, the volatile acidity being obtained by difference from the total acidity.

E. B. HUGHES.

Determination of sucrose in sweet wines.

H. JAHR (Z. anal. Chem., 1931, 83, 321—338).—The official method for the determination of sucrose in wine gives correct results only if the lead acetate is added after the wine has been made slightly acid with acetic acid. The following simpler method of analysis is recommended: a quantity of wine equal to 3000/ e c.c., where e is the content of solids in g./litre, is weighed and diluted to 100 c.c. with water in a graduated flask. The liquid is transferred to a larger dry flask and shaken for 10 min. with 1.5 g. of freshly-burned bone charcoal; 25 c.c. of the filtered solution are neutralised with N -sodium hydroxide and the reducing sugars determined with Fehling's solution. A further 50 c.c. of the filtrate are diluted to 75 c.c. and the sucrose is inverted in the usual way; after dilution to 100 c.c., 50 c.c. are removed and diluted to 150 c.c., and 50 c.c. of this solution are neutralised with N -sodium hydroxide and the total sugar content is determined as before. The difference between the two results is calculated to sucrose.

A. R. POWELL.

Enzymic clarification of unfermented apple juice. Z. I. KERTESZ (N.Y. State Agric. Exp. Sta., Bull., 1930, No. 589, 10 pp.).—A pectin-destroying enzyme obtainable from *Penicillium glaucum* and other moulds is used to clarify apple juice. Coagulated colloidal matter is removable by filtration.

A. G. POLLARD.

Determination of the quality of spirit by the Barbet test. B. LAMPE (Z. Spiritusind., 1931, 54, 69—70).—For the test 50 c.c. of spirit are mixed with 2 c.c. of a solution of potassium permanganate containing 0.2 g. per litre, and the time required for the colour to change to pale salmon is determined at 18°. For a spirit of "good quality" 20 min. is chosen as the standard. The value of the test is limited, as the time required for the colour change is prolonged with any increase in the storage time of the spirit. An example is given of a spirit which showed no lessening of undesirable flavour and odour at the end of a year, i.e.,

showed no improvement of quality, but with which the original time of 11 min. required for the colour change increased to 30 min.

C. RANKEN.

Distillation of [fermented juice from] apples.

J. VIDAL and P. VIDAL (Bull. Assoc. Chim. Sucr., 1930, 47, 393—404).—In distilleries operating on apples the yields of alcohol commonly correspond to less than 80% of the sugar in the freshly-pulped fruit, as determined by copper reduction, and only a small proportion of the deficit is accounted for by the reducers remaining in the exhausted pulp and the vinasses. Careful control of well-conducted distilleries showed 1—3% of the original reducers in the exhausted pulp and 87—89% in the juice before fermentation, i.e., a loss of about 10% not accounted for in the extraction process. Analysis of the fermented juice revealed a further loss of 6—8% not accounted for as alcohol (on the basis of 61.1 litres of absolute alcohol per 100 kg. of hexoses) or as residual reducers. That these undetermined losses are mainly due to destruction of fermentable sugar, possibly in a labile form, is indicated by experimental fermentations of mashies of the fresh pulp, which gave yields of alcohol representing up to 96% of the reducers in the pulp. This method of working has not yet been adapted to large-scale operations. Rapid fermentation with specially-selected yeasts, as soon as possible after the pulping of the fruit, offers the best means of reducing the losses of sugar.

J. H. LANE.

Distillation.—See I. Water in foods. Pineapple [wine].—See XIX.

PATENTS.

Nutrient gelatin for production of a stable preparation of lees of wine cultures. A. KUBICEK (B.P. 343,122, 7.11.29).—The nutrient gelatin is produced by mixing disintegrated edible mushrooms and fruit juices with gelatin so that the mixture, which is solid at normal temperature, becomes liquid at approx. 35°.

C. RANKEN.

Digestible milk.—See XIX.

XIX.—FOODS.

The p_H values of New Zealand wheats and flours.

J. K. DIXON (New Zealand J. Sci. Tech., 1930, 12, 146—153).—The quality of flour cannot be predicted from the p_H and buffer action of laboratory-milled samples. Values obtained are largely determined by the treatment received by the wheat in the mill, and although they may be utilised to indicate the most suitable treatment in milling, they offer no criterion of any inherent properties of the wheat.

