

BRITISH CHEMICAL ABSTRACTS

B.—APPLIED CHEMISTRY

OCT. 26, 1928.

I.—GENERAL; PLANT; MACHINERY.

Effect of pressure on fundamental filtration equation when solids are non-rigid or deformable.

D. R. SPERRY (Ind. Eng. Chem., 1928, 20, 892—895).—For filtration under constant pressure the rate of flow per unit area is given by $\sqrt{\omega PT}$, approx., where ω is a constant for a given suspension, P is the pressure, and T the time. The value ωP can be calculated from the time-discharge curve if two points on it and the pressure are known. Time-discharge curves were taken for given mixtures under several different pressures and the value of ωP for each was computed. For rigid solids the relation of ωP to P should be (on logarithmic paper) a straight line at an angle of 45° . If the solids are not rigid the angle is less and the exponent of P is given by the tangent of the angle. This value as found varied from 0.87 for starch down to 0.115 for fuller's earth. The effect of increase of pressure on the rate of filtration of the latter is therefore very slight. C. IRWIN.

Quantitative relations of the counter-current washing process. L. SILBERSTEIN (Ind. Eng. Chem., 1928, 20, 899—901).—In the systematic washing of an insoluble solid, if p is the concentration of the solute in the adherent mother liquor, a the weight of this, and b the weight of liquor transferred at each washing, then, writing $\alpha = a/(a+b)$, $\beta = b/(a+b)$, and $s = \alpha\beta \leq \frac{1}{4}$, it is shown that if 3 tanks are used the concentration of the liquor in the third tank when equilibrium has been established is $\alpha^3 p / (1 - 2s)$. If 4 tanks are used it is $\alpha^4 p / (1 - 3s) + s^2$, and with 5 tanks $\alpha^5 p / [(1 - s)(1 - 3s)]$. The data also permit of the calculation of the concentration of any other of the liquors used. C. IRWIN.

Conditions governing extraction of a solution by an immiscible solvent.

E. L. SMITH (J.S.C.I., 1928, 47, 159—160 T).—A discussion of the general principles involved in the extraction of a solute from its solution by an immiscible solvent. It is shown that if the number of extractions and total volume of extracting solvent are fixed, the maximum extraction is obtained by dividing the extracting solvent into equal parts.

Recommended specifications for analytical reagent chemicals. W. D. COLLINS, H. V. FARR, J. ROSIN, G. C. SPENCER, and E. WICHES (Ind. Eng. Chem., 1928, 20, 979—983).

Electrification in dust clouds. BLACKTIN.—See II.

PATENTS.

Furnace. F. MENNE, ASSR. to H. F. HOEVEL (U.S.P. 1,680,468, 14.8.28. Appl., 20.5.27. Ger., 9.10.25).—

A furnace with a longitudinal chamber is provided with a loose hearth from one end of which project spaced cooling pipes, forming a grid through which loose material can drop. B. M. VENABLES.

Retorts or furnaces. J. FENTON and R. BAIN (B.P. 296,255, 24.1.28).—The retort is tubular with a horizontal or sloping axis, and preferably tapers expanding from the feed end. It is subjected to a to-and-fro or oscillating rotation about its axis. B. M. VENABLES.

Retorts. A. E. WHITE. From INTERNAT. BITUMENÖIL CORP. (B.P. 295,225, 5.4.27).—The material is progressively heated during its passage through an inclined rotary cylinder. The progressive temperatures are obtained by forming the retort with a double shell, the annular spaces being divided into sections filled with "heat-equalising" (heat-conducting) solid material alternating with insulating zones filled with non-conducting material, e.g., air. The rotary part is surrounded by a fixed casing with transverse walls coinciding with the air-space sections, thus forming a number of zones for external heating, each of which is provided with its own furnace, the products of combustion being used to heat separate stills for fractionating or cracking the condensed vapours evolved from the retort. The retort may be operated under vacuum. B. M. VENABLES.

Heat exchanger. N. R. FORSSBLAD (U.S.P. 1,680,145, 7.8.28. Appl., 27.1.25. Swed., 30.1.24).—The two fluids pass in parallel alternate courses through flat channels formed between metal partitions. Heat-conducting filling material is placed in the channels, and the whole group is compressed from the two outside partitions so that the pressure is propagated through the filling material, which thus makes good conductive contact with the partitions. B. M. VENABLES.

Heat transfer. J. E. BELL, ASSR. to FOSTER WHEELER CORP. (U.S.P. 1,681,926, 28.8.28. Appl., 17.9.23).—Heat is transferred from a hotter fluid to a cooler fluid by means of a heat-transfer medium or third fluid which is divided into a number of fine streams in contact with each of the first two fluids and circulated between them. B. M. VENABLES.

Heat-exchanging structure for air heaters and the like. O. STRACK, ASSR. to PFÄLZISCHE CHAMOTTE- u. THON-WERKE SCHIFFER & KIRCHER A.-G. (U.S.P. 1,679,993, 7.8.28. Appl., 21.3.27. Ger., 23.3.26).—A heat exchanger is constructed of superposed refractory bodies, all of the same external shape and having vertical passages of approximately equal aggregate cross-section, but with one or only a few passages in the

uppermost body and the number of passages increasing in each body downwards with a corresponding decrease in thickness of refractory material and increase in number of passages. The distribution of passages in the blocks is regular. B. M. VENABLES.

Grinding or crushing machines. J. H. PULLEN, LTD., and J. STEWART (B.P. 295,117, 16.7.27).—In grinding mills of the type where a roller runs against a fixed grinding block, a scraper is provided which moves axially to and fro and removes solids accumulated behind the block. The reciprocation is effected by means of a rotating shaft cut with right- and left-hand threads with a nut adapted to engage with each thread in turn. B. M. VENABLES.

Crushing apparatus. S. F. OSSING, Assr. to JEFFREY MANUF. CO. (U.S.P. 1,681,779, 21.8.28. Appl., 26.10.25).—A crushing rotor is constructed of a number of spaced discs on a shaft, with radially projecting arms between the discs. The arms are arranged in line to form groups, each group extending half the axial length; the groups at each end are staggered in relation to each other and are equally spaced circumferentially. B. M. VENABLES.

Pulveriser. H. G. LYKKEN (U.S.P. 1,680,894, 14.8.28. Appl., 16.8.24).—The crushing action takes place between a stationary plate and a rotary member formed with teeth having tangential and radial faces. B. M. VENABLES.

Apparatus for grinding or comminuting rubber and other materials. C. E. GARDNER (B.P. 295,435, 12.5.27. Addn. to B.P. 272,572; B., 1927, 689).—Additional feeding devices such as spiked rollers are used. B. M. VENABLES.

Handling of dusty materials. O. SODERLUND, T. GRAM, and TECHNO-CHEMICAL LABORATORIES, LTD. (B.P. 295,233, 4.5.27).—A small proportion of hydrocarbon liquid, preferably non-volatile, is added at a suitable stage and at a suitable temperature to materials that are or would become dusty. In the case of the drying of fine coal, 3% (on the dry weight) of coal tar is mixed with the wet coal. In the case of air-borne dry materials the binder may be added to the stream before or after passing through the cyclone or other collector for the comparatively coarse material. Or the binder may be mixed with already collected dust and the mixture added to the main stream for recirculation, thus avoiding any harmful effects of direct addition of binder etc. B. M. VENABLES.

Tunnel dryer. M. C. H. O. LECOCQ (B.P. 282,663, 15.12.27. Fr., 22.12.26).—In a tunnel dryer two air circuits are provided, each with a propelling device and heater, passing through separate parts of the tunnel and in opposite directions; one circuit thereby receives fresh air and passes it on the second circuit, which exhausts the moist air. By adjustment of the fans the pressure at both ends of the tunnel may be made to approach atmospheric if desired. Modifications claimed are: the direction of one current is reversed, the effect then being of one extended air circuit; a single fan may be used for the two circuits; the whole apparatus may be contained in rotary cylinders; the tunnel may be annular in shape, the goods and air streams entering

and leaving by circumferential openings and the heaters being placed in the central part of the annulus.

B. M. VENABLES.

Drying granular and pulverulent materials. F. S. TUCKETT (B.P. 295,476, 23.6.27).—The apparatus comprises a number of superposed rotary tables to the uppermost of which the material is fed; it is then spread and scraped off by fixed but adjustable spreaders and scrapers so that it falls to the next table through a central opening, and from that table is scraped at the periphery and so on down the series. The tables are contained within an inner casing, and through the annular space between that and an outer casing the drying gases are first passed in a downward, preferably spiral, direction, then upwards in contact with and counter-current to the material. A proportion of the drying medium may be passed directly to the inner chamber and thermostatic control provided. A magnetic separator may be provided for tramp iron. B. M. VENABLES.

Process and apparatus for [leaching and] washing materials. E. SILVANO and V. L. CERRI (B.P. 282,446, 19.12.27. Italy, 17.12.26).—Previously pulverised or granulated material is sandwiched between two conveyor belts, and the solvent or washing liquid may be passed through the thickness of the material (the belts being permeable) several times in opposite directions, or the solvent may be forced in at one end of the ribbon and flow countercurrent to the direction of motion of the belts and material so that the out-flowing solvent is saturated as far as possible. The belts may be supported on a rigid surface preferably comprising one or more cylinders, which in the case of permeable belts are perforated. Methods of collecting the washed material and of washing the belts ready for re-use are described. The edges of the belts are thickened, giving them a channel shape. B. M. VENABLES.

Method and apparatus for classifying materials. ERZ- U. KOHLE-FLotation GES.M.B.H. (B.P. 287,499, 6.12.27. Ger., 22.3.27).—The material while travelling under water is separated by "cross-currents" (upward jets) of water into coarse and fine grains. The fine grains are further separated by hindered settling in a portion of the apparatus screened off from the cross-currents. B. M. VENABLES.

Centrifugal machines. A. E. WHITE. From LAUGHLIN FILTER CORP. (B.P. 295,916, 20.3.28).—A rotary drum with the cylindrical wall comprising the filtering surface is driven at centrifugal speed. Within the drum is a spiral scraper driven at a slightly different speed. The working edge of the scraper is formed of many small segments inserted in a groove in the spiral and loosely secured by pins through slotted holes, so that under the centrifugal force the segments will always make contact with the filtering wall and keep it clear of residue, which is continuously discharged at one end of the drum. B. M. VENABLES.

Centrifugal machines. T. BROADBENT & SONS, LTD., and B. L. BROADBENT (B.P. 296,200, 13.9.27).—A very simple form of centrifuge comprising a bowl or basket above and A.C. motor below, the whole machine being slung at three points. B. M. VENABLES.

Centrifugal separator. D. T. SHARPLES, Assr. to SHARPLES SEPARATOR Co. (U.S.P. 1,679,790, 7.8.28. Appl., 21.3.25).—The drag bush at the lower end of a centrifugal bowl is formed of laminated phenolic-condensation material, and is frictionally held in place by pressing the feed tube upwards. B. M. VENABLES.

Centrifugal separator. E. KOPKE (U.S.P. 1,679,829, 7.8.28. Appl., 30.11.25. Renewed 23.12.27).—A centrifugal bowl has the wall joined to the bottom by an inclined surface, and within is placed an annular baffle of which the height is adjustable, so that the space between the baffle and the inclined surface is variable. B. M. VENABLES.

Centrifugal liquid purifiers. PRESTON STREET COMBING Co., LTD., and J. W. ADAMS (B.P. 296,178, 27.7.27).—In a centrifugal separator for two liquids, e.g., suint and grease in wool washing, which contain also solid matter that would necessitate frequent cleaning of a de Laval type separator, the bowl is bulged outwardly and jets are situated at the largest circumference, of which the apertures are large enough to discharge the solid matter; a quantity of water is added to the feed equal to that discharged through the jets. In the case of wool washing the number of jets (rather than the size of each jet) is adjusted to discharge suint liquor equal to the diluent water necessary to keep the suint liquor at working strength. B. M. VENABLES.

Clarifier and thickener. H. G. SCHWARZ (U.S.P. 1,682,256, 28.8.28. Appl., 23.3.26).—A vertical shell is formed as a conical settling chamber at the lower part with outlet for settled pulp, and is divided by a partition into upper and lower parts, from which partition is suspended a hood surrounding a central feed opening through the partition. The hood is spaced from the wall of the vessel so that clear liquid can rise to the underside of the partition, whence it is drawn off; a weir and draw off is also provided above the partition for floating matter. B. M. VENABLES.

Filter. E. J. SWEETLAND (U.S.P. 1,680,029, 7.8.28. Appl., 10.1.22).—In a filter that operates within a casing, the filter unit is in the upper part of the casing and a settling zone is formed in the lower part, which is provided with a drain plug and attached scraping or dredging means for removal of heavier impurities. B. M. VENABLES.

Separation, by distillation, of miscible liquids. T. E. PERKS (B.P. 289,394, 16.2.28. N. Zealand, 26.4.27).—The mixture of liquids flows in a continuous course and its temperature is progressively raised. A collecting hood for vapours is placed over the liquid divided by partitions into separate zones for the various fractions, each having its own condenser, which in one form of apparatus may take the form of trays to catch liquid condensed on the water-cooled partitions. The liquid may flow in a zig-zag, spiral, or concentric path. B. M. VENABLES.

Heating or cooling liquids or fluids. ROYLES, LTD., and A. G. ROYLE (B.P. 295,245, 6.5.27).—A heat exchanger is formed of two concentric tubes with end caps affording inlet and outlet connexions for the two fluids. The annular space is formed into a spiral passage by means of a spiral rod equal in diameter to

the width of the annular space and inserted therein. The rod is held in place, and good heat conductivity obtained, by tinning. B. M. VENABLES.

Spraying tower for cooling and crystallising solutions. GEWERKSCHAFT BURBACH, and F. KILLEWALD (G.P. 446,087, 25.7.24).—The apparatus comprises a central feed column through which the hot liquid is passed in a series of interconnected pipes to allow of stage cooling, and from the top of which the solution is sprayed into a number of cooling chambers with inclined floors arranged round the central shaft. A. R. POWELL.

Dehydrating apparatus [for fluids]. W. D. CALLAN, Assr. to ECONOMIC POWDERED PRODUCTS Co. (U.S.P. 1,682,596, 28.8.28. Appl., 5.5.20. Renewed 5.7.27).—The fluid is sprayed into currents of heated air in an upper compartment, and the air passes from the lower part of the upper compartment to the upper part of a lower compartment through a restricted horizontal passage, below which is situated collecting means such as conveyor belts for the powder. After passing through the main collecting zone the air may be exhausted through screens. B. M. VENABLES.

Separation or recovery of a gas or vapour from a mixture of gases or vapours. SILICA GEL CORP., Assees. of F. H. WAGNER, JUN. (B.P. 273,261, 25.5.27. U.S., 24.6.26).—Finely-divided solid absorbent is suspended in a stream of non-absorbable gas—preferably a minor quantity of gas already treated—and sprayed into the main stream of gas to be treated in such a manner that it (the solid) falls by gravity through the gas, the latter preferably following a rising path. The process may be made cyclic and continuous by the use of two cyclone or other separators, between which the solid absorbent is regenerated in a stream of heated gas. B. M. VENABLES.

Separation and recovery of gases and vapours by absorbent solids. A. GODEL (B.P. 295,504, 25.7.27. Addn. to B.P. 267,369; B., 1927, 689).—The apparatus works on the same principle as the subject of the original patent, but the heating tubes are differently arranged, and a series of separated masses of absorbent may be used. B. M. VENABLES.

Adsorption processes [for gases] and apparatus. S. PILAT (B.P. 295,874, 22.11.27).—The container for the absorbent is divided so that in a first charging operation the gases may be passed through the full height of the absorbent mass, and in a second charging operation through only a portion of the mass (or *vice versa*), the second operation always being in the reverse direction to the first; by this means the whole mass is approximately uniformly charged. The treatment of gas may be continuous by having a series of containers to allow for regeneration. B. M. VENABLES.

Separation of dust from a gas or mixture of gases. E. PRAT (B.P. 288,190, 2.4.28. Fr., 1.4.27).—A fan is provided with a volute exceeding 360°, and a minor branch is taken off tangentially and leads to a cyclone collector for the dust. Suction is produced at the outlet of cyclone either directly or indirectly by the same fan; several methods are described for effecting this. B. M. VENABLES.

Separation of gases from mixtures thereof. URBAIN CORP. (B.P. 270,287, 23.4.27. Fr., 1.5.26).—A jet of vapour containing very fine liquid or solid particles, preferably of the same substance as the vapour, is passed through the gas. This jet will remove a greater proportion of the gas constituent which has the greater speed of diffusion and absorption. Means are provided for regulating the speed and pressure of the gaseous mixture and of the jet, also the nature of the latter, the temperature, and size of the conduits.

B. M. VENABLES.

Air- and gas-washing apparatus. E. M. BASSLER (B.P. 296,159, 28.6.27).—The gas enters the apparatus downwardly upon the upper surface of a horizontal, rapidly rotating disc on the centre of which a jet of water or other washing liquid impinges. The gas and spray leave the disc through a restricted annular space between the disc and the top of the apparatus, which space is swept by pins upstanding from the edge of the disc. The spray is caught on a cylindrical depending baffle, and the water is drawn off from the bottom of the main casing while the gas is deflected upwards, and leaves through an outlet which is situated higher than the lower edge of the baffle. [Stat. ref.]

B. M. VENABLES.

Effecting an intimate contact between gases and liquid which have to react on each other. H. PETERSEN (B.P. 295,856, 10.10.27).—A propeller is situated near, and sweeps over the whole surface of, one wall of a reaction chamber, and causes a strong whirling action without causing any admission or exhaust of the gases. To one side of the propeller may be attached a spraying device for the liquid in the form of a hollow stepped pyramid with apertures for exit of the liquid.

B. M. VENABLES.

Determining the temperature of gases. KAISER-WILHELM-INST. F. EISENFORSCHUNG E. V. (B.P. 274,440, 21.6.27. Ger., 16.7.26).—A sample of the gas is continuously aspirated over a thermocouple. To compensate for errors due to cooling of the gases the thermometer is heated by electric resistance elements, such an amount of heat being supplied that no change of temperature is indicated when the rate of aspiration of the gas is suddenly changed.

B. M. VENABLES.

Purification of gases by high-tension discharge. A. WEIGAND (G.P. 446,862, 23.9.24).—The gas stream is passed downwards through permeable brush electrodes, whereby the greater part of the impurities is precipitated, into a chamber the diameter of which increases towards the bottom, from which it rises through a gradually decreasing volume of crude gas to the outlet pipe, traversing an electrostatic field throughout. The electrodes consist of iron gratings covered with sheet iron with large perforations in the middle only.

A. R. POWELL.

Centrifugal separating machine. K. J. SVENSSON and K. A. P. NORLING (U.S.P. 1,683,424, 4.9.28. Appl., 7.1.27. Swed., 10.9.26).—See B.P. 264,777; B., 1927, 241.

Bricks or blocks for furnace building etc. R. HICKTON, W. W. BAGGULEY, and R. G. HICKTON (B.P. 296,033, 18.2.27.)

Gas burners for furnaces. F. LILGE (B.P. 296,204, 22.9.27).

[Differential expansion] apparatus for measuring or controlling temperatures. J. JERIKE (B.P. 268,812, 31.3.27. Ger., 3.4.26).

[Reinforcing or uniting means for] lead columns, pipes, etc. [subject to corrosive action]. Soc. BELGE DE L'AZOTE (B.P. 290,664, 8.5.28. Belg., 20.5.27).

Refrigerating apparatus of the absorption type. G. MAIURI and R. F. BOSSINI (B.P. 296,109 and 296,110, 25.2.27).

Refrigerating apparatus of the absorption type. H. D. FITZPATRICK. From S. K. D. M. VAN LIER (B.P. 296,478, 21.12.27).

Absorption refrigerating apparatus. ELECTROLUX, LTD., Assees. of PLATEN-MUNTERS REFRIGERATING SYSTEM AKTIEBOLAG (B.P. 271,513, 21.5.27. Swed., 22.5.26).

Heat-producing composition (U.S.P. 1,679,432).—See VII. **Rotary drum furnace** (B.P. 284,731).—See X. **Separation of materials** (U.S.P. 1,679,739 and 1,679,740).—See XI.

II.—FUEL; GAS; TAR; MINERAL OILS.

Microbiology of coal and its associated strata. II. Microflora of bituminous coal deposits. R. LIESKE and E. HOFMANN (Brennstoff-Chem., 1928, 9, 282—285; cf. B., 1928, 554).—The micro-organisms in a number of Ruhr mines at depths of 400—750 m. have been studied. The mine water was seldom sterile. Iron bacteria (*Gallionella*) and sulphur bacteria (*Thiothrix*) were found in some galleries. Bacteria, chiefly of the *Subtilis* and *Mesentericus* groups, together with various cocci, were found in the coal seams themselves. None of these was pathogenic.

A. B. MANNING.

Hydrogenation of an eocene brown coal under pressure. J. VARGA (Brennstoff-Chem., 1928, 9, 277—282).—An eocene brown coal (moisture 1.1%, ash 7.4%) has been hydrogenated, without the addition of tar, in a 3.7 litre bomb at 450—480°, and under an initial pressure of 75—125 atm. The rate of heating was such as to reach the reaction temperature in 72—77 min., and the bomb was then maintained at this temperature for 1 min., 1 hr., or 3 hrs. On account of the high sulphur content of the coal (3.98%) it was necessary to add 15% of iron oxide in order to obtain a gas free from hydrogen sulphide and an oil with a minimum sulphur content (0.22—0.29%). The iron oxide had also a positive catalytic effect on the process, lowering the temperature of hydrogenation and increasing the yield of oil. From 16.8 to 57.9% of the coal was converted into oil, the best yields being obtained with only a short heating period (1 min.) after reaching the reaction temperature. On further heating the oil was more or less (up to 50%) decomposed again. The maximum conversion into oil (57.9%) was obtained with a charge of 300 g. of coal at 470° and an initial pressure of 100 atm. The yield fell off when the charge was increased. The experiments carried out under an initial

pressure of 125 atm. throw most light on the mechanism of the process. The coal is first converted into high-boiling products, and these subsequently into lighter lower-boiling oils. If decomposition occurs the higher-boiling primary products are first affected. The relative quantity of hydrogen used, the temperature, and the time of heating affect the quality of the oil produced as well as the yield. A. B. MANNING.

Hydrogenation of Japanese coals. Y. OSHIMA and S. TASHIRO (J. Fuel Soc. Japan, 1928, 7, 70—73).—A number of Japanese coals have been hydrogenated in an electrically heated nickel-chromium steel autoclave. The total yield of oil varied from 67 to 96% (calc. on pure coal) according to the coal used and the conditions of temperature and pressure under which the hydrogenation was carried out. The temperature-pressure curves show two characteristic points, one at which the temperature tends to fall in spite of the continued heating, whilst at the other the pressure does not change in spite of the rising temperature. By varying the temperature and pressure from those giving the maximum oil yield it may be possible to increase the yield of the more valuable lighter oils and so render the process more successful economically, although the total oil yield is smaller. A. B. MANNING.

Spontaneous electrification in dust clouds (with special reference to coal dust clouds). S. C. BLACKTIN (Safety in Mines Res. Bd. Paper No. 43, 1928, 19 pp.).—The electrical charge generated in a cloud of coal dust raised by a current of air has been measured by passing the cloud through a copper conductor connected to a quadrant electrometer. The coal was ground to pass 200-mesh. The charge increased with the speed of the air current and with the amount of dust dispersed; it also varied considerably with different samples of coal. Potential differences sufficiently high to produce visible sparks were generated. Experiments with lycopodium spores and with rice and potato starches suggested that, other things being equal, the charges generated per unit weight of material increase with decrease in particle size. This conclusion was confirmed by experiments on coals ground for increasing periods of time, and on elutriated samples of American coals differing in fineness between known limits.

A. B. MANNING.

Carbon black. I. Volatile constituents. C. R. JOHNSON (Ind. Eng. Chem., 1928, 20, 904—908).—Carbon black shows on combustion the presence of 5—15% of oxygen, hydrogen, and nitrogen. It is far from certain that these gases are simply adsorbed. These volatile constituents are of importance in relation to the reinforcing power of carbon black when vulcanised with rubber. The volatile matter evolved was found to increase with temperature from 400° to 955°, to be less under reduced pressure (perhaps owing to oxidation being less), and to proceed in two stages as regards time. Carbon black which has been heated to 955° is no longer hygroscopic or adsorbent. The ultimate analysis of a sample, the analysis of the gases evolved, and a combustion of the residue were correlated for five varying samples. "Long" blacks suitable for printing ink gave much higher volatile contents and

higher original oxygen contents than rubber blacks. There is evidence that oxygen is present in the elementary state, and that the oxides of carbon found are reaction products. The hydrogen is the last gas to be driven off. For any particular make of carbon black there is a limit beyond which volatile matter adversely affects the tensile strength of rubber. It is not possible for the volatile matter to be a cause of "blow-outs" in solid tyres. It is suggested that the gas acts as a lubricant during mixing with rubber, and that, therefore, samples of very low volatile content sometimes show an excessive development of heat. C. IRWIN.

Complete gasification of coal for towns' gas. M. W. TRAVERS (J.S.C.I., 1928, 47, 203—210, 213—219 T).—The process of manufacture of water-gas from bituminous coal is discussed. It is shown that in a water-gas plant operated with bituminous coal as fuel the coal can be efficiently carbonised if both the blow gas and the water-gas are allowed to pass through it. If the blow gas be diverted, and only the water-gas is passed through the coal, sufficient heat is not carried to it to effect the process of carbonisation. In the process already described the coal is carbonised by passing through it the water-gas generated from the coke, and an additional quantity of mixed coal gas and water-gas, preheated by passing through chequer-work heated by the blow gas. The heat of the blow gas is thus utilised regeneratively for carbonising the coal. The process has been further developed, and a plant is described in which the coal is carbonised and gasified as in the original process, but the gas can also be enriched in a manner analogous to that employed in the carburetted water-gas plant, but so that the enriched gas does not return to the circulation system, and the tar produced in the process of carburetting does not mix with the coal tar produced by the distillation of the coal. The details of working of the whole process are discussed, particularly with regard to the carbonisation of the coal.

Analysis of gaseous mixtures containing carbon dioxide, carbon monoxide, hydrogen, and methane. W. E. J. BROOM (J.S.C.I., 1928, 47, 276—278 T).—A method for the determination of the above gases by the well-known oxidation process, using copper oxide at 290—300°, is described. The apparatus used is easily constructed from soft soda-lime glass, and the method allows for the differences in molar volume of different gases. Tests show that results accurate to 0.1% on a volume of 10 c.c. may be obtained.

Catalysts used in the synthesis of higher hydrocarbons from water-gas. A. ERDELY and A. W. NASH (J.S.C.I., 1928, 47, 219—223 T).—A series of experiments were carried out with the catalysts cobalt-copper-aluminium oxide (zinc oxide and cerium oxide) and also with an unpromoted cobalt-copper mixture, and the effect of various factors on the interaction of carbon monoxide and hydrogen was studied. Such factors were use of catalyst support, temperature, relative proportion of the two gases, and gas velocity. The use of alumina in catalyst mixtures was found to favour the formation of water rather than of oil; a reverse effect was observed when ceria was the promoter. Temperatures of 280—290° were the most favourable.

When silica gel was used as the catalyst supporting material, only one case was noted where the activity reached that of unsupported catalysts.

Possible chemical utilisation of methane, with special reference to natural gas. A. W. NASH and H. M. STANLEY (*Fuel*, 1928, 7, 397—401).—A summary of the methods which have been proposed for the utilisation of methane, *e.g.*, by chlorination, oxidation to formaldehyde, thermal decomposition with production of carbon black, etc. A. B. MANNING.

Inflammability of automobile exhaust gas. G. W. JONES (*Ind. Eng. Chem.*, 1928, 20, 901—903).—A number of analyses of automobile exhaust gas are given showing inerts varying from 76.9 to 98.5% on the air-free analysis (the oxygen content in the original did not exceed 1.1%). The combustibles are hydrogen, carbon monoxide, and methane. The limits of inflammability for mixtures of these gases singly with either carbon dioxide or nitrogen were determined and depicted graphically. Then for a given exhaust gas the inerts are distributed arbitrarily amongst the combustibles, and the inflammability limits of the mixture may be calculated in accordance with Le Chatelier's law. These results were in good accord with those given by experiment. Exhaust gases are non-inflammable if the air-fuel ratio exceeds 11.75 to 1 by weight. Normal carburettor adjustments are in excess of this, but in special cases danger of explosion may arise. C. IRWIN.

Hydrocarbons in a higher fraction of low-temperature tar. K. KURIHARA (*J. Fuel Soc. Japan*, 1928, 7, 61—62).—The presence of naphthalene (0.4—1.0%), 1-methylnaphthalene, and dimethylnaphthalene in the neutral oil fractions boiling above 200° of low-temperature tars from Fushun coals has been established. 2-Methylnaphthalene was not found. In the fraction boiling above 300° anthracene and methylanthracene were identified. The existence of azulene in the fraction 140—150° (20 mm.), indicated by its deep green colour and blue fluorescence, was confirmed by Kremer's method (B., 1923, 424 A). A. B. MANNING.

Hydrogenation of neutral oil of low-temperature tar. S. TASHIRO (*J. Fuel Soc. Japan*, 1928, 7, 67—70).—A neutral oil fraction of Fushun tar, of boiling range about 200° to 350°, has been hydrogenated ("berginised") in a 600 c.c. autoclave under various conditions of temperature and pressure. Above a definite temperature, about 450°, decomposition of the oil occurs with separation of free carbon. Hydrogenation proceeds most favourably just below this temperature; the initial pressure of the hydrogen should be at least 75 atm. It is, however, impossible to hydrogenate the oil completely, the iodine value of the product still amounting to 65% (approx.) of that of the original oil. In the presence of nickel oxide the hydrogenation is much more complete, and it is possible to bring the iodine value down to 12% of the original. Ferric oxide has a slight favourable effect, and the addition of zinc oxide also lowers the iodine value of the product. Copper and magnesium oxides are without action, whilst the addition of alumina appears to accelerate the decomposition of the oil. A. B. MANNING.

Oil-asphalts and tars. A. N. SACHANOV and N. A. VASILEV (*Neft. Choz.*, 1927, 13, 334—339).—Neutral tar, extracted from fuller's earth after removal of asphaltenes and acid sludge, was unstable, and had a composition corresponding with $C_nH_{2n-m}O_p$, where n is 19—55, m is 9—33, and p is 2—3; these compounds are polycyclic and contain not more than one double linking. They are soluble in sulphuric acid, and may form compounds with it. CHEMICAL ABSTRACTS.

Manufacture of asphalt. A. N. SACHANOV and L. G. SHERDEVA (*Neft. Choz.*, 1928, 14, 513—518).—The possibility of using certain Russian acid sludges is examined. CHEMICAL ABSTRACTS.

Retort construction and the constitution of low-temperature gas benzene. Y. BAN (*J. Fuel Soc. Japan*, 1928, 7, 62—67).—The low-temperature carbonisation plant of the Imperial Fuel Research Institute of Japan consists of six cast-iron vertical retorts with a total throughput of 6 tons per day. Each retort is 11 ft. high and slightly tapered, the section at the centre being 5 in. \times 2 ft. 6 in. The retorts are covered with carborundum brick to prevent overheating, and are heated by horizontal flues. The flue temperature is maintained at about 600°, the temperature of the charge being about 550°. The semi-coke is discharged continuously into water and is then conveyed to a bin. The yields of products from Takasaka and Okinoyama coals were respectively: semi-coke 61.50 and 59.77%, tar 12.20 and 7.78%, gas benzene 0.29 and 0.26%, gas 12.42 and 9.76%. The gas benzenes contained 7—10% of unsaturated hydrocarbons (by loss on washing with 80% sulphuric acid) and 22—25% of aromatics (by the aniline point method). The presence of benzene, toluene, and xylene, indicated by the position of the maxima on the sp. gr. and refractive index curves of the fractionated gas benzene, was confirmed by the isolation of their nitro-compounds. The presence of benzene in the gas benzene is ascribed to local overheating of the retort. A. B. MANNING.