A. G. POLLARD.

March of acidity in stored flour. II. M. C. MARKLEY and C. H. BAILEY (Cereal Chem., 1931, 8, 29—38; cf. Fifield and Bailey, B., 1930, 213).—The initial acidity of flour determined by the A.O.A.C. method is greater than that by the Greek official method, but the latter shows that a greater rate of increase in acidity is produced on storage.

E. B. HUGHES.

Importance of degree of acidity in bread-making.

E. and L. ELION (Chem. Weekblad, 1931, 28, 103—105).—The work of earlier authors is discussed, and it is shown experimentally that the amount of diastase present in solution when flour is extracted is increased

when acid is added. It does not appear that formation of sugar is otherwise influenced by the degree of acidity.

S. I. LEVY.

Methods of examining flour, with special reference to the effects of heat. I. Effects of heat on flour proteins. C. W. HERD (Cereal Chem., 1931, 8, 1—23).—Heat-treatment was found to increase the viscosity of flour suspensions, interference by bacterial action being prevented by addition of ammonium fluoride or lactic acid. Changes in acidity of dough during normal fermentation do not exceed p_H 0.2. The effects of heat treatment are greatly retarded on reducing the moisture content of the flour. The work of previous authors bearing on this subject is reviewed and an extensive bibliography presented.

E. B. HUGHES.

Relation of peptisation of wheat-flour protein to loaf volume. R. H. HARRIS (Cereal Chem., 1931, 8, 47—63).—A comparison is made of three methods of determining peptisation of flour protein. Using 44 samples of Marquis wheat from the 1929 crop and 12 samples from the 1928 crop, a 75% patent flour from each was submitted to baking test with and without bromate. The correlation between protein content and loaf volume, also between peptisable protein and loaf volume, was worked out and it was concluded that total protein was of greater value than peptisable protein in predicting loaf volume. E. B. HUGHES.

Wheat and flour studies. XVII. Factors influencing the viscosity of flour-water suspensions. IV. Effect of extraction with solutions of the potassium and sodium halides. A. H. JOHNSON (Cereal Chem., 1931, 8, 39—44; cf. B., 1930, 683).—Flours were extracted with solutions of potassium halides followed by extraction with distilled water to remove the halide. The viscosity of the residue, suspended in lactic acid, was greater where the halides had been used for extraction than in the case of water alone. It is concluded that the protein removed by extraction with halide solution consists mainly of the gliadin fraction. E. B. HUGHES.

Stability of leavening in self-rising flour. P. LOGUE and E. McKIM (Cereal Chem., 1931, 8, 24—29).—Keeping tests on self-raising flours containing varying percentages of water show that with a flour of moisture content less than 12.5% deterioration is slight over a period of 1 year. The experiments were carried out on phosphate-type baking-powder. E. B. HUGHES.

Effect of overgrinding of flour on the keeping quality of bread. L. P. KARACSONYI and C. H. BAILEY (Cereal Chem., 1931, 8, 44—46).—Tests by the viscosimetric method of Karacsonyi (B., 1929, 760) showed no difference in keeping quality between bread made with normal and with overground flour.

E. B. HUGHES.

Preliminary report on experimental baking test. P. P. MERRITT (Cereal Chem., 1931, 8, 64—68).—Preliminary experiments giving the results of comparison of hand and machine mixing, also of hand and machine moulding, are recorded. E. B. HUGHES.

Biometric analysis of cereal-chemical data.

1. Variation. A. E. TRELOAR (Cereal Chem., 1931, 8, 69—88).—A discussion of the meaning and use of

statistical constants and of their application to the results of analysis of cereal products.

E. B. HUGHES.

Determination of the ash of bread. F. BERNARDINI and E. A. GAUTHIER (Giorn. Chim. Ind. Appl., 1931, 13, 7—9).—To determine the ash of bread free from any sodium chloride added during the manufacture, 5 g. of the finely-powdered, dry bread is swollen with 3.2 c.c. of water in a beaker and then treated for 1 hr., with occasional stirring, with 50 c.c. of 99.5% methyl alcohol. The liquid is decanted off on to a filter, and the residue twice treated in the same way with one half of the above amounts of water and methyl alcohol. The final residue is dried, incinerated with the filter, and weighed.

T. H. POPE.

Hardening of moti, a Japanese rice foodstuff. T. MAEDA (Nature, 1931, 127, 442—443).—After pounding, steamed glutinous rice hardens in air to a stone-like mass. Hardening is due to loss of water and to internal changes. The material which has been cooled once in a sealed vessel shows a transition temperature at 63.5°.

L. S. THEOBALD.

Solubility of milk powder. J. C. MARQUARDT (Creamery and Milk Plant Mo., 1930, 19, No. 12, 32—33).—The quality of ice cream and cream cheese is not affected by the solubility of skim milk powder, which is preferably stored in sealed containers. Slight acidity is developed during storage. The insoluble portion of highly soluble powders consists of protein, whilst that of highly insoluble powders may consist of sugar and protein in various proportions. CHEMICAL ABSTRACTS.

Application to Italian butters of Hoton's method for detecting coconut oil. C. MANICARDI (Giorn. Chim. Ind. Appl., 1931, 13, 9—11).—Hoton's method (B., 1929, 109) is satisfactory for the purpose of the test. T. H. POPE.

Coloration of frozen meat. R. HEISS (Z. ges. Kälte-Ind., 1930, 37, 189—194; Chem. Zentr., 1930, ii, 3660).—Coloration is due to the formation of methemoglobin, which is favoured by increase in acidity. Freezing in envelopes or treatment with carbon monoxide preserved the red colour. A. A. ELDRIDGE.

Liver extract as a source of vitamins-B and -G [B_{12}]. W. D. SALMON and N. B. GUERRANT (Science, 1931, 73, 243—244).—A commercial liver extract was found to be a good source of vitamin- B_2 but a comparatively poor source of vitamin-B. L. S. THEOBALD.

Effect of drying and sulphuring on the vitamin-C content of prunes and apricots. A. F. MORGAN, A. FIELD, and P. F. NICHOLS (J. Agric. Res., 1931, 42, 35—45).—Frozen, fresh prunes retained their vitamin-C content. Apricots similarly treated entirely lost this property, but retained it if packed in cases evacuated and subsequently filled with nitrogen prior to freezing. Sulphured dehydrated and sun-dried prunes retained their vitamin-C only when dipped in lye, in the customary manner, prior to treatment with sulphur dioxide. Dehydrated products of both fruits retained more vitamin-C than did corresponding sun-dried samples. Dehydrated or sun-dried apricots retained their full vitamin-C content if treated to contain > 450—500 p.p.m. of sulphur dioxide. A. G. POLLARD.

The pineapple industry. J. GUILLAUME (Bull. Assoc. Chim. Sucr., 1931, 48, 25—28).—A short survey is made of the pineapple industry, indicating its uses and giving details for the preparation of a wine from the waste and over-ripe fruit. B. W. TOWN.

Some properties of honey colloids and the removal of colloids from honey with bentonite. R. E. LOTHROP and H. S. PAINE (Ind. Eng. Chem., 1931, 23, 328—332).—The colloidal constituents of certain low-grade honeys are largely responsible for their low caramelisation point, and they have in all cases considerable influence on colour, flavour, and crystallisation. The amounts as determined by ultra-filtration through collodion membranes ranged from 0.1 to 1.0%. Cataphoresis tests showed that the colloidal particles of most honeys are positively charged, but the charge can be reversed by increasing the p_H , and an isoelectric point, which is practically the same for all types of honey, occurs at p_H 4.3. At this value spontaneous flocculation occurs after several hours. The removal of the positively-charged colloids can be effected by adding the negatively-charged colloidal clay, bentonite. Successive portions of an aqueous suspension of bentonite are added to the honey, diluted to 40° Brix, until cataphoresis tests show no migration of the aggregates. After sedimentation and filtration, the filtrate was evaporated under reduced pressure to the original honey density. When applied to three typical honey samples, viz., clover, lucerne, and buckwheat, the treatment gave products almost identical with those obtained by ultra-filtration. In all cases colour, flavour, clarity, and brilliance were improved.

H. J. DOWDEN.

Some organic acids in honey. E. K. NELSON and H. H. MOTTERN (Ind. Eng. Chem., 1931, 23, 335—336).—The volatile and non-volatile acids in 15 samples of honey of different origin have been determined. The non-volatile acids were precipitated by adding lead subacetate to 5 kg. of honey diluted with 3 litres of water and 6 litres of alcohol. After settling and removal of the supernatant liquor, the precipitate was washed with 50% alcohol. A check analysis, using an 80% sucrose solution containing known amounts of malic and citric acids, showed that not more than 75% of the acids present were recovered. The malic acid contents varied from a mere trace (in the majority of the samples) to 0.056% for cotton-honey, whilst the citric acid contents varied from 0.001 to 0.008%. Succinic acid was detected only in samples of high acidity (sourwood, cotton). Tests for tartaric acid were negative in all cases. Volatile acids were determined by steam-distillation, the acids in the distillate being liberated by sulphuric acid and the formic acid then destroyed by boiling with mercuric oxide. The total volatile acids ranged from 0.011 to 0.051% and consisted mainly of formic and acetic acids. Sage-honey had the largest amount of acetic acid (0.046%) and tulip-honey the largest amount of formic acid (0.024%).