Low-temperature tar oil as a Diesel engine fuel. Y. BAN and T. SUWA (*J. Fuel Soc. Japan*, 1928, 7, 57—60; cf. preceding abstract).—The suitability of low-temperature tar oils from Sakhalin and Fushun coals as fuels for a 33-b.h.p. Diesel engine has been examined. The acid-free tar oils, whether free from pitch or not, gave a slightly better performance than a Diesel oil of petroleum origin. The pitch-free oils, containing tar acids, required a higher fuel consumption, and under light loads gave rise to misfires and detonations. No trouble was experienced with a tar oil containing 1.1% of water. It is concluded that in order to produce a satisfactory Diesel oil from low-temperature tar it is necessary to remove the tar acids, the presence of which raises the auto-ignition temperature and lowers the calorific value. It is also desirable to remove the solid paraffins, which give the oils a high viscosity at ordinary temperatures. A. B. MANNING.

Auto-ignition temperature of Diesel oil. T. SUWA (*J. Fuel Soc. Japan*, 1928, 7, 53—56).—The auto-ignition temperatures of a number of low-temperature tar oils have been determined in an improved Moore

type apparatus provided with a platinum crucible of 14.8 c.c. capacity. The determinations were made in an atmosphere of oxygen, supplied at the rate of 15 c.c./min. Low-temperature tar and the pitch-free tar oils gave higher values (e.g., 337° and 405°, respectively, for the tar from Fushun coal) than a Diesel oil of petroleum origin (about 260°); the acid-free oils gave values below 300°. Varying the rate of passage of oxygen from 10 to 30 c.c./min. had no effect on the behaviour of the petroleum and the neutral tar oils, but with oils containing tar acids the auto-ignition temperatures varied with the rate of oxygen supply. The auto-ignition temperatures of a series of neutral oil fractions varied only slightly with their b.p.

A. B. MANNING.

Comparison of Diesel fuel oils from Baku, Grozni, and Emba. N. TSCHERNOSHUKOV (Neft. Choz., 1927, 13, 323—327).—The characteristics of the above oils are recorded.

CHEMICAL ABSTRACTS.

Sakhalin crude oils. S. S. NAMETKIN and V. G. PUZILLO (Neft. Choz., 1928, 14, 519—520).—Data concerning crude oils from the Okha oil field, and distillates obtained therefrom, are recorded.

CHEMICAL ABSTRACTS.

Use of lubricating greases for preservation of metals. M. V. BORODULIN (Trans. State Inst. Appl. Chem., Moscow, 1927, [5], 53—58).—Adhesiveness is more important than viscosity, but the only measure available of the former is a determination of the latter. The presence of free naphthenic acids is deleterious, but the addition of soap to neutralise the effect of free acids tends to facilitate the action of atmospheric oxygen on the metals.

CHEMICAL ABSTRACTS.

Carius determination of sulphur in less volatile petroleum oils. J. M. DEVINE and F. W. LANE (J. Amer. Chem. Soc., 1928, 50, 1707—1710).—The following modification gives accurate results with oils containing more than 0.5% S and also with *n*-butyl sulphone. Approximately 0.25 g. of oil and 4 c.c. of fuming nitric acid are heated during three 7-hr. periods to 175°, from 175° to 225°, and from 225° to 300°, the gases being released after each heating. The analysis is completed as usual.

H. E. F. NOTTON.

Determination of unsaturateds in lubricating oils. F. S. BACON (Ind. Eng. Chem., 1928, 20, 970—971).—The sample (1—10 c.c.) diluted with at least 10 c.c. of benzene or gasoline of known unsaturated content, is added to 25 c.c. of 10% sulphuric acid. Small quantities of 0.5*N*-sodium or -potassium bromide-bromate solution are added with vigorous shaking until the change in colour indicates an excess of free bromine. Saturated potassium iodide solution (1—2 c.c.) is next added. If a brown colour is not developed the test is repeated using a greater volume of bromide-bromate solution; otherwise, the mixture is back-titrated using 0.2*N*-sodium thiosulphate to the disappearance of the brown colour, and an excess of 1—2 c.c. of thiosulphate is added. The oil and water layers are now separated, the oil layer is washed, and starch indicator added to the combined aqueous solution, which is then titrated to a blue coloration using 0.1*N*-iodine (cf. Francis, B., 1926, 811).

W. S. NORRIS.

Adsorption by bone char. WAYNE.—See XVII.

PATENTS.

Carbonising apparatus. H. HENNEBUTTE and E. GOUTAL (U.S.P. 1,680,613, 14.8.28. Appl., 28.12.23. Fr., 3.1.23).—An annular drying or carbonising chamber is formed between two vertical metal cylinders, arranged concentrically one within the other, and enclosed within a brick setting. The lower end of the chamber is closed by an inturned flange on the outer cylinder, but the upper end is open and in communication with an annular flue surrounding the chamber. Hot gases can pass from this flue, down through the material in the chamber, and out through perforations in the lower part of the inner cylinder.

A. B. MANNING.

Carbonisation plant. CHAMBER OVENS, LTD. From PINTSCH & DR. OTTO GES.M.B.H. (B.P. 295,885, 7.12.27).—The end walls of retort oven benches etc. are constructed of a number of juxtaposed, curved, wall segments, which ensure uniform distribution of the stresses due to expansion when the setting is heated. Buckstays are interposed between the adjacent segments, which are held in contact with the brickwork walls of the plant by means of resiliently mounted ties.

A. B. MANNING.

[Low-temperature] carbonising or like retorts. C. TURNER (B.P. 295,461, 31.5.27).—In the lower part of a vertical retort are two or more, preferably five, intermeshing Archimedean screws on vertical axes, which support the charge and by their rotation regulate its rate of discharge. The conditions of carbonisation and the pitch and dimensions of the screws may be such that the discharge of the coke from the retort occurs without rotation of the screws. Passing up centrally through the screws is a steam inlet pipe. The offtake of the retort contains a valve which is opened at intervals to permit rapid escape of the volatile products of carbonisation, and is closed again when the pressure within the retort has fallen to the desired limit.

A. B. MANNING.

Means for distilling carbonaceous material. J. H. ANDERSON (B.P. 295,503, 25.7.27).—The drum of a horizontal rotary retort for the low-temperature carbonisation of carbonaceous materials is provided with inwardly projecting annular flanges at intervals in order to prevent lateral movement of loose heavy masses of metal, which are placed within the drum to assist in the transfer of heat and to prevent the formation of a heat-insulating coating. The discharge end of the drum, which is entirely open, projects into a box containing a conveyor for the removal of the carbonised material. A pipe communicating with this box carries off the distillation gases. The drum projects beyond the ends of the combustion chamber in which it rotates, the escape of the products of combustion being prevented by annular flexible diaphragms attached to the drum and making contact with seatings on the end of the combustion chamber. The hot combustion gases from suitably placed gas jets below the drum pass round the latter and escape through flues arranged alternately with the inlet flues for the combustion air, which thereby becomes preheated.

A. B. MANNING.

Construction of gas and coke ovens. F. TOTZEK (B.P. 295,906, 16.2.28).—Coke oven walls with vertical flues are built up of courses in which stretchers are interspersed with bricks having symmetrically arranged limbs projecting towards the interior of the hollow wall; these limbs are either joined to the bricks forming the transverse walls or are of such length as to extend across the cavity, forming the transverse walls themselves. A. B. MANNING.

Distillation of solid carbonaceous materials and retorts therefor. H. NIELSEN and B. LAING (B.P. 295,755, 18.5.27. Cf. B.P. 287,381; B., 1928, 395).—A rotary and preferably inclined retort is fitted with sets of shelves or baffles, in the form of truncated pyramids, the narrower ends of which are directed towards the discharge end of the retort. As the retort rotates, the material to be carbonised is carried upwards into the zones through which the heating gases are passed, and is heated, not only by the hot gases travelling between the periphery of the retort and the exterior of the shelves, but also by heat transmitted through the shelves from the gases passing beneath them. A. B. MANNING.

Continuous distillation of carbonaceous fuel. W. E. TRENT, Assr. to TRENT PROCESS CORP. (U.S.P. 1,675,315, 26.6.28. Appl., 22.12.22).—Coal or a mixture of coal and oil is distilled in a series of containers through which hot gases are passed; successive containers being thus subjected to progressively lower temperatures, different oil fractions distil from one container to the next or are collected in traps placed between the containers. As coking is completed in one container the maximum temperature is transferred to the next. C. HOLLINS.

Carbonaceous fuel and its manufacture. A. OBERLE, Assr. to UNIVERSAL OIL PRODUCTS CO. (U.S.P. 1,674,837, 26.6.28. Appl., 9.5.23. Renewed 13.1.28).—Residues from cracked petroleum are treated at 170–340° with steam under 10 lb. pressure, and the non-volatile matter (which now contains active carbon) is dried under reduced pressure and treated with gaseous cracking products under pressure. C. HOLLINS.

Low-temperature carbonisation. KOHLENVEREDLUNG A.-G., Assees. of KOHLENVEREDLUNG GES.M.B.H. (B.P. 267,505, 7.3.27. Ger., 9.3.26).—Illuminating or heating gas is produced by the addition of water-gas or generator gas to low-temperature gases from externally-heated retorts, the added gas being fed through or from one side to the other of the charge as it moves in a thin layer over the heating surfaces. The added gas may be preheated by the waste gases, hot coke, or other means. In retorts provided with means for the fractional distillation of carbonaceous materials, the added gas is fed separately in suitable amounts to the different gaseous fractions. A. B. MANNING.

Combustion with the aid of a catalyst. T. W. GRUETTER (B.P. 276,300, 10.3.27. U.S., 23.8.26).—An oxide of copper, cobalt, or nickel, or a mixture of these, supported, if desired, on a suitable carrier, is used as a catalyst for the flameless combustion of fuels for industrial and domestic heating purposes. To initiate com-

bustion, the catalyst requires heating to only a moderate temperature, well below that of incandescence. A. B. MANNING.

Utilising waste heat in gas-producing plant. FRANKFURTER GAS GES., and F. REICHARD (B.P. 295,900, 31.1.28).—The blow gases of a water-gas plant are used to heat a waste-heat boiler which is also heated by auxiliary fuel; the supply of the latter is throttled down during the blow period to such an extent that the total heat supplied to the boiler per unit time is maintained constant. A. B. MANNING.

Purification of gases. W. H. FULWEILER, Assr. to U.G.I. CONTRACTING CO. (U.S.P. 1,679,858, 7.8.28. Appl., 4.12.23).—In the purification of gases by absorption of the hydrogen sulphide in an alkaline salt solution, the foul solution is revived by being passed in a thin film over coke in the presence of air. The sulphides present are thereby oxidised to sulphur and the original salt is regenerated. A. B. MANNING.

Drying of fuel gases. C. COOPER, D. M. HENSHAW, and W. C. HOLMES & Co., LTD. (B.P. 295,411, 7.4.27).—In carrying out the processes of B.P. 248,841, 285,936, and 287,678 (B., 1926, 428; 1928, 325, 396) the rate of circulation of the liquor, which is maintained constant, and the total volume of liquor are so chosen that temporary, e.g., diurnal, variations in the gas consumption produce only negligible variations in the average concentration of the liquor and in the dryness of the treated gas. In order to meet seasonal variations in the gas consumption, the area of heating surface with which the liquor is brought into contact for reconcentration is correspondingly varied. A. B. MANNING.

Recovery of carburetted gases as fuel [alcohol] from the distillation of natural or waste products. E. CLAUSEN (F.P. 625,379, 20.9.26).—The residues from oil distillation, waste wood, peat, or coal slack are subjected to destructive distillation, and the gases evolved are passed through a scrubber and thence into sulphuric acid in the presence of a catalyst to absorb the unsaturated hydrocarbons. The acid is then diluted and distilled with steam to hydrolyse the alkyl sulphonates with the production of a crude alcohol for use as motor fuel. A. R. POWELL.

Recovering acetylene in a concentrated form from gaseous mixtures thereof with inert or reducing gases free from oxygen or oxygen-containing compounds. I. G. FARBERIND, A.-G. (B.P. 280,885, 28.10.27. Ger., 16.11.26).—The gases are washed with water under pressure; the acetylene is dissolved and is recovered from the solution on releasing the pressure. A. B. MANNING.

Distillation of coal tar. C. WESSEL (B.P. 273,675, 8.6.27. Ger., 29.6.26).—Tar, heated sufficiently to prevent subsequent condensation of steam therein, is subjected to the action of live steam at as low a temperature as possible in order to drive off, in separate stages, the light oil and water, and then substantially pure naphthalene. The steam supply is then discontinued and the residual tar distilled by direct heating. A. B. MANNING.

Manufacture of [bituminous] emulsions. L. KIRSCHBRAUN (U.S.P. 1,679,475, 7.8.28. Appl., 24.3.26).—A colloidal emulsifying agent is mixed with sufficient of a previously prepared emulsion of similar character to form a paste, heated bituminous material in the liquid state is added, and the whole is agitated.

A. B. MANNING.

Treatment of montan wax. J. Y. JOHNSON. From I. G. FARBERIND. A. G. (B.P. 296,145, 9.6. and 22.12.27).—The tendency of bleached (oxidised) montan wax to crystallise is avoided by esterifying or otherwise converting the carboxyl groups present into groups not containing free hydroxyl. For boot polishes etc. the wax is preferably partly esterified with glycol and the remaining carboxyl groups are neutralised with lime.

C. HOLLINS.

Production of low-b.p. oils by thermal treatment of coals, oils, etc. I. G. FARBERIND. A. G. (B.P. 272,194, 23.5.27. Ger., 1.6.26).—The starting materials are subjected, generally in the liquid state, to heat treatment at 300–500°, under any desired pressure and in the presence of catalysts. The resulting products, in the state of superheated vapour, are passed over other catalysts at a temperature substantially higher than that used in the first stage of the process. Either or both stages may be carried out in the presence of gases, preferably hydrogen.

A. B. MANNING.

Conversion of heavier hydrocarbons into lighter hydrocarbons. R. CROSS (B.P. 273,256, 12.5.27. U.S., 28.6.26. Cf. B., 1923, 260 A; 1925, 951).—Hydrocarbons of the kerosene and gasoline series, having a critical temperature not above 490°, are converted into motor fuel by passage through a heating zone into a large insulated reaction chamber; the charging stock is raised in the heating zone to a temperature above its critical temperature, but passes into the reaction chamber before substantial decomposition takes place. The pressure is maintained at a value (700–1000 lb./in.² or higher) above the critical pressure of most of the hydrocarbons present. The reaction products pass successively through a polymeride separator and a bubble tower to a condenser. The final product is a motor fuel low in unsaturated hydrocarbons, high in naphthenes, and possessing marked anti-detonating qualities.

A. B. MANNING.

Synthesis, distillation, cracking, and hydrogenation of hydrocarbon oils. J. TRAUTMANN (B.P. 261,786, 20.11.26. Ger., 21.11.25).—In carrying out these processes the necessary heat is transmitted to the oil by spraying hot finely-divided metals, in the form of powder, liquid, or vapour, into the reaction chamber. The reaction substances themselves may be used to assist in the atomisation of the metals, or may be sprayed into the chamber simultaneously through adjacent nozzles, so arranged as to give as intimate contact as possible of the substances with the metal. Catalysts in a finely-divided form may, if desired, be sprayed similarly into the reaction chamber.

B. MANNING.

Treatment of gasoline and similar petroleum products. A. G. BLOXAM. From ALLGEM. GES. F. CHEM. IND. M.B.H. (B.P. 295,25 3,7.5.27; cf. B.P. 245,072; B., 1926, 621).—Gasolines having a substantial

proportion of constituents boiling above 160° are improved in volatility and in "anti-knocking" qualities by the removal of the higher-boiling saturated hydrocarbons. The unsaturated hydrocarbons in the fraction of the oil boiling from about 160° to 250° are extracted therefrom by liquid sulphur dioxide, acetone, or mixtures of these, and, after recovery from the extracting agent, are added to the fraction boiling below 160°.

A. B. MANNING.

Purification of liquid hydrocarbons by liquid sulphur dioxide in counter-current. ALLGEM. GES. F. CHEM. IND. M.B.H. (B.P. 279,774, 18.2.27. Ger., 1.11.26).—To ensure complete separation of the liquid sulphur dioxide from the oil in an apparatus in which the latter is continuously washed by a counter-current of the former, the head of the washing tower, or the container into which the oil flows from the tower, is made of greater cross-section than the tower itself, so that the velocity of flow of the oil is reduced and any entrained drops of liquid sulphur dioxide are given time to settle.