H. J. DOWDEN.

Coffee. K. LENDRICH (Volksernähr., 1930, 5, 310—312; Chem. Zentr., 1930, ii, 3660).—Roasting scarcely affects coffee oil. The high rotation (-19°) is due to the presence of an unsaponifiable substance having $[\alpha]_D -155^\circ$ as well as phytosterol. The astringent

taste of certain varieties of coffee is due to the presence of an excess of chlorogenic acid. A. A. ELDRIDGE.

Determination of water in foods and food adjuncts etc. B. BLEYER and W. BRAUN [with P. FUSCH] (Z. anal. Chem., 1931, 83, 241—268).—The theory, apparatus, technique, reproducibility, sensitivity, range, and rapidity of the following methods are discussed: (1) Loss of weight on heating. (2) Distillation with a solvent of high b.p. and immiscible with water (e.g., benzene, toluene, xylene, or, preferably, tetrachloroethane), the volume of which is measured. This is rapid, but requires 20—50 g. of sample, whilst the solvent must be recovered. (3) Volumetric determination of the acetylene evolved by the action of powdered calcium carbide for 15 min. at 130° . (4) Determination of ϵ , water having a much higher value than most of the other constituents of foods. The weighed sample is inserted between the plates of a condenser, the change in capacity of which is measured by means of a valve (induction) circuit, and a calibration curve for the particular type of substance used then obtained by plotting the ratios, scale readings/weight, against the corresponding (known) water contents. Method (1) is recommended for barley (4 hrs. at 105°), malt, and hops; (2) gave high results; (3) gave results which were low by a small constant amount; (4) gave curves characteristic of each type of sample used (caramel malts differing from pale malts), and results having a maximum error compared with (1) of about 0.3%. Lactose, after 3 hrs. at 130° , gave reliable results by method (1), methods (2) and (3) being unsatisfactory, whilst with (4) the curves showed a change in ϵ with increase in water content only in the presence of more than 5% of water. For dried milk and marmalade (1) was unsatisfactory owing to retention of small traces of water, (2) and (4) gave excellent results, and (3) may be used for the former if the results are multiplied by 1.05, but is useless for the latter owing to difficulty in producing an intimate mixture. J. GRANT.

Cacao butter.—See XII. **Varnished tins.**—See XIII. **Alcohol from bananas.**—See XVIII.

PATENTS.

Increasing the digestibility and pharmacological action of animal milk. A. HINDELANG, J. VON DALL'ARMY, J. FORSTER, F. RUHLAND, A. FORSTER, R. WEHSARG, and L. WILL ("SAYA" GES. ZUR HERSTELLUNG VON HEILMILCH) (B.P. 343,127, 8.11.29. Ger., 10.11.28).—Filtered milk, or skim milk freed from cream by centrifuging, is cooled and inoculated with a culture of lactic acid bacilli, and, if desired, with a small amount of *Micrococcus acidilavolactici* and yeast. After the removal of air from the containers by means of an inert gas, the latter are hermetically sealed and the milk is allowed to ferment for about 6 weeks at $8-10^\circ$.

C. RANKEN.

Preparation of dough. BRIT. ARKADY CO., LTD., and H. HEWITT (B.P. 343,193, 23.11.29).—In the sponge system of breadmaking, the amount of water incorporated may be increased by beating the sponge, either before or after fermentation, by means of a high-speed mixer. By adding a proportion of leguminous flour before beating, a bleaching effect is obtained at the same time.

E. B. HUGHES.

Apparatus for kneading of margarine and other edible fatty substances. A. GERSTENBERG and H. J. J. BIGUM (B.P. 345,095, 19.3.30. Ger., 2.4.29).

[Cereal] crushers. Canned goods.—See I. Vegetable waste.—See II.

XX.—MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Determination of morphine in opium and its preparations. L. DÁVID and S. NOVÁK (Pharm. Ztg., 1931, 76, 289).—Extractum opii is treated in aqueous suspension with calcium hydroxide and lead acetate and the filtrate evaporated to dryness with ammonium carbonate. Morphine is extracted from the residue (charcoal) and titrated with 0.1N-hydrochloric acid (lactoid). Anhydrous methyl alcohol is a better solvent than ethyl alcohol for this purpose. H. E. F. NOTTON.

Chemical investigations of tobacco. H. B. VICKERY and G. W. PUCHER (Conn. Agric. Exp. Sta., Bull. 311, 1930, 234—246).—Methods of determining the amounts of nitrogenous constituents in tobacco are discussed and a permutit method of determining free ammonia in the presence of nicotine and trimethylamine is indicated. A base similar to the nicotimine (dipicrate, m.p. 163°) of Pictet and Rotschy (B, 1901, 501) was isolated (dipicrate, decomp. 179.5—180.5°). Several varieties of mature tobacco seed contained no nicotine, and it is suggested that conflicting statements in the literature are due to the use of seed at various stages of maturity. Nicotine was found to be present in tobacco seed germinated for 9—11 days on blotting paper in the dark and was presumably derived from the nitrogenous reserves in the seed. Data are also given for the nitrogen distribution in germinated and ungerminated seed. The nitrate nitrogen of tobacco leaf may vary between 0 and 23% of the total nitrogen, or from 0 to 50% of the total soluble nitrogen, these figures being considerably influenced by the fertiliser application. E. HOLMES.

Formation of carbon dioxide during the fermentation of tobacco. I. A. I. SMIRNOV and S. M. PETRIK (U.S.S.R. State Inst. Tobacco Invest., 1930, Bull. 72, 18 pp.).—The effects of adding various compounds to different oriental tobaccos undergoing autolysis in moist air have been studied. Some tobaccos show increased formation of carbon dioxide in presence of organic acids, including hydroxy-acids, but with others decreases occur. Nicotine has a variable effect in this direction and carbohydrates are without influence, but amino-acids constantly increase the amount of the dioxide formed. It is concluded that amino-acids are permanent sources of carbon dioxide in tobacco and that, with some tobaccos, organic acids are still more fertile sources. T. H. POPE.

Essential oil of Queensland sandalwood (*Santalum lanceolatum*). T. G. H. JONES and F. B. SMITH (Perf. Ess. Oil Rec., 1931, 22, 47—48).—Queensland-grown sandalwood, on extraction, gave 4% of comparatively inodorous oil and the seven samples examined had constants within the following limits: $d^{15.5}$ 0.9522—0.9756, $[\alpha]_D$ —47.1° to +12°, n_D^{20} 1.5050—1.5100, acetyl value 180—191.9, alcohols 82—88%. Two alcohols have been isolated: (a) $C_{15}H_{24}O$, $d^{15.5}$ 0.9908, $[\alpha]_D$ +28°, n_D^{20} 1.5127, b.p. 142°/5 mm.; (b) $C_{15}H_{24}O$, $d^{15.5}$ 0.9510, $[\alpha]_D$ +63°, n_D^{20} 1.5062, b.p. 148°/5 mm.

A small quantity of another alcohol is present, together with a sesquiterpene having $d^{15.5}$ 0.8954, $[\alpha]_D$ —30°, n_D^{20} 1.4960. E. H. SHARPLES.

Tobacco.—See XVI.

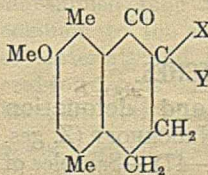
PATENTS.

Medicinal product for intravenous use. A. W. LARSON and A. K. EPSTEIN (U.S.P. 1,775,133, 9.9.30. Appl., 22.12.25).—Hexamethylenetetramine is dissolved in a neutralised solution of phenylcinchoninic acid or its derivatives, with or without the addition of sodium salicylate. E. H. SHARPLES.