A. B. MANNING.

Manufacture of unsaturated hydrocarbons. I. G. FARBERIND. A. G. (B.P. 267,155, 7.3.27. Ger., 8.3.26).—Liquid or solid hydrocarbons are mixed with oxygen, or with gases containing at least 50% of oxygen, in amount insufficient for the complete oxidation of the hydrocarbons, and are subjected to incomplete combustion at 650–900°. Water, in the form of liquid or vapour, may be added if desired. Gases rich in olefines are produced.

A. B. MANNING.

Refining and stabilisation of hydrocarbons. E. A. PRUDHOMME, ASSR. to SOC. INTERNAT. DES PROC. PRUDHOMME (S.I.P.P.) (U.S.P. 1,674,796, 26.6.28. Appl., 7.4.26. Fr., 4.3.26).—Vapours of hydrocarbon fractions, b.p. below 400°, are treated above 180° with nickel oxide and copper oxide in succession to remove impurities, and are then passed with hydrogen (etc.) first over a nickel catalyst and finally over active carbon. An oil distilling at 60–220° is thus obtained (cf. B.P. 267,138; B., 1928, 220).

C. HOLLINS.

Oil-refining still. O. E. ANDRUS and S. HERMANSON ASSRS. to A. O. SMITH CORP. (U.S.P. 1,680,276, 14.8.28. Appl., 29.10.27).—A vessel is lined with a sheet of corrosion-resisting alloy which is electrically spot-welded at numerous points to prevent distortion and give good heat conduction. The welding must be done in such a way as not to change the character of the lining.

B. M. VENABLES.

Fuel-dust furnace. G. SZIKLA and A. ROZINEK (U.S.P. 1,680,183, 7.8.28. Appl., 24.1.25. Hungary, 4.2.24).—See B.P. 228,906; B., 1926, 572.

Apparatus for washing coals. P. WOLF (U.S.P. 1,682,820, 4.9.28. Appl., 22.10.23. Fr., 24.10.22).—See B.P. 206,151; B., 1925, 162.

Recovery of petroleum from oil-bearing sands. H. ATKINSON (B.P. 296,213, 10.10.27).—See U.S.P. 1,651,311; B., 1928, 45.

Means for forming combustible mixtures for use in internal-combustion engines. C. N. POGUE and A. J. ANDREWS (B.P. 296,238, 19.12.27).

[Oil burner for] combustion of hydrocarbons. J. L. BREESE, JUN. (B.P. 295,758, 23.5.27).

Retorts (B.P. 295,225 and 296,255).—See I. Oil colours from petroleum pitch (G.P. 447,470).—See XIII.

III.—ORGANIC INTERMEDIATES.

Methyl alcohol from hydrogen and carbon monoxide. R. L. BROWN and A. E. GALLOWAY (Ind. Eng. Chem., 1928, 20, 960–966).—The synthesis of methyl alcohol was studied on a small scale, using a reaction tube and receiver of chrome-vanadium steel plated with copper. Uncombined gas could be recirculated. The gases were freed from oxygen, carbon dioxide, and moisture. Pressure-time curves are given for the following catalysts: Zinc oxide, basic zinc chromate, and normal zinc chromate. The chromic oxide considerably accelerates the reaction at temperatures up to 400°. The methyl alcohol actually recovered amounted to 70–95% of that calculated from the pressure drop. The principal by-product was methane. 1 hr.-tests at 400° and under constant pressure (180 atm.) with various space velocities were then made, the yield with normal zinc chromate being the best. The activity of zinc oxide was found to diminish more than 50% after 5 hrs.' use at 400°; the deterioration of zinc chromate was much more gradual. The best chromate catalysts are prepared by reduction at as low a temperature as possible (300°). The data indicate the probability of equilibrium at 400° and 180 atm. at 20% conversion. This point is investigated theoretically, and a method of calculating conversions under other conditions is indicated. C. IRWIN.

Oxidation of anthracene by oxides of nitrogen. M. A. ILJINSKI and B. V. MAXAROV (J. Chem. Ind., Moscow, 1928, 5, 469–473).—Oxides of nitrogen, whether mixed with air or alone, have no oxidising action on nitrobenzene, or on anthraquinone suspended in the latter. Anthracene in nitrobenzene solution is under these conditions quantitatively oxidised to anthraquinone, and 2-methylantracene to the corresponding methylantranthraquinone, but no further. A series of products is obtained from carbazole, chiefly 3:6-dinitrocarbazole, with an admixture of 3- and 9-nitroso-carbazole, 3-nitrocarbazole, 9-nitroso-3-nitrocarbazole, and 3-nitroso-6-nitrocarbazole. Phenanthrene yields a mixture of tarry products, which were not separated. Anthraquinone cannot be isolated from the reaction products when very impure samples of anthracene are taken. Where 25% anthracene is used, the yield of anthraquinone is only about 40% of the theoretical, and the product is contaminated with nitrogenous and tarry matter, from which about one third of the anthraquinone is inseparable. The anthraquinone so derived from crude anthracene cannot be purified by sulphonation. R. TRUSZKOWSKI.

PATENTS.

Polymerisation and purification of hydrocarbons. S. P. MILLER and J. B. HILL, ASSTS. to BARRETT CO. (U.S.P. 1,679,093, 31.7.28. Appl., 5.8.26).—Solvent naphtha, benzol, or other hydrocarbon, mixed with a polymerising agent, is passed continuously through an

emulsifier. The polymerisation is hastened and the quality of the resulting resins is improved.

F. G. CLARKE.

Manufacture of aromatic amines from nitro-compounds. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 295,824, 4.8.27).—Since sodium or ammonium polysulphides and thiosulphates are reduced to sulphides, especially in presence of silica gel, heavy metal oxides, etc., by hydrogen or carbon monoxide at high pressures (100–200 atm.) and temperatures (150–180°), a small amount of sulphide is sufficient in the presence of these gases under these conditions to reduce a large quantity of aromatic nitro-compound. The sulphide may be replaced by caustic alkali (or ammonia) and sulphur, or by polysulphides or thiosulphates. Part of the thiosulphate formed (or introduced) is converted at the temperatures used into sulphate; by employing 1.7–5% of the ammonium sulphide theoretically required there is obtained at the end of the reduction ammonium sulphate free from sulphide or thiosulphate. The hydrogen and carbon monoxide need not be purified. The reduction of nitrobenzene, *m*-dinitrobenzene, *p*-nitroaniline, and *p*-nitrophenol to amines is described. C. HOLLINS.

Manufacture of 1-methyl-2:5-dichloro-4-amino-benzene [2:5-dichloro-*p*-toluidine]. I. G. FARBENIND. A.-G. (B.P. 287,110, 8.3.28. Ger., 15.3.27).—5-Chloro-*o*-toluidine is nitrated at 0° in mixed acid, the reaction mixture is diluted, diazotised with solid nitrite, and the diazo solution decomposed with cuprous chloride solution at 70° to give 2:5-dichloro-4-nitro-toluene, m.p. 40–45°, which is reduced to 2:5-dichloro-*p*-toluidine, m.p. 90–91°, b.p. 130–133°/12 mm. The yield is 80% on the 5-chloro-*o*-toluidine.

C. HOLLINS.

Conversion of cyanonaphthalenesulphonic acids, and products of the conversion. W. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 296,010, 21.2.27).—Naphthalenesulphonic acids containing a cyano-group *o*- or *p*- to the sulphonic group are converted by caustic alkali or alkaline salts into hydroxy-nitriles, -amines, or -acids, and by alcoholic alkali into corresponding alkoxy-derivatives, at 80–150°. The following compounds are described: 2-cyano- α -naphthol, m.p. 179°; 1-hydroxy-2-naphthoic acid, m.p. 186°; 4-cyano- α -naphthol; 3-hydroxy-6-sulpho-2-naphthoic acid; 3:6-dihydroxy-2-naphthoic acid; 1-hydroxy-4-naphthoic acid, m.p. 184–185°; 2-methoxy-1-naphthamide, m.p. 189°; 1-methoxy-2-naphthamide, m.p. 156–157°; 1-methoxy-2-naphthoic acid, m.p. 127°; 4-methoxy-1-naphthamide, m.p. 237°; 4-methoxy-1-naphthoic acid, m.p. 239°; 4-ethoxy-1-naphthamide, m.p. 244°; 4-ethoxy-1-naphthoic acid, m.p. 214°; 4-*n*-butoxy-1-naphthamide, m.p. 250°; 4-*n*-butoxy-1-naphthoic acid, m.p. 208°.

C. HOLLINS.

Manufacture of *N*-dihydro-1:2:1':2'-anthraquinoneazine [indanthrone]. J. Y. JOHNSON. From I. G. FARBENIND. A.-G. (B.P. 296,106, 22.2.27).—Improved yields of indanthrone are obtained by adding to the alkaline melt of β -aminoanthraquinone (i) sodium formate, acetate, or propionate, together with (ii) salts of butyric or higher aliphatic acids, or alkali alkoxides or phenoxides. [Stat. ref.] C. HOLLINS.

Manufacture of products applicable for making dye preparations and of dye preparations made therewith. SOC. CHEM. IND. IN BASLE (B.P. 271,898, 27.5.27. Switz., 29.5.26).—Still residues from distillation of benzaldehyde are sulphonated with oleum or chlorosulphonic acid, and used as dispersing and drying-down agents for acetate silk dyes and other dyes.

C. HOLLINS.

Preparation of stable emulsions, suspensions, and colloidal dispersions of organic substances insoluble in water. M. BUCHNER and R. UHDE (G.P. 446,162, 16.8.22).—For the preparation of stable emulsions of oils, fats, waxes, resins, and similar insoluble compounds a salt of a highly chlorinated fatty acid or resin acid is used as the emulsifying agent.

A. R. POWELL.

Extraction of butyric acid and its homologues. J. LEFRANC, ASST. to SOC. DES BREVETS ÉTRANGERS LEFRANC & C^{ie}. (U.S.P. 1,683,198, 4.9.28. Appl., 25.1.27. Fr., 27.8.26).—See B.P. 276,617; B., 1928, 280.

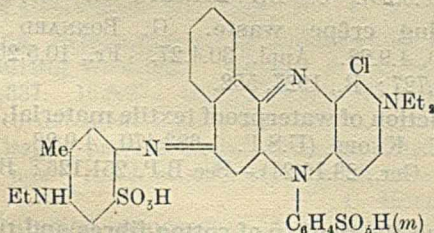
Production of soluble salts of organic compounds possessing acid character. M. BUCHNER, ASST. to A. F. MEYERHOFER (U.S.P. 1,683,159, 4.9.28. Appl., 22.12.25. Ger., 16.1.25).—See B.P. 246,142; B., 1927, 733.

Conversion of cyanonaphthalenesulphonic acids. R. HERZ, F. SCHULTE, and W. ZERWECK, ASSTS. to GRASSELLI DYESTUFF CORP. (U.S.P. 1,669,297, 8.5.28. Appl., 10.11.27. Ger., 17.5.26).—See B.P. 296,010; preceding.

IV.—DYESTUFFS.

PATENTS.

Manufacture of acid dyes of the phenonaphthasafranine series. J. R. GEIGY A.-G. (B.P. 284,614, 31.1.28. Ger., 31.1.27. Addn. to B.P. 265,986; B., 1928, 441).—Greener dyes are obtained by using in the prior process isorosindulinedi- or tri-sulphonic acids containing halogen in position 1; one sulphonic group is always in the arylimino-group and *ortho* to the imino-nitrogen. Thus the phenonaphthasafraninedisulphonic acid of formula—



is obtained by condensing 6-ethylamino-*m*-toluidine-4-sulphonic acid with the disulphonic acid prepared by the action of bisulphite on 1-chloro-3-diethylisosinduline-12-sulphonic acid (from *m*-sulphophenyl- β -naphthylamine and 3-chloro-4-nitrosodiethylaniline). It gives fast greenish-blue shades on wool.

C. HOLLINS.

Manufacture of vat dyes of the anthraquinone series. W. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 295,645, 14.5.27).—1 : 2 : 6 : 7-Diphthaloylacridone, from 2-aminoanthraquinone condensed with 1-chloroanthraquinone-2-carboxylic acid and cyclised,

is nitrated with mixed acid at 10–40°, and the product is reduced. The *amine*, which differs from Eckert and Halla's 4-amino-1 : 2 : 6 : 7-diphthaloylacridone (A., 1914, i, 994), is a grey-blue vat dye, and on benzoylation gives a fast olive-green vat dye. The isomeric 3 : 4 : 6 : 7-diphthaloylacridone similarly yields a grey-blue vat dye and on benzoylation a fast violet-grey vat dye.

C. HOLLINS.

Manufacture of vat dyes [of the anthraquinone series]. BRIT. DYESTUFFS CORP., LTD., A. DAVIDSON, and A. SHEPHERDSON (B.P. 295,770, 26.5.27).—A 1-arylaminoanthraquinone-2-carboxylic acid is heated in a high-boiling solvent (trichlorobenzene) with thionyl chloride largely in excess of that required to form the acid chloride. The product, with or without isolation, is then chlorinated at 190°. 1-Anilino- or 1-*p*-toluidinoanthraquinone-2-carboxylic acid gives a pink vat dye, the 1- β -naphthylamino-compound an orange-brown.

C. HOLLINS.

New azo dyes. BRIT. DYESTUFFS CORP., LTD., R. BRIGHTMAN, and P. CHORLEY (B.P. 296,047, 22.4.27. Cf. B.P. 296,011; B., 1928, 782).—Dyes giving level shades on viscose silks, and on wool dyeings fast to milling, are obtained by coupling a tetrazotised 4 : 4'-diaminodiphenyl mono-, di-, or tri-sulphide with 2 mols. of a 2 : 8-aminonaphtholsulphonic acid, or with 1 mol. of such acid and 1 mol. of a coupling component of the benzene or naphthalene series. Examples are : 4 : 4'-diaminodiphenyl sulphide with salicylic acid and phenyl- γ -acid (brown), or with 2 mols. of γ -acid (violet-brown on viscose, maroon on wool); the disulphide with 2 mols. of γ -acid (violet-brown); the trisulphide with salicylic acid and γ -acid (red-brown), or acetyl- γ -acid (yellowish-red).

C. HOLLINS.

Manufacture of acid dyes of the phenonaphthosafranine series. P. LAEUGER, ASST. to J. R. GEIGY SOC. ANON. (U.S.P. 1,683,559, 4.9.28. Appl., 28.12.27. Ger., 13.2.26).—See B.P. 265,986; B., 1928, 441.

Dye preparations (B.P. 271,898).—See III.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Plasticity of wool. J. B. SPEAKMAN (Proc. Roy. Soc., 1928, B, 103, 377–396).—The plasticity of wool fibre has been determined under various conditions, *e.g.*, of humidity, by stretching a fibre to a definite extent and measuring the decrease in the tension of the fibre which subsequently takes place. The plasticity increases with increasing humidity, and it is considered that the plasticity is due to the rupture of amide linkages in the wool protein following adsorption of water. Treatment by chemicals, such as acids, which combine with tervalent nitrogen and thereby inhibit addition of the elements of water to the amide linkage decreases the plasticity. The mechanical structure of the elastic and plastic elements in the wool fibre is also discussed.

W. O. KERMACK.

Action of chlorine on jute fibre. H. W. STRONG (J.S.C.I., 1928, 47, 196–198 r).—It is shown that in the interaction between chlorine and jute fibre the simple substitution of chlorine for hydrogen is not the only reaction which occurs, but that it is accompanied by oxidation. The amount of chlorine combined with the

lignone is 5% on the oven-dry fibre sample, and that as hydrochloric acid is 9.9%. The former value corresponds to the formation of a tetrachloro-compound with the lignone.