Manufacture of new heterocyclic [azo] compounds [bactericides]. A. CARPMAEL. From SCHERING-KAHLBAUM A.-G. (B.P. 341,598, 6.11.29).—A heterocyclic diazo compound is coupled with a mono- or di-aminopyridine to give azo compounds which are bactericides. Examples are: 2:6-diaminopyridine coupled with diazotised 6-chloro-3-aminopyridine (product, m.p. 242°), 3-amino-6-acetamidopyridine [sulphate, m.p. 253° (decomp.)]; hydrolysis product, m.p. 260°, 5-amino-6-ethoxyquinoline (m.p. 239°), 3-amino-6-hydroxypyridine (decomp. 290°), 3-amino-6-ethoxypyridine (m.p. 181°), 3-amino-2-ethoxypyridine (m.p. 154°), 3-amino-6-butoxypyridine (m.p. 129°); 3-amino-6-acetamidopyridine with diazotised 6-chloro-3-aminopyridine (decomp. 160°); 3-bromo-2:6-diaminopyridine, m.p. 176°, with diazotised 6-chloro-3-aminopyridine [m.p. 255° (decomp.)]; 6-hydroxy-3-aminopyridine with diazotised 6-chloro-3-aminopyridine (decomp. 195°); 3-iodo-2:6-diaminopyridine, m.p. 130°, with diazotised 6-iodo-3-aminopyridine (m.p. 224—225°). The following intermediates are described: 3-nitro-6-ethoxypyridine, m.p. 96°; 3-nitro-2-aminopyridine, m.p. 163—164°; 2-chloro-3-nitropyridine, m.p. 103°; 3-nitro-2-ethoxypyridine, m.p. 20°; 3-amino-2-ethoxypyridine hydrochloride, m.p. 230° (decomp.). C. HOLLINS.

Manufacture of easily soluble sodium salts of acylaminophenolarsinic acids. I. G. FARBERIND. A.-G. (B.P. 341,405, 9.10.29. Ger., 9.10.28).—The disodium hydrogen salts of acylaminohydroxybenzene-arsinic acids are sufficiently soluble for injection and are non-irritant. They are prepared by dissolving the arsinic acid (e.g., 3-acetamido-4-hydroxybenzene-arsinic acid or its 5-chloro-compound) in the calculated quantity of sodium hydroxide or carbonate solution, and precipitating the salt with alcohol, acetone, or brine. C. HOLLINS.

Manufacture of alicyclic lactones of [ar-hydroxy-] tetrahydronaphthalenes [anthelmintics, desmotroposantonin]. I. G. FARBERIND. A.-G. (B.P. 341,402, 7.10.29. Ger., 5.10.28).—*r*-desmotropoSantonin and its analogues are synthesised from 2-alkoxy-1:4-dialkyl-8-keto-5:6:7:8-tetrahydronaphthalenes. 2-Methoxy-1:4-dimethyl-8-tetralone (in formula, X = Y = H), m.p. 63° (from *p*-xyleneol methyl ether and succinic anhydride, the product being reduced to a hydroxyxylylbutyric acid, which is cyclised and re-alkylated), is condensed with ethyl oxalate to give the naphthoylformic ester (X = H, Y = CO·CO₂Et), m.p. 73—75°, which at



150—190°/15 mm. loses carbon monoxide and yields ethyl 2-methoxy-1:4-dimethyl-8-tetralone-7-carboxylate ($X = H$, $Y = CO_2Et$), m.p. 62—64°, b.p. 170—186°/1.5 mm. The potassium compound of this is condensed with ethyl α -bromopropionate to give the di-ester ($X = CO_2Et$, $Y = CHMe \cdot CO_2Et$), b.p. 196—210°/2 mm., which when hydrolysed loses one carboxyl group and yields the acid ($X = H$, $Y = CHMe \cdot CO_2H$), m.p. 144°, and the corresponding enol-lactone, m.p. 160—162°. This last acid is demethylated by heating with aluminium chloride in chlorobenzene, and the resulting hydroxyketo-acid is reduced with sodium amalgam and carbonic acid to give the lactone, *r-desmotroposantonin* (cf. A., 1930, 919), m.p. 197—199°.

C. HOLLINS.

Digestible milk.—See XVIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Depression of density produced by the presence of bromide in the developer of photographic emulsions exposed to light and X-rays. A. P. H. TRIVELLI and E. C. JENSEN (J. Franklin Inst., 1931, 211, 335—347).—The depressions of density caused by the addition of potassium bromide (5 mg./litre) to pyrogallol and quinol developers have been determined for varying exposures of kinema positive and negative films to light and X-rays. For equal original densities the depressions were greater (1) for X-rays than for light, except at low exposures (when they might be the reverse), or with longer development, when they tend to equalise; (2) for positive than for negative film; (3) for quinol than for pyrogallol developer. The results are discussed in relation to the distribution and size of developable specks in the emulsion and to current theories of the restraining action of bromide. Abegg's theory is favoured.