Behaviour of lignin and chlorolignin in the preparation of wood pulp by means of chlorine. II. P. WAENTIG (Z. angew. Chem., 1928, 41, 1001—1005; cf. B., 1928, 742).—Chlorolignins produced in the chlorination processes from woody and other fibres have a mean chlorine content of 30% if extracted by organic solvent. In water-extracted chlorolignins the average value is 18—19%, but further extraction of these with organic solvents yields the higher chlorinated product. The most successful extraction of chlorolignin occurs when the preliminary cooking of the fibre with soda is abandoned. Chlorolignin so obtained decomposes slowly if moist and more rapidly by heating, yielding hydrochloric acid. In a sealed tube two thirds of its chlorine is recovered as hydrochloric acid. The amount of soda necessary to dissolve chlorolignin in the cold is less than the chlorine equivalent, but at 95—100° more soda is required. Lime precipitates chlorolignin from soda solution; hence the disadvantages attaching to the use of lime and bleaching powder in processes for cellulose production. The lime-chlorolignin precipitate is easily hydrolysed, and a large excess of lime is required for complete precipitation. The mol. wt. of chlorolignin in acetone is about 1000. A. G. POLLARD.

PATENTS.

Preparation of artificial silk with special mechanical properties. N. V. NEDERLANDSCHE KUNST-ZIJDEFABR. (B.P. 285,890, 11.11.27. Holl., 25.2.27. Addn. to B.P. 282,721; B., 1928, 706).—The increase in strength of viscose threads may be achieved by leading the spinning bath liquor in counter-flow to the spun material, or by leading the thread over a large number of preferably rotating thread-guides so that it runs in a slightly zig-zag fashion. [Stat. ref.]

D. J. NORMAN.

Manufacture of filaments, threads, bands, etc. from viscose. COURTAULDS, LTD., and J. H. TAYLOR (B.P. 294,805, 10.10.27).—The emulsification of small quantities of petroleum jelly with viscose solution for the production of viscose threads of subdued lustre (cf. B.P. 273,386; B., 1927, 649) is facilitated if the petroleum jelly is first mixed with 5—10% of its weight of cyclohexanol. Other suitable additions such as 5% of oleic acid may also be made. D. J. NORMAN.

Application of cellulose esters and ethers, and products thereby obtained. BRIT. CELANESE, LTD. (B.P. 274,841, 1.7.27. U.S., 23.7.26).—Threads, fabrics, films, etc., made of or having a surface of cellulose acetate or other fatty acid esters or ethers of cellulose, are treated with a solution of another or of the same fatty acid ester or ether of cellulose having different solubility characteristics, the solvent employed in the coating solution being a non-solvent for the cellulose compound of the material to be coated. The original surface is thus protected from dampness or friction, any effects therein are rendered permanent, and other effect

materials may be introduced by means of the coating solution. F. R. ENNOS.

Composition for preserving food products. H. BUEL, Assr. to W. P. HAMMOND (U.S.P. 1,680,934, 14.8.28. Appl., 8.9.21).—A composition for the manufacture of milk containers comprises a mixture of ethylcellulose acetate deposited from acetone solution and a tasteless, odourless, light oil as plasticising agent. A. R. POWELL.

Making paper pulp. R. W. HOVEY (B.P. 295,759, 23.5.27).—During the cooking of wood under pressure using direct steam, a uniform temperature may be maintained throughout the digester by continuously withdrawing liquor from the top of the digester and injecting it (together with steam, if desired) into the bottom thereof through a series of nozzles so arranged, e.g., annularly, that the hot liquor is forced up through the cooler peripheral zone. A more uniform product is thus obtained, particularly in sulphite cooking. D. J. NORMAN.

Continuous cooking of fibrous material. T. L. DUNBAR, Assr. to CHEMIPULP PROCESS, INC. (U.S.P. 1,679,336, 31.7.28. Appl., 25.10.26).—Fibrous material is passed through a series of cooking chambers arranged end to end, and is treated therein with hot cooking liquor. In the first chamber the cooking is effected under hydrostatic pressure, and in succeeding chambers under super-atmospheric pressure at increasing temperatures. D. J. NORMAN.

Manufacture of straw pulp and paper. C. H. DEDRICK, Assr. to PHILADELPHIA QUARTZ CO. (U.S.P. 1,682,834, 4.9.28. Appl., 6.1.25).—Straw is cooked with sodium silicate, beaten with the liquor, and sized. F. G. CROSSE.

Artificial thread and process for making same. L. LILIENFELD (U.S.P. 1,683,199, 4.9.28. Appl., 23.12.26. Austr., 20.6.25).—See B.P. 294,521; B., 1927, 745.

Artificial material and process for making same. L. LILIENFELD (U.S.P. 1,683,200, 4.9.28. Appl., 3.6.26. Austr., 20.6.25).—See B.P. 281,351; B., 1928, 228.

Treating crêpe waste. G. BONNARD (U.S.P. 1,683,520, 4.9.28. Appl., 30.4.27. Fr., 10.5.26).—See B.P. 270,727; B., 1927, 552.

Production of waterproof textile material, paper, etc. C. KNOPF (U.S.P. 1,683,470, 4.9.28. Appl., 24.4.25. Ger., 23.12.24).—See B.P. 251,126; B., 1926, 627.

Testing the quality of cotton fibres and the like. G. ZWEIFLE (B.P. 283,861, 16.1.28. Ger., 17.1.27).

Apparatus for measuring the moisture content in wool and like fibrous materials. ROYLES, LTD., C. WILSON, and E. H. TOWNEND (B.P. 296,157, 25.6.27).

Liquid purifiers (B.P. 296,178).—See I.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Dyeing of regenerated cellulose silk. BRIT. DYE STUFFS CORP., LTD., R. BRIGHTMAN, and P. CHORLEY (B.P. 296,011, 22.4.27).—Level dyeings on viscose

silks are obtained by using dyes obtained by coupling tetrazotised 4:4'-diaminodiphenyl mono-, di-, or trisulphide with 2 mols. of an aminonaphtholsulphonic acid, or with 1 mol. of such acid and 1 mol. of any other coupling component. Examples are: 4:4'-diaminodiphenyl sulphide coupled with salicylic acid and phenyl- γ -acid (brown), with 2 mols. of phenyl-J-acid (bluish-red), or with phenylmethylpyrazolone and J-acid (scarlet); the disulphide with 2 mols. of J-acid (scarlet); the trisulphide with salicylic acid and *m*-xylyl- γ -acid (brown), or with 2 mols. of γ -acid coupled acid (maroon).
C. HOLLINS.

Production of yellow dyeings on cellulose esters or ethers. I. G. FARBERIND. A.-G. (B.P. 275,230, 25.7.27. Ger., 29.7.26).—Yellow non-phototropic shades on acetate silk are obtained by using arylazodiphenylamines containing one sulphonic group and in the diphenylamine residue at least one nitro-group, *e.g.*, 4-benzeneazo-2':6'-dinitrodiphenylamine-4'-sulphonic acid and 4-benzeneazo-4'-nitrodiphenylamine-2'-sulphonic acid.
C. HOLLINS.

Coloration of cellulose esters and ethers. Soc. CHIM. DES USINES DU RHÔNE, and M. J. THEUMANN (B.P. 294,137, 12.4.27. Addn. to B.P. 275,553; B., 1928, 639).—The prior process is extended to include the formation of lakes of organic dyes in solutions of cellulose esters or ethers in an organic solvent, the coloured product being subsequently precipitated with water and washed. *E.g.*, a slight excess of an aqueous solution of lead acetate may be stirred into an acetone solution of cellulose acetate coloured with eosin, and the resulting product precipitated etc. as described.
D. J. NORMAN.

Dyeing throughout with vat dyes compact vegetable material. Soc. CHEM. IND. IN BASLE (B.P. 288,306, 4.4.28. Switz., 9.4.27).—The material (*e.g.*, twisted, highly mercerised embroidery and knitting yarn) is treated with a protective colloid such as glue or sulphite-cellulose lye in hot water before dyeing. Good penetration and even dyeings may then be obtained with vat dyes of the anthraquinone series, *e.g.*, Cibacine Blue 3G or Indanthrene Blue Green B.
C. HOLLINS.

Reducing deterioration of colours of textile fabrics during washing. HENKEL & Co., G.M.B.H. (B.P. 276,337. 16.8.27. Ger., 17.8.26).—If carbamide is added to detergent liquors for textiles, running of colours is largely prevented, the colours are brightened, and the "new" touch of silks and wool is restored.
C. HOLLINS.

Fabric dyeing processes. J. C. WATSON (B.P. 295,982 and 295,977, 18.5.27).—See U.S.P. 1,629,769 and 1,629,770; B., 1927, 553.

Mounting textile bobbins to be dyed in columns. J. ANNICQ (B.P. 296,603, 5.12.27).

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

Explosive properties of solid hypochlorites. J. WEICHERZ (Chem.-Ztg., 1928, 52, 729—730).—Pure calcium hypochlorite with 70% of available chlorine evolves oxygen slowly at temperatures below

100°, but explodes violently with liberation of its oxygen content at 112°. Mixtures of the hypochlorite with organic substances such as alcohol, tars, mineral oils, or starch are stable at ordinary temperatures, but, on warming, deflagrate, sometimes with explosive violence. Similar effects are obtained by contact with moisture, but in this case there is a more or less lengthy period of induction depending on the nature of the organic substance.
A. R. POWELL.

Manufacture of zinc oxide. R. G. DANIELS (J. Oil Col. Chem. Assoc., 1928, 11, 277—288).—Oxidation of zinc in crucibles each with its own furnace gives good quality oxide if very pure zinc is used, but the thermal efficiency is low. Cadmium and lead give rise to discoloration. Cadmium can be removed by preheating in a reducing atmosphere, but fuel costs are prohibitive. A converter similar to the Bessemer converter consisting of a steel shell with chrome brick lining and hand turning gear was constructed and gave good results. Zinc being fed in the molten state, the heat of oxidation was more than sufficient and air cooling was necessary. For the manufacture of zinc oxide from residues and ores the Wetherill grate was used. This consists of a cast-iron plate with conical perforations tapering upwards placed over a brick chamber. Zinc ore and anthracite culm are fed on to the grate, which is worked by forced draught from below. Zinc sulphate solution (*d* 1.2) was used to bind the charge, which was briquetted, and recoveries of over 80% were obtained with residues and calamine. Zinc oxide discoloured with lead and cadmium is rendered white by heating with zinc sulphate at 600—720°. A deep charge is necessary. The impurities are converted into white basic sulphates. About six times the theoretical amount of zinc sulphate is required. Small proportions of lead in zinc oxide can be determined by dissolving in hydrochloric acid, adding ammonia solution, and saturating with hydrogen sulphide. The colour of the turbid solution is matched with that given by a pure zinc with known addition of lead.
C. IRWIN.

Corrosion of lead. JONES.—See X. **Potassium xanthate as fumigant.** DE ONG and TYLER.—See XVI.

PATENTS.

Manufacture of sulphuric acid in towers, chambers, and boxes. S. BARTH (G.P. 446,398, 11.7.23).—The Glover tower and a small part of the usual lead chamber are retained, whilst the greater part of the lead chamber is replaced by a series of absorption boxes through which the gases from the chamber are passed. These boxes are divided longitudinally into three long narrow compartments by means of perforated walls, and the gases are passed into the central compartment and out of the side compartments.
A. R. POWELL.

Contact sulphuric acid process. A. O. JAEGER, Assr. to SELDEN Co. (U.S.P. 1,675,308—9, 26.6.28. Appl., [A] 3.8.27, [B] 24.8.27).—Contact masses are made from (A) non-siliceous base-exchange materials, (B) zeolite mixtures, which have been combined with a catalytically active material such as vanadic acid. The absence of platinum enables the contact masses to be used in the presence of catalyst poisons.
C. HOLLINS.

Manufacture of phosphoric acid and phosphates.

I. E. WEBER, H. E. ALCOCK, and B. LAPORTE, LTD. (B.P. 295,848, 22.9.27).—Phosphoric acid made from a mineral phosphate and sulphuric acid, or the mixture containing phosphoric acid, is heated at 150–200° for some hours to destroy organic matter before the mass is worked up into the final product. W. G. CAREY.

Heat-producing composition. C. E. LYON, ASSR. to HOOKER ELECTROCHEM. CO. (U.S.P. 1,679,432, 7.8.28. Appl., 21.12.25).—Local heating without flame may be produced by addition of water to a mixture of 90 pts. of powdered sodium hydroxide and 10 pts. of anhydrous sodium aluminium chloride; addition of sodium chloride to the mixture serves to moderate the effect.

A. R. POWELL.

Preparation of colloidal metal solutions. C. MARTINESCU (G.P. 446,864, 18.2.25).—A dilute solution of a soluble salt of the metal is treated with thin aluminium foil whereby a dilute colloidal solution is obtained. This is enriched by suspending in it a more or less insoluble salt of the same metal and repeating the treatment with aluminium.

A. R. POWELL.

Production of base-exchanging substances. A. ROSENHEIM (B.P. 276,967, 21.7.27. Ger., 1.9.26. Addn. to B.P. 266,313; B., 1928, 710).—Material consisting entirely or in part of substances necessary for base-exchanging are vitrified, or, if already vitreous, are revitrified, with the addition of substances (*e.g.*, alkali carbonates, water-glass, etc.) which simplify vitrification; the vitrified portion is separated from the unvitrified and is then treated at increased pressure with solutions of substances containing the necessary base-exchanging constituents.

W. G. CAREY.

Decolorising agents. BÜTTNER-WERKE A.-G. and F. KLEINMANN (B.P. 295,623, 14.5.27).—Fuller's earth and finely-divided carbon are intimately mixed in the presence of a good wetting liquid, *e.g.*, alcohol, acetone, in a kneading machine or by heat-treatment, *e.g.*, boiling, so that the carbon particles do not separate during the decolorising process. Suitable binding agents with decolorising powers, *e.g.*, silica gel, may be added before treatment.

W. G. CAREY.

Production of acid substances used in the production of carbon dioxide. E. W. GEERE (B.P. 295,842, 9.9.27. Addn. to B.P. 276,146; B., 1927, 815).—A suitable liquid acid is added in excess to acid or other salts, which are then treated with fats, waxes, or hydrogenated oils, and finally with untreated acid salts according to the final acid strength required.

W. G. CAREY.

VIII.—GLASS; CERAMICS.

Coloured glasses. W. M. HAMPTON (J.S.C.I., 1928, 47, 192–196 r).—A general description is given of the properties and manufacture of coloured glasses. The factors controlling manufacture and the difficulties encountered are indicated. A summary of the methods of control of the colour and the effects of various colouring oxides is included.

PATENTS.

Ceramic material. F. H. RIDDLE, ASSR. to CHAMPION PORCELAIN CO. (U.S.P. 1,682,250, 28.8.28. Appl., 3.1.21).—Alumina is mixed with clay and a flux, in such amount as to give aluminium silicate on firing.

F. G. CLARKE.

Refractory ware. Ceramic material. F. H. RIDDLE, ASSR. to CHAMPION PORCELAIN CO. (U.S.P. 1,682,249 and 1,682,251, 28.8.28. Appl., [A] 29.11.20, [B] 9.9.22).—See B.P. 259,757; B., 1926, 1014.

Annealing sheet glass manufactured intermittently by means of sheet glass forming machines. SOC. ANON. DES MANUF. DES GLACES ET PROD. CHIM. DE ST. GOBAIN, CHAUNY, & CIREY (B.P. 296,282, 12.4.28. Fr., 18.2.28).

IX.—BUILDING MATERIALS.**PATENTS.**

[Brick] kilns. A. L. GELDENS (B.P. 295,867, 2.11.27).—The firebridges of the combustion chambers in a Hoffman type kiln are constructed to distribute the flames uniformly among the products being fired. Briefly, the arrangement consists of a shelf projecting away from the fire and cored with channels which act as jets to send the flames a considerable distance into the work chamber.

B. M. VENABLES.

Manufacture of hydraulic cement. DR. A. WACKER GES. F. ELEKTROCHEM. IND. G.M.B.H. (B.P. 282,458, 20.12.27. Ger., 21.12.26).—Dry calcium hydroxide obtained by making acetylene from calcium carbide with a small proportion of water is mixed with clay and the mixture is burnt.

W. G. CAREY.

Preservation of wood. W. IWANOWSKI and J. TURSKEI (B.P. 296,332, 28.4.27).—Wood is impregnated with di-, tri-, or poly-chloro-derivatives of phenol or phenoxides, or with the condensation products of these compounds with arsenic chloride, alone or in admixture with other preservatives.

L. A. COLES.

Fireproof and anti-rotting composition [for wood]. T. SHIGA (U.S.P. 1,674,802, 26.6.28. Appl., 1.11.26. Japan, 17.7.26).—Boric acid is added to ammoniacal magnesium sulphate solution, followed by acetic acid and sodium cresolate.

C. HOLLINS.

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

Gaseous cementation of iron and steel. IV. Action of mixtures of carbon monoxide and ammonia on iron and steel, and its bearing on the process of cementation. A. BRAMLEY and G. TURNER (Iron Steel Inst. Carnegie Schol. Mem., 1928, 17, 23–66; cf. B., 1927, 485, 844). V. Determination of iron-iron nitride eutectoid. Action of ammonia on steels containing different concentrations of carbon. A. BRAMLEY and F. W. HAYWOOD (*Ibid.*, 67–87).—IV. The cementation of Armeo iron by mixtures of ammonia and carbon monoxide has been studied at temperatures between 700° and 1050°. The carburising action of the mixtures is much greater than that

of carbon monoxide alone. This is regarded as due to the formation of cyanides, which were detected experimentally, and to the effect of the hydrogen, formed by decomposition of the ammonia, on the carbon monoxide-carbon dioxide equilibrium. The depth of penetration and distribution of carbon during cementation closely resembled those previously found (*loc. cit.*) for cementations under corresponding conditions with mixtures of carbon monoxide and pyridine. The distributions of nitrogen, however, resembled those previously found with mixtures of carbon monoxide and acetonitrile, the greater stability of cyanides at high temperatures accounting for the large amount of nitrogen introduced. Hence comparatively little cyanide can be formed when pyridine decomposes at high temperatures. Mixtures of carbon monoxide and hydrogen were also used, and had carburising properties greater than those of carbon monoxide alone, but less than those of the corresponding mixtures with ammonia. The addition to carbon monoxide of one fourth its volume of hydrogen greatly increases the carburisation, but further additions of hydrogen have less effect, and a stage is eventually reached at which carburisation is reduced. When cemented above 900° the specimens decrease in length, but below 900° the specimens expand on cementation. The microstructures are profoundly influenced by the presence of nitrogen, especially below 800°; above 800° marked segregation of the cementite takes place. Needles of iron nitride are only present in zones in which the concentration of nitrogen is below 0.22% and above 0.015%.

V. A cylindrical bar of Armco iron was nitrogenised by heating it in a mixture of nitrogen and ammonia. The nitrogen concentration at different depths was then determined by turning part of the specimen down in a lathe and analysing the thin concentric layers of metal thus obtained. By combining these values with measurements of photomicrographs of a section of the same specimen, the composition of the iron-iron nitride eutectoid was determined as 2.0% N. If it be assumed that the laws of Raoult and Van't Hoff can be applied to the lowering of transition points of iron by the compounds Fe_3C and Fe_3N , the temperature of the iron-iron nitride eutectoid is deduced as 608°. If steels be used in place of iron, the amount of nitride formed decreases as the initial concentration of carbon increases, and slight loss of carbon takes place. No evidence could be found for the formation of complex compounds of iron, carbon, and nitrogen. Nitrogenised steel, free from carbon, will by suitable heat-treatments give rise to all the structures of carbon steels, although with a somewhat finer texture.

In an appendix the above-mentioned analytical microscopic method was used to determine the eutectoid composition in pure carbon steels, the value found being 0.89% C. The solubility of carbon in α -ferrite is deduced as 0.04% C, but this value depends on determinations of pearlite, and it is possible that thin films of cementite may still be present in a steel containing 0.04% C.

W. HUME-ROTHERY.

Specific heat of iron below 400°. W. H. DEARDEN (Iron Steel Inst. Carnegie Schol. Mem., 1928, 17, 89–108).—The sp. heat of Swedish Lancashire iron

(0.04% C, 0.006% Si, 0.006% S, 0.069% P) has been determined over the range 16° to 400° by a modification of the vacuum calorimeter method of Schwes and Günther (cf. Nernst, "The New Heat Theorem," 1926). The sp. heat rises rapidly from 0.0852 at 17° to a maximum of 0.1942 at 108°, then falls to about 0.12 in the range 150° to 200°, and then rises again. These values are subject to a very slight correction for the energy taken up by the small heating disc, but this does not affect the relative values. The abnormal maximum sp. heat at 110–115° corresponds to other abnormalities in sonority, resistivity, mechanical properties, etc., but the nature of the change is obscure.

W. HUME-ROTHERY.

Magnetic and electrical properties of cast iron. J. H. PARTRIDGE (Iron Steel Inst. Carnegie Schol. Mem., 1928, 17, 157–190).—The effects of different metals on the magnetic and electrical properties of cast irons have been investigated. The form in which the carbon is present greatly influences the magnetic properties. Graphite does not affect the hysteresis loss, but prevents the attainment of very high magnetic induction, especially if present in the form of flakes; if present as nodular graphite a higher induction can be obtained. The effect of graphite is due to lack of magnetic continuity. A ground mass of ferrite gives low hysteresis loss and high permeability, whilst a pearlite matrix gives high hysteresis loss and low permeability. Silicon decreases the magnetic induction, remanence, coercive force, and hysteresis loss of cast iron, and, in amounts not exceeding 5%, also decreases the maximum permeability. The effect on hysteresis loss is particularly marked, and alloys with a very low hysteresis loss can be cast. On annealing, the magnetic effects are complex according to the structure produced, but silicon increases the electrical resistance in both cast and annealed conditions. Cobalt increases the induction, remanent magnetisation, and permeability of cast iron, but has little effect on the coercive force and hysteresis loss, which remain high. Annealing increases the permeability, and decreases the hysteresis loss, coercive force, and remanent magnetism. Cobalt decreases the electrical resistance in the cast state, but the results for annealed specimens are erratic. Nickel decreases the permeability to such an extent that cast irons containing 15% Ni are practically non-magnetic. Nickel, and also aluminium, increases the electrical resistance of cast iron. Blackheart malleable iron possesses a high induction and permeability, with low hysteresis loss and coercive force; this is because nearly all the carbon exists as small islands of graphite in a ferrite matrix. Whiteheart malleable iron has a lower permeability and induction than blackheart, but the permeability is still greater than that of a mild steel. It is concluded that by using a suitable composition cast iron could in many cases be used in place of steel in the electrical industry, whilst the high electrical resistance is an additional advantage where it is desired to reduce eddy currents.

W. HUME-ROTHERY.

Apparatus for determination of sulphur in iron and steel. M. H. STEINMETZ (Ind. Eng. Chem., 1928, 20, 983).—In order to prevent too large a quantity

of hydrochloric acid and steam from distilling over into the absorption flask when determining sulphur in steel by the evolution method, the dissolution flask is fitted with a glass condenser by means of a sulphur-free rubber stopper. The condenser is provided with a central sealed-in tube with thistle funnel for adding the acid to the steel.

A. R. POWELL.

Precipitation method for determination of vanadium, and its application to steel analysis. B. S. EVANS and S. G. CLARKE (*Analyst*, 1928, **53**, 475—486).—To 5 g. of steel are added 80 c.c. of dilute sulphuric acid (1:7) and dissolution is effected, as far as possible, by heating, after which nitric acid is added to clear the solution, followed by 70 c.c. of citric acid (100 g. in 200 c.c.) and sufficient hot concentrated sodium carbonate solution to render neutral or only faintly alkaline. Any tungstic oxide will then be in solution, and if nickel be present this must be separated by means of dimethylglyoxime (1 g. in hot alcohol). After filtering, 25 g. of sodium sulphite crystals are added, followed by 40—45 g. of commercial potassium cyanide dissolved in 100 c.c. of water. After shaking, the liquid is warmed for 10 min., boiled for 5 min., and the solution tested to make sure the iron is all present as ferrocyanide. Dilute sulphuric acid (1:3) is added to bring to neutral point (litmus), and the solution is shaken, set aside for at least 2 hrs. for the vanadium to settle out, and filtered through a "free-running" pulp filter, the precipitate being washed with 2% ammonium nitrate solution. Filter pulp and precipitate are ashed, fused with 1 pt. of sodium phosphate and 5 pts. of fusion mixture, and the melt is extracted with hot water, filtered, washed with dilute sodium sulphate solution, and the filtrate acidified with sulphuric acid, and boiled with a few drops of a saturated solution of potassium permanganate, and then boiled again for 20 min. after addition of 20 c.c. of saturated sulphur dioxide solution. Finally the liquid is titrated with 0.1*N*-potassium permanganate at 80°. No metals except nickel interfere with this process and accuracy to the limit of the permanganate titration is obtained, i.e., to about 0.1% of vanadium on a 5 g. sample. In the case of small amounts of vanadium the hydrogen peroxide method is used with a colorimetric process, but it is necessary to modify the procedure slightly, particularly in the removal of the molybdenum, the bleaching of any colour due to titanium, and the precipitation of the vanadium by cupferron if chromium interferes with the colour.

D. G. HEWER.

Natural rusting tests with cupriferous steel. K. DAEVES (*Stahl u. Eisen*, 1928, **48**, 1170—1171).—Atmospheric rusting tests over a period of 21 months with a steel containing 0.03% Cu and with one containing 0.23% Cu showed the marked superiority of the latter. Ungalvanised wires of the former lost 23% and of the latter 16% in weight; the loss in weight with galvanised wires was 12% and 7%, respectively. The zinc coating of the copper-steel remained unperforated by rust for a much longer period than that of the same steel without copper, and the tendency to pit and scale was much less with the copper-steel.

A. R. POWELL.

WITTNEBEN (*Z. Metallk.*, 1928, **20**, 316—322).—As is the case with soft iron and copper, the curve showing the minimum temperature of recrystallisation against the minimum deformation required to cause recrystallisation to take place is a hyperbola for α -brass. The minimum temperature below which no amount of work will cause recrystallisation in α -brass increases with an increase in the zinc content from 265° with 10% Zn to 330° with 32% Zn. The axes of reference of the hyperbolæ showing the grain-growth against the time of annealing coincide with the co-ordinate axes for 500°, 550°, and 700°, but for 850° the abscissæ axis is displaced towards higher temperatures. The grain size after recrystallisation is independent of the original grain size and depends only on the time, temperature, and degree of deformation. The rate of recrystallisation of brass containing 90% Cu changes with the temperature according to the exponential curve $V = 1.0134^t - 2.65$. An increase in the zinc content also accelerates recrystallisation at temperatures above 350°.

A. R. POWELL.

Corrosion of chemical lead. D. W. JONES (*J.S.C.I.*, 1928, **47**, 161—167 T).—Antimony is regarded as a very injurious impurity, and copper is one of the few metals which can practically be introduced into lead with any hope of beneficial results. Chemical lead is examined by immersion in either plain sulphuric acid (*d* 1.72) or nitrous vitriol (2.5% N_2O_3) of *d* 1.72. The general behaviour and loss in weight are recorded. Lead sulphate has an important bearing on corrosion, and the method can give a value to this form of protection. Addition of 0.027% Cu to lead containing 0.008% Bi has the effect of correcting a loss. In plain sulphuric acid pure lead can show a "protective coating value" of over 100%. A second immersion of pure lead after cleaning and exposing a fresh surface had the effect of reducing corrosion losses, possibly due to a state of passivity, or a measure of passivity, having been brought about in the lead. When nitric or nitrous acid is involved, a great decline is shown in the figure which represents the "protective coating value"; the average for all leads in plain acid was 70, whereas in nitrous vitriol it was only 3. Of the four leads which lost most by corrosion, three contained copper, whilst the fourth, a pure lead, failed to pass the "flash" test. There was no evidence to prove that selective action had proceeded with respect to the dissolution of copper in any lead. Over longer periods the "protective coating value" of coppered lead in plain sulphuric acid can exceed 100%, and this type of lead resists plain sulphuric acid at atmospheric temperature rather better than pure lead. The latter over long periods of immersion resists corrosion in nitrous vitriol to a greater degree than a coppered lead. A high standard of purity in lead (99.99%) is essential—except for copper, which is permitted in some cases to the maximum extent of 0.05%. Casting previous to rolling sheet must be conducted so that no "cold setting" takes place, and there must be no excessive shrinkage in the cast block which would show cleavage of lead crystals at those places which solidify last of all. Too much reliance is sometimes placed on the self-annealing characteristic of lead, with the result that it may be subjected to excessive working.

Rupture has been brought about by severely straining cold-worked lead. Aspects of corrosion related to users of chemical lead are: (1) Pitting, which is attributed in some cases to a too liberal use of nitre. (2) The necessity of properly supporting lead wherever applied because under stress or strain with or without the aid of a corrosive agent intercrystalline failure is induced. A grave danger lies in the introduction of copper to mask a fault, and uniformity in the final product may be lacking.

Aluminium and its alloys in the chemical and allied industries. J. DORNAUF (Z. angew. Chem., 1928, 41, 993—1001).—Results of corrosion experiments with pure aluminium and with its alloys together with a consideration of their physical properties and micro-structure are recorded. The value of the alloy "silumin" is emphasised. A *précis* is presented of data concerning the corrosion of a large number of aluminium articles of industrial use.

A. G. POLLARD.

Corrosion of aluminium conductor wires. H. BOHNER (Z. Metallk., 1928, 20, 309—315).—As a result of an investigation into the causes of various corrosion phenomena which may occur in aluminium conductor wires, the conclusion is reached that failure may be ascribed to four main causes, viz., the presence of too much impurity or the segregation of impurities due to incorrect heat-treatment, careless work in the wire-shops involving the introduction of foreign metals into the wire or "lapping," incorrect methods of suspending the wires, and, finally, changes in the structure of the wires due to lightning or short-circuits. To avoid these troubles it is recommended to use 99.5% aluminium; before drawing, the forged castings should be annealed just below the solidus point to obtain complete solid solutions of the impurities and then quenched. During drawing, the wire must be annealed below 200°, and, after drawing, for 7—20 hrs. at 175°. A. R. POWELL.

Hardness and its relation to the cold-working and machining properties of metals. II. H. O'NEILL (Iron Steel Inst. Carnegie Schol. Mem., 1928, 17, 109—156; cf. B., 1927, 490).—The construction of a sclerometer suitable for use with both hard and soft metals is described. In this the scratch is made by a 1 mm. hemispherical diamond, the surface of the specimen being tilted at an angle of 7° so that the scratch is made downhill. The load is applied by means of weights. Tests made with this instrument on single crystals of iron and on polycrystalline iron and steels are described. The mean pressure hardness values obtained are of the same order as those given by the Brinell test, and the method is suitable for the study of directional hardness in single crystals. If the orientation of an unstrained body-centred or face-centred cubic crystal be determined by making pressure figures, the scratch hardness is greatest in the direction parallel to the lobes of the pressure figure. The effect of straining large crystals has been studied. The relations between the various hardness tests and the "machinability" of metals are discussed. No hardness test alone is able to place metals in the order of their machinability; the micro-structure and other factors have always to be considered.

But the Brinell value H_n (the Brinell number corresponding to the load which gives an indentation of the same diameter as the indenting ball) gives a much better indication of the machinability than the ordinary Brinell number. The relations between indentation, scratch, tensile, and compression tests are discussed. There is a similarity between the curves connecting true stress with some function of strain irrespective of the method by which deformation is caused. The phenomena are correlated under the title "pressure of fluidity" introduced by Ackerman (Trans. Soc. Engineers, 1923, 25). The historical development of the term "hardness" and hardness testing is summarised; both elastic and plastic deformation should be measured, and an instrument for this purpose is described.

W. HUME-ROTHERY.

Ludwig-Soret effect in metallic alloys. M. BALLAY (Rev. Mét., 1928, 25, 427—454).—The Ludwig-Soret effect has been measured in binary liquid alloys of tin with lead, copper, cadmium, and zinc by heating in vertical and horizontal silica tubes, the temperature difference being of the order of 500°. The effect is the greater the larger is the temperature gradient. About 150 hrs. heating was required to reach equilibrium. In horizontal tubes no differences in composition are produced unless precautions are taken to avoid convection, by making a constriction at the centre of the tube. The effects then observed are small, and may be in the reverse sense to those obtained in vertical tubes. Solid alloys of lead with tin and with thallium, when treated similarly, showed only very small effects. A wire of platinum-rhodium alloy showed a distinct effect after heating over a Méker burner for 55 days.

C. W. GIBBY.

Determination of copper in molybdenite. M. G. RØEDER (Tidssk. Kjemi Bergvesen, 1928, 8, 91—93).—1 g. of molybdenite concentrates (which should not contain less than 0.02 g. Cu) is dissolved at a gentle heat in 25 c.c. of nitric acid (3:1) and 6—7 c.c. of concentrated sulphuric acid, and the liquid evaporated to strong fuming. The residue is boiled with 100 c.c. of water, and, after filtering, the filtrate is diluted to 200—300 c.c. and heated to boiling. N-Sodium thio-sulphate is added from a burette until the deep blue solution shows a turbidity due to separated sulphur. After again boiling, the liquid is filtered and the precipitate washed with water containing sulphur dioxide until the filtrate is colourless. The paper and precipitate are ignited, and the copper in the residue is determined by titration with 0.02N-sodium thiosulphate. The above method yields accurate results, and is quicker than the usual separation with thiocyanate. H. F. HARWOOD.

Trend of engineering developments in steel. B. D. SAKLATWALLA (J.S.C.I., 1928, 47, 198—202, 210—212 t).

Production and uses of beryllium. K. ILLIG (Trans. Amer. Electrochem. Soc., 1928, 54, Advance copy, 211—222).

Preservation of metals. BORODULIN.—See II. **Corrosion of copper by milk.** QUAM and others.—See XIX.

PATENTS.

Cupola with forehearth. H. LUYKEN (U.S.P. 1,681,043, 14.8.28. Appl., 26.2.24. Ger., 5.3.23).—The lower end of the cupola is connected with the upper part of the forehearth through a vertical channel with two horizontal channels of small cross-section on opposite sides thereof, so as to damp momentary fluctuations of the level of the metal in the shaft.

A. R. POWELL.

Open-hearth furnace. A. T. KELLER, ASSR. to BETHLEHEM STEEL CO. (U.S.P. 1,682,378, 28.8.28. Appl., 5.12.21).—An end construction for open-hearth steel furnaces comprises a series of air-gas channels with horizontal air and gas ports terminating near the end of the combustion chamber, a separate port for waste gases, and means for closing the terminal ends of the air and gas ports to protect them from the hot flue gases.

A. R. POWELL.

Regenerative open-hearth furnaces. S. J. CORT, T. BURNS, R. S. A. DOUGHERTY, and C. E. LEHR (U.S.P. 1,680,365, 14.8.28. Appl., 24.9.25).—A system of buckstaves and beams provided with water-cooling is described.

B. M. VENABLES.

Smelting furnace. J. A. LANIGAN (U.S.P. 1,682,343, 28.8.28. Appl., 15.8.27).—The furnace comprises a cupola shaft with fuel door above the tuyères and a sloping bottom communicating with the hearths of a reverberatory furnace, which is heated from the usual firebridge and from inclined tuyères in the roof, one of which is directed over the communicating channel between the shaft and hearths.

A. R. POWELL.

Apparatus [furnace] for smelting. H. W. HALL, ASSR. to AMER. SMELTING & REFINING CO. (U.S.P. 1,681,535, 21.8.28. Appl., 30.7.25).—A furnace of the reverberatory type is provided with feed openings on each side in which rotating cylinders provided with shovelling devices are operated in such a manner that the charge is continuously fed to the furnace at the top and forms an inclined heap in the furnace, which closes the charging opening.

A. R. POWELL.

Rotary drum furnace for roasting sulphur-containing ores and the like. METALLBANK & METALLURGISCHE GES. A.-G. (B.P. 284,731, 4.2.28. Ger., 4.2.27).—A rotary drum furnace is provided with a number of vertical partitions, with central apertures, dividing the furnace into a number of compartments. Lifters are provided on the cylindrical wall, also projections, guide members, etc. to break up the material as it is showered. Transfer of the material through the central apertures is effected by inclined guide members supported on a fixed hollow shaft projecting through the end closures of the furnace. The hollow shaft serves also to introduce the air for roasting; the inclined guides are adjustable to vary the rate of transfer of the material. The partition walls may be secured either to the rotating part of the furnace or to the fixed hollow shaft.

B. M. VENABLES.

Furnace for treating metal. W. E. WATKINS, ASSR. to COPPER PLATE, SHEET & TUBE CO. (U.S.P. 1,679,389, 7.8.28. Appl., 25.6.27).—The furnace consists of a long horizontal chamber with a horizontal dividing wall at the front end to divide this part into a

lower combustion chamber and an upper preheating zone.

A. R. POWELL.

Apparatus for reclaiming [easily oxidisable] metals [from dross]. T. D. STAY and C. O. TESSIER, ASSRS. to ALUMINUM CO. OF AMERICA (U.S.P. 1,679,385, 7.8.28. Appl., 20.10.25. Cf. U.S.P. 1,630,361; B., 1927, 528).—The dross is heated just above the m.p. of the metal in a crucible provided with a rotating propeller so shaped as to cause the dross to rise to the surface while the liberated metal is thrown against the walls of the crucible. The dross is discharged on to a vibrating screen from which it passes through a launder in which the liberated metal is agglomerated and rapidly solidified. Finally, a second vibrating screen separates the coarser particles of metal from the finely-divided oxide dust.

A. R. POWELL.

Liquid treatment [quenching] of roasted ores. M. E. BRANTHAVER, ASSR. to AMER. MILLING & REFINING CO. (U.S.P. 1,681,696, 21.8.28. Appl., 10.5.24).—The roasting furnace is provided with a water-sealed discharging duct which delivers the hot ore to the quenching pit without permitting access of air.

A. R. POWELL.

Flotation process. D., M., S. R., and S. GUGGENHEIM, J. K. MACGOWAN, and E. A. C. SMITH (GUGGENHEIM BROS.), ASSEES. of A. H. FISCHER (B.P. 296,270, 5.3.28. U.S., 29.12.27).—Ethyl xanthylformate, $\text{EtO} \cdot \text{CS} \cdot \text{S} \cdot \text{CO}_2\text{Et}$, m.p. -36.5° , obtained from ethyl chloroformate and potassium xanthate, is used as collecting agent in conjunction with a frothing agent (cresylic acid, pine oil, etc.) in ore flotation processes. [Stat. ref.]

C. HOLLINS.

Manufacture of wrought iron. H. WADE. From INTERNAT. NICKEL CO. (B.P. 295,857, 11.10.27).—An alloy of iron with 0.25–5% Ni, 0.08% C, and 0–1% Cu, Cr, or Mo is claimed. [Stat. ref.]

A. R. POWELL.

Alkali or alkaline-earth fluxes for deoxidation of iron and steel. MANNESMANNRÖHREN-WERKE (G.P. 448,510, 29.11.24).—The use of one or more alkali or alkaline-earth salts of boric, tungstic, or titanous acids, together with a flux, such as soda-lime glass or analcime, and a deoxidiser is claimed.

A. R. POWELL.

Production of a rust-preventing layer on iron and steel. W. SCHMIDTING (G.P. 448,009, 1.6.26).—The surface of the metal is treated with a solution of phosphoric acid, hydrogen peroxide, and potassium chlorate.

A. R. POWELL.

Manufacture of metal-coated sheets and plates. J. MCFETRIDGE, ASSR. to AMER. SHEET & TIN PLATE CO. (U.S.P. 1,679,435, 7.8.28. Appl., 17.1.27).—Sheets of iron or steel for galvanising or tinning are transferred directly from the hot acid pickling bath to a bath containing a cold solution of suitable inorganic salts which act as fluxes in the subsequent galvanising or tinning operation.

A. R. POWELL.

Plating of metal. [Coating iron articles with copper.] W. E. WATKINS (B.P. 282,624, 5.7.27. U.S., 24.12.26).—The articles are coated with a suspension of finely-divided copper or copper oxide and carbon in a hydrocarbon oil with asphaltic base, then

heated in a tunnel kiln with a neutral atmosphere so that the products of combustion encircle the articles. The articles are thereby coated with a bright deposit of copper below a layer of iron oxide which is subsequently removed by pickling. [Stat. ref.] A. R. POWELL.

Additional material for ferrous metals. P. D. MERICA and T. H. WICKENDEN, ASSTS. to INTERNAT. NICKEL Co. (U.S.P. 1,680,058 and 1,680,161, 7.8.28. Appl., [A] 28.4.25, [B] 10.3.24).—(A) The properties of cast iron and other ferrous alloys are improved by the addition of chromium, manganese, tungsten, copper, or molybdenum, together with an alloy of nickel with sufficient carbon and silicon to reduce its m.p. to that of the remainder of the alloy. (B) About 5% of nickel containing 0.25–2.5% C and 1–10% Si is added to molten cast iron just prior to casting.

A. R. POWELL.

Treatment of alloy steel. A. C. DAVIDSON, ASST. to D. Co., INC. (U.S.P. 1,680,937, 14.8.28. Appl., 28.10.19).—A mixture of iron, chromium, and tungsten in the desired proportions is melted, deoxidised under a layer of fluxes, treated with cobalt, again deoxidised, treated with vanadium in quantity not exceeding a 50% excess over the amount desired in the final alloy, and cast above 1750°.

A. R. POWELL.

Recovering copper from its ores. A. ELLIOTT (U.S.P. 1,681,528, 21.8.28. Appl., 17.3.24. Renewed 23.6.27).—Copper ores are leached with ferrous sulphate solution in a vessel through which a finely-divided stream of compressed air is passed.

A. R. POWELL.

[Nickel-copper] alloys. CANAD. GEN. ELECTRIC Co., LTD., ASSEES. of E. T. ASP (Can. P. 266,292, 2.3.25).—Copper-nickel alloys containing at least 50% Ni, 0.5–5% Al, and 0.1–1% Mg are claimed. The alloys are non-magnetic, work easily, and have a higher electrical resistance than similar alloys without the aluminium.

A. R. POWELL.

Treating copper alloys [brass and Muntz metal]. V. O. HOMERBERG and D. N. SHAW (U.S.P. 1,680,045—6, 7.8.28. Appl., [A] 28.1.26, [B] 30.1.24).—(A) Copper alloys, the composition of which falls within that portion of the temperature-composition diagram of the series which resembles the portion of the copper-zinc diagram in which 60:40 brass is found, are heated to such a temperature that a single solid solution is formed, quenched, aged at a temperature at which a constituent separates from this solution in a finely-divided form, and cooled at a rate which maintains this structure at the ordinary temperature. (B) Muntz metal is heat-treated as described above and aged at 250° to obtain a tensile strength of over 75,000 lb./in.² and a Brinell hardness of over 200.

A. R. POWELL.

Vertical zinc retort. F. G. BREYER and E. H. BUNCE, ASSTS. to NEW JERSEY ZINC Co. (U.S.P. 1,680,726, 14.8.28. Appl., 5.3.27).—An externally heated vertical reducing chamber for the distillation of zinc from its oxide is supported and tied in at its lower end only, and built up from refractory bricks to make a vapour-tight chamber.

A. R. POWELL.

Recovery of zinc from fine zinc ores etc. METALLBANK U. METALLURGISCHE GES. A.-G. (G.P. 448,598, 7.2.26.

Addn. to G.P. 421,384; B., 1926, 412).—The desulphurised and sintered ore is smelted together with the necessary carbonaceous material in a zinc furnace with vertical retorts.

A. R. POWELL.

Treatment of lead-zinc ores containing iron and manganese. E. LANGGUTH (G.P. 448,150, 7.7.25).—The ore is introduced into a fused mass of zinc chloride and alkali chloride, and when the reaction is completed the greater part of the lead is precipitated by addition of zinc. The salt mixture is then dissolved in water and the solution after addition of zinc oxide is electrolysed, whereby the iron and manganese are precipitated as oxides on the anode and the remaining lead together with some zinc is deposited as a sponge on the cathode. This sponge is utilised for the removal of lead from further quantities of the fused salts.

A. R. POWELL.

Fuel-heated furnace and converter [for nickel matte] using preheated air. O. LELLEP, ASST. to INTERNAT. NICKEL Co. (U.S.P. 1,680,155, 7.8.28. Appl., 29.10.23).—A converter comprises a rectangular furnace for the molten matte above which is a cylindrical feeding chamber charged with roughly crushed matte and fluxes. A blast of air is blown into the lower chamber, where it is preheated, and passes upwards through the feeding chamber, thereby melting its charge, which falls through to the furnace chamber for further treatment.

A. R. POWELL.

Metallurgy of ores or materials containing tin and extraction of metals or metal products therefrom. E. A. ASHCROFT (B.P. 295,805, 7.7.27).—The ore or concentrate is heated at 700–900° with nickel pellets or nickel oxide and a reducing agent, such as carbon or sponge iron, together with a small quantity of zinc, iron, or ammonium chloride to act as catalyst or carrier. The tin is reduced to metal, which is carried in the form of chloride to the iron and nickel particles, with which it alloys, and the resulting iron-nickel-tin alloy is separated by means of an electromagnet. The tin is recovered from the alloy by electrolysis or by chemical means.

A. R. POWELL.

Aluminium alloys. R. SELZ (B.P. 266,720, 22.2.27. Ger., 27.2.26).—An alloy of aluminium with at least 18% of zinc is treated with 2% of a hardener made by melting 90 pts. of copper with 5 pts. of nickel under a flux of potassium fluoride and adding 5 pts. of magnesium.

A. R. POWELL.

Bearing-metal alloys. T. GOLDSCHMIDT A.-G. (B.P. 266,696, 9.2.27. Ger., 25.2.26).—The alloys comprise eutectic mixtures of aluminium with one or more of the following: silicon, copper, nickel, cerium, calcium, barium, strontium, or magnesium silicide, hardened with small quantities of lithium, magnesium silicide, or lithium silicide. Also there may be added titanium, vanadium, molybdenum, tungsten, chromium, iron, manganese, or boron. [Stat. ref.]

A. R. POWELL.

Improving the mechanical properties of heavy metals [nickel, cobalt, and lead] or their alloys. L. MELLERSH-JACKSON. FROM SIEMENS & HALSKE A.-G. (B.P. 295,971, 21.5.27).—The tensile strength and hardness of nickel, cobalt, lead, or nickel-copper alloys with more than 10% Ni are considerably increased by

the addition of 0.1–15% of beryllium together with small quantities of magnesium, tin, zinc, antimony, aluminium, cadmium, carbon, or silicon. The worked alloys are annealed at 600–900°, quenched, and aged at 150–600°. A suitable nickel alloy contains 92.5% Ni, 2% Be, 5% Si, and 0.5% C. Addition of 0.2% Be increases the strength of lead by 100% without heat-treatment.

A. R. POWELL.

Manufacture of molybdenum alloying compounds. E. A. LUCAS, Assr. to MOLYBDENUM CORP. OF AMERICA (U.S.P. 1,681,123—4, 14.8.28. Appl., 30.12.24).—(A) A composition for use in preparing molybdenum alloys comprises a fused mass of molybdenum trioxide and lower oxides with a basic oxide as a flux. (B) Molybdenite is roasted to expel sulphur and the product is fused with a reducing agent, a flux, and lime to form a coherent fused mass containing a calcium molybdenum silicate.

A. R. POWELL.

Coloration of metal surfaces. K. BARANOWSKI (B.P. 295,889, 21.12.27).—The articles are pickled, subjected to the action of a suitable current in an electrolytic bath to give a granular metal surface, sprinkled with colouring solutions or pastes, and heated in a more or less oxidising flame.

A. R. POWELL.

Manufacture of metal sheets and articles with radioactive properties. C. BALLIN (G.P. 448,160, 16.8.25).—Radioactive oxides are melted at a high temperature with iron, aluminium, copper, brass, or tin, and the products are rolled into sheets; e.g., 40 g. of uranium oxide are melted with 60 g. of tin, and the cast product is rolled.

A. R. POWELL.

Radioactive material. A. FISCHER (B.P. 285,467, 22.9.27. Austr., 19.2.27. Addn. to B.P. 278,347; B., 1928, 489).—Radioactive substances, e.g., radium salts, are introduced into short narrow platinum tubes, sealed at one end, the tube is then fused, welded, or soldered to close it above the substance introduced, and finally the container so produced is heated to bright redness whereby the radioactive metal enters into solid solution in the platinum.

A. R. POWELL.

Etching process [for metals] with electrolytically produced protective films. J. RIEDER (G.P. 448,554, 9.10.25).—The design is produced on the plate in the usual way, and the parts which are not to be etched are provided with a protective film of lead dioxide or manganese dioxide by anodic electrolysis. The design is then etched and the protective film removed by cathodic electrolysis in a strongly alkaline electrolyte.

A. R. POWELL.

Magnetic [chromium-iron] alloys. W. S. SMITH, H. T. GARNETT, and J. A. HOLDEN (B.P. 296,137, 30.4.27).—Alloys of high permeability for loading telephone conductors consist of iron with 1–10% Cr, 1–4% Al, and 0–1% Mn and/or Si. Part or all of the chromium may be replaced by molybdenum. High permeability is obtained by annealing at 900–1020° in an inert atmosphere and cooling slowly.

A. R. POWELL.

Production of metals in electric furnaces. E. G. T. GUSTAFSSON (B.P. 278,005, 26.9.27. Swed., 27.9.26).—During the main part of the operation of smelting a metalliferous charge, the current supply to the furnace

is adjusted to correspond to a combined arc and slag resistance not less than 0.020 ohm per electrode.

J. S. G. THOMAS.

[Roller] method of plating iron and other metals in the form of sheets or strips. F. JORDAN (B.P. 296,474, 1.6.27).

Magnetic core (G.P. 447,243).—See XI.

XI.—ELECTROTECHNICS.

Electrification in dust clouds. BLACKTIN.—See II.
Properties of cast iron. PARTRIDGE. **Corrosion of aluminium wires.** BOHNER.—See X.

PATENTS.

Electric induction furnaces. E. F. NORTHRUP (B.P. 296,464, 30.5.27).—In plant comprising a number of induction furnaces in parallel, individual power-factor means connected with the respective inductor coils and means for connecting power supply to the inductor coils of the various furnaces over a different set of turns from these rectifying devices are provided.

J. S. G. THOMAS.

Induction furnace. R. B. LINCOLN, Assr. to WESTINGHOUSE ELECTRIC & MANUF. CO. (U.S.P. 1,682,388, 28.8.28. Appl., 21.3.27).—The furnace comprises a helically-wound, water-cooled coil in which a crucible is nested, the whole being embedded in refractory material in a metal casing within which is a ferromagnetic device to prevent induction of heating currents in the casing.

A. R. POWELL.

Electric battery cell. H. KÖHNE and W. SUHRCKE (B.P. 296,184, 28.7.27).—In a cell of the Bunsen type, the positive electrode consists of a carbon rod supported within a glass, casein, or porcelain cylinder closed below by a carbon bottom and containing acid. The negative electrode of zinc or zinc-lead alloy is coated with a perforated sleeve.

J. S. G. THOMAS.

[Photo-sensitive surface for] photo-electric cells and other electric discharge devices. WESTINGHOUSE ELECTRIC & MANUF. CO., Assees. of V. K. ZWORYKIN (B.P. 291,763, 2.6.28. U.S., 8.6.27).—The active surface comprises superposed layers of different materials, the whole being transparent to light. Thus a thin film of alkali metal may be deposited upon a film of a more stable metal, e.g., tungsten or molybdenum.

J. S. G. THOMAS.

Making of electric conductors. J. V. CAPICOTTO, Assr. to DUBILIER CONDENSER CORP. (U.S.P. 1,683,064, 4.9.28. Appl., 27.2.24).—The conductor comprises an intimate mixture of finely-divided platinum and iridium containing also barium and strontium. F. G. CROSSE.

Welding electrodes. O. Y. IMRAY. From E.M.F. ELECTRIC CO. PROPRIETARY, LTD. (B.P. 296,509, 28.6.27).—A metallic core is coated with a hydrated silicate, e.g., china clay, and a carbonaceous material, e.g., vegetable black, so that hydrogen is produced by decomposition of water liberated from the hydrated silicate when the electrode is in use, and protects the fused metal of the weld against oxidation. [Stat. ref.]

J. S. G. THOMAS.

Manufacture of a magnetic core material. DEUTSCH-LUXEMBURGISCHE BERGWERKS- u. HÜTTEN-A.-G.,

and A. SCHNEIDER (G.P. 447,243, 8.6.23).—Hammer or rolling scale is pulverised and reduced to metal in a current of hydrogen. The iron powder so obtained is mixed with an insulating substance and the mixture pressed into cores. A. R. POWELL.

Electric arc lamp. I. J. LAVOISIER, ASSE. to BURDICK CORP. (U.S.P. 1,682,847, 4.9.28. Appl., 1.10.24).—The lamp contains an arc electrode comprising a dehydrated and glazed mixture of zirconia and yttria.

F. G. CROSSE.

Chromium plating bath. ELEKTRO-CHROM-GES. M.B.H. (G.P. 448,526, 22.7.24).—A solution of chromium trioxide containing other acids in amount not exceeding 1.2% of the weight of chromium trioxide present is reduced cathodically in such a way that no metal is deposited. A. R. POWELL.

Pyro-electrical separation of finely-divided materials. G. A. OVERSTROM (U.S.P. 1,679,739 and 1,679,740, 7.8.28. Appl., [A] 24.11.25, [B] 23.11.26).—(A) Electrical separation of powdered materials is effected without external electricity, the materials being heated so that one constituent becomes more pyro-electric than another; the constituents separate as they pass over and fall off a surface. (B) A mixture of sand and mica is heated as above and allowed to slip over a glass surface. B. M. VENABLES.

[Control of temperature in] electric annealing resistance furnace. A.-G. BROWN, BOVERI & CO., (B.P. 278,352, 23.9.27. Ger., 30.9.26).

Gas-filled electric incandescence lamps [with concentrated filaments]. N. V. PHILIPS' GLOEILAMP-ENFABR. (B.P. 287,563, 19.3.28. Holl., 25.3.27).

Water-cooled mercury vapour arc lamps. A. K. CROAD. From HANOVIA CHEM. & MANUF. CO. (B.P. 296,527, 27.7.27).

Chromium plating [of recessed articles]. J. C. PATTEN (B.P. 282,337, 27.5.27. U.S., 20.10.26).

Temperature of gases (B.P. 274,440). **Purification of gases** (G.P. 446,862).—See I. **Treatment of lead-zinc ores** (G.P. 448,150). **Colouring metal surfaces** (B.P. 295,889). **Radioactive metal sheets etc.** (G.P. 448,160). **Etching process** (G.P. 448,554). **Magnetic alloys** (B.P. 296,137). **Production of metals** (B.P. 278,005).—See X. **Irradiation of liquids** (B.P. 279,902).—See XIX.

XII.—FATS; OILS; WAXES.

Component glycerides of coconut and palm-kernel fats. G. COLLIN and T. P. HILDITCH (J.S.C.I., 1928, 47, 261—269 T).—Oxidation of these fats by potassium permanganate in acetone solution according to the method of Hilditch and Lea (A., 1928, 152), together with fractionation analyses of the methyl esters of the fatty acids in the original fat and in the neutral product of oxidation (fully-saturated glycerides), leads to information of a partially quantitative nature as to the structure of the glyceride mixtures present. Coconut fat was found to contain 84%, and palm-kernel fat 63%, of fully-saturated glycerides. From the saponification equivalents of the latter and of the

original fats, and knowing the original content of unsaturated acids (8 and 18%, respectively, in coconut and palm-kernel fatty acids), it was found that in each, in the mixed saturated-unsaturated glycerides, one equivalent of unsaturated acid was present along with 1.3—1.4 equiv. of saturated fatty acids; this figure was confirmed by the results of the detailed methyl ester analyses. The proportions of the individual saturated acids in the mixed saturated-unsaturated glycerides have at present to be estimated by comparison of the amounts present in the original fat and in the fully-saturated glycerides. Since the amounts of several of the acids are relatively small, the small differences then obtained tend to make the data in question less accurate than when substantial proportions are present. The definite results obtained are as follows:—(i) Throughout both fats the fatty acids are distributed in the glycerides in a remarkably even manner, and no evidence has been obtained of the presence of any simple triglyceride, such as trilaurin or triolein. (ii) The unsaturated acids, as stated, are linked with 1.3—1.4 equiv. of saturated acids in both fats; since no triolein is apparently present, this corresponds with a mixture of about 3 equiv. of mono-oleo-disaturated glycerides with 1 equiv. of dioleomonosaturated glycerides. (iii) Subject to a few minor exceptions, the composition of the saturated fatty acids is of much the same order in both the fully-saturated and mixed saturated-unsaturated portions of the fats. (iv) Fractional crystallisation of the fully-saturated glycerides did not yield any one individual component, but the partial separation effected indicated that the most sparingly soluble components (judged from their equivalents and m.p.) were of the nature of dilauro-myristin, laurodimyristin, dilauropalmitin, lauromyristopalmitin, etc. (v) Practically the only difference between the two fats (apart, of course, from their differing content of oleic acid and the equally characteristic contents of their various saturated acids) was that, whilst but little palmitic acid was found in the mixed saturated-unsaturated glycerides of coconut fat, this acid was present in relatively large amount in the corresponding glycerides of palm-kernel fat. Less certain differences were observed in the distribution of caprylic and capric acids in these fractions, capric acid appearing to be absent from the unsaturated glycerides of coconut oil. The results of the investigation were compared with those obtained by Bömer (cf. B., 1924, 478) who adopted an entirely different procedure, namely, intensive fractional crystallisation of the two fats, and the conclusions arrived at by both methods appear on the whole to be compatible.

Tests for incipient rancidity of fats. W. L. DAVIES (J.S.C.I., 1928, 47, 185—187 T).—A survey of the more important tests for following the course of autocatalytic oxidation of fats is given and the drawbacks of the Kreis test are dealt with. A test to forecast the keeping qualities of batches of fats is described. Equal weights of fat are emulsified in 10 c.c. of diluted separated milk containing 1 c.c. of 0.25% methylene-blue, and the blue colour is bleached by the "reductase" of the milk by incubating at 37—40°. When bleached, the tubes are shaken for 15 sec. and kept for 2 min. before the intensity of the blue colour restored is noted. The

restoration of the blue colour compares with the oxidation intensity in the fats. The test was carried out on a large number of fats of known history and keeping qualities, and the restoration of colour corresponded accurately with the keeping qualities of the fats. The test was particularly applicable to detecting metallic contamination and comparing the catalytic activity of metals in oxidising fats. The test was also applied to study the state of oxidation of individual fats, and was found more reliable and less cumbersome than some of the other tests tried.

Luminescence of oils and fats. A. VAN RAALE (Chem. Weekblad, 1928, 25, 544—546).—The appearance after refining of luminescence in fats and oils which show no luminescence in the crude condition is shown to be due to the removal by the refining process of some constituent which inhibits luminescence. It is found that this "anti-luminescent" constituent is removed by treatment of the oil or fat with fuller's earth, or with warm benzoyl peroxide, but not with cold benzoyl peroxide or norite. It is suggested that this constituent is a vitamin, and experiments in support of this view are described. S. I. LEVY.

Rapid determination of fatty acids in soap. N. SPASSKI (Masloboino-Shirowoje Djelo, 1926, [12], 33—34; Chem. Zentr., 1927, II, 1908).—An aqueous solution of the soap is acidified with hydrochloric or sulphuric acid, and the liberated fatty acids are extracted with ether. The ethereal solution is evaporated and the residual acids are dissolved in alcohol and titrated with 0.5*N*-alcoholic potash. The neutral fat is saponified with 0.5*N*-potash and the excess alkali titrated with 0.5*N*-hydrochloric acid, phenolphthalein being used as indicator in both titrations.

A. R. POWELL.

PATENTS.

Grease extractor. F. E. LYNN (U.S.P. 1,679,728, 7.8.28, Appl., 9.6.26).—A condensing chamber for solvent is situated above the extraction chamber containing the material, and the connexion between the two is through a siphon which operates when sufficient liquid solvent has collected in the condensing chamber. The solvent plus grease passes through a restricted outlet to a distilling chamber, which is heated and the vapour returned to the condensing chamber.

B. M. VENABLES.

Manufacture of margarine and similar butter-like edible fats. L. N. REDDIE. From A.-G. F. MEDIZ. PROD. CHEM. FABR. (B.P. 295,884, 6.12.27).—By extraction of vegetable or animal oils (*e.g.*, egg-yolk oil) with hot alcohol a mixture of lecithin, sterols, and oil or fat is obtained, which is readily emulsifiable with water. The extract is mixed with edible fats to form margarines.

E. LEWKOWITSCH.

Manufacture of highly sulphonated oils of vegetable or animal origin. ERBA A.-G. (B.P. 292,574, 15.12.27. Ger., 23.6.27).—Vegetable or animal oils are sulphonated in the presence of substances (*e.g.*, per-salts or hydrogen peroxide) which are capable of evolving active oxygen in acid solution. The product is washed in the usual way or may be neutralised by alkali and the alkali sulphates precipitated by the addition of water-soluble alcohols. E. LEWKOWITSCH.

Centrifuging of wax [from honeycombs]. C. BOESCH (B.P. 287,094, 13.3.28. Ger., 14.3.27).

Emulsions etc. (G.P. 446,162).—See III. **Vermicide** (B.P. 296,608).—See XVI.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Detection of adulteration of turpentine oil. G. DUPONT and BARRAUD (Bull. Inst. Pin, 1927, 87—90; Chem. Zentr., 1927, II, 2123—2124).—The method is based on the Christiansen phenomenon whereby an opalescent mixture of two immiscible liquids each having the same *n* value for a given spectrum colour and temperature and thereby appearing homogeneous produces an alteration in spectrum colour and indices of refraction on alteration of temperature. Glycerin of known refractive index is mixed with the turpentine oil and the temperature is measured when the emergent colour from the dark rim of the bright surface changes from indigo to violet. The point where the refractive index curves of the two pure liquids intersect gives for a definite temperature a definite colour to the emergent light. E. H. SHARPLES.

Zinc oxide. DANIELS.—See VII.

PATENTS.

Catalytic production of metal resins etc. [driers]. J. CHABANNAIS (F.P. 625,219, 29.11.26).—Resins, fatty acids, or glycerides are heated at 150—200° with steam under pressure and the metal oxide is slowly added with constant stirring. The process avoids the necessity of using precipitated hydroxides, the steam acting as a catalyst in converting the oxide into resinate, oleate, stearate, etc. A. R. POWELL.

Manufacture of oil colours and impregnation materials from petroleum pitch. HABA G.M.B.H. FÜR INDUSTR. BETEILIGUNG, Assees. of R. WEITHÖNER (G.P. 447,470, 27.2.25).—Petroleum pitch is heated at 300° with lime, zinc oxide, manganese oxide, lead oxide, or alumina, and linseed oil. A. R. POWELL.

Phenol resin compositions. BAKELITE CORP. (B.P. 280,520, 27.10.27. U.S., 10.11.26).—A phenol is condensed with excess of formaldehyde in presence of a basic catalyst (sodium carbonate). The resin so produced, containing no free phenol and therefore non-darkening, is further condensed with urea in the presence of an acid catalyst (lactic, boric, or phosphoric acid), the excess of formaldehyde being thereby absorbed.

S. S. WOOLF.

Manufacture of condensation products of arylamines. P. HALLER and H. KAPPELER (B.P. 274,501, 16.7.27. Switz., 16.7.26. Addn. to B.P. 266,358; B., 1928, 224).—The condensation products described in the earlier patent are treated with an organic base (methylamine, pyridine), a neutral or acid salt (sodium bisulphite), or an organic acid (acetic acid, tannic acid).

S. S. WOOLF.

Manufacture of combined pieces, particularly sheets or plates of artificial resins. SOC. CHEM. IND. IN BASLE (B.P. 286,250, 27.2.28. Switz., 1.3.27).—Compound plates are formed by joining sheets of urea-formaldehyde resins at any intermediate stage of their

production, and curing as a whole. Suitable cement may be used if desired. "Non-splinter" sheets are made by using inner layers of softer material than that composing the outer layers. S. S. WOOLF.

Process of sticking, cementing, impregnating, or filling, and manufacture of agents therefor. CONSORT. F. ELEKTROCHEM. IND. G.M.B.H. (B.P. 271,090, 11.5.27. Ger., 11.5.26).—Polymerisation products of vinyl acetate soluble in alcohol, benzene, etc. are claimed. S. S. WOOLF.

Polymerised hydrocarbons (U.S.P. 1,679,093). **Emulsions etc.** (G.P. 446,162).—See III.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Purification and fractionation of caoutchouc. VII. R. PUMMERER, A