J. LEWKOWITSCH.

Double toning of motion-picture film. J. I. CRABTREE and W. MARSH (Brit. J. Phot., 1931, 78, 150—151).—The film is treated with (1) a toning bath, consisting essentially of a solution of ferric ferricyanide in oxalic acid; (2) thiosulphate solution (and then washed); (3) re-immersion in the toning bath; (4) a solution of a basic dye. Blue half-tones and purple (with safranine A), or green (with auramine), or dark green (with chrysoidine 3R) shadows are obtained. The toning has no effect on the quality of sound records.

J. LEWKOWITSCH.

PATENTS.

[Optical system for] colour cinematography. W. W. TRIGGS. From CINEMACOLOR CORP. (B.P. 344,878, 9.11.29).

[Automatic exposure control in] photographic printing. CAMBRIDGE INSTRUMENT CO., LTD., and E. B. MOSS (B.P. 344,900, 10.9.29).

Azo-dye components.—See IV.

XXII.—EXPLOSIVES; MATCHES.

Sensitiveness to detonation and detonation velocity of gelatine dynamite. S. NAUCKHOFF (Z. ges. Schiess- u. Sprengstoffw., 1931, 26, 45—47).—Samples of Extra Dynamite (20% nitroglycerin) were submitted to

vacuum for periods of 10—120 sec., and determinations made of their final air content, sp. gr., loading density, detonation velocity in an aluminium tube, and transmission of detonation. Under high vacuum, the air content is rapidly reduced, with consequent increase in sp. gr., and the detonation velocity falls. No definite relationship between sp. gr. and velocity could be traced, however. After vacuum treatments of 1 min. and 15 min., the sp. gr. increased from 1.376 to 1.56 and to 1.58, respectively, and in both cases the explosive failed to detonate. Brisance, as determined in Hess' apparatus, is also decreased by vacuum treatment. Investigations were made to determine the relationship between the loss of air content, i.e., the ageing, of dynamite and the time of storage. It was established that high temperature has a marked influence, and that, in addition, the gelatinising power of the nitrocellulose is of great importance. To determine the effect of confinement, as it occurs in practice, detonation velocity tests were carried out on 50% ammonium dynamite in a borehole, one sample being untreated and another having been submitted to vacuum and having d 1.56. No appreciable difference in the velocities was indicated, the figures being 6100 and 6200 m./sec., respectively.

W. J. WRIGHT.

Nitrocellulose.—See V.

PATENTS.

Manufacture of smokeless powder propellants. A. HOUGH (B.P. 343,107, 11.9.29).—Nitrocellulose (12.4—12.7 N) is dissolved in 20—25% of diethylene glycol dinitrate, with the addition of another solvent, which is subsequently recovered. The powder has a high stability.

W. J. WRIGHT.

Aluminium ophorite. D. B. BRADNER (U.S.P. 1,775,063, 2.9.30. Appl., 21.2.25).—The magnesium in ophorite may be replaced by aluminium foil, ground in a mineral oil; the oil content of the mixture should not exceed 2%. Such treatment increases the efficiency and stability of the explosive.

W. J. WRIGHT.

XXIII.—SANITATION; WATER PURIFICATION.

Nomograms.—See I. Sulphur-oxidation of activated sludge.—See XVI.

PATENTS.

Manufacture of products for destroying animals. A. HOUSE-MORTON. From F. HOFFMANN—LA ROCHE & Co. A.-G. (B.P. 342,237, 30.5.30).—The methyl sulphate quaternary salts of dialkylaminophenyl alkyl- or aralkyl-carbamates are stable, non-hygroscopic, easily soluble, tasteless poisons, suitable for mixing with bait for destroying rats etc. Examples are quaternary salts from methyl sulphate and *m*-dimethylaminophenyl methylcarbamate (m.p. 150—153°), ethylcarbamate (m.p. 126—131°), dimethylcarbamate (m.p. 129—132°), benzylcarbamate (m.p. 155—160°), diethylcarbamate (m.p. 136°), or pentamethylenecarbamate (m.p. 120—124°); and from methyl sulphate and *m*-diethylaminophenyl methylcarbamate. The first-mentioned product has the formula $NHMe \cdot CO \cdot O \cdot C_6H_4 \cdot NMe_3 \cdot SO_4Me$.

C. HOLLINS.

Greensand.—See VII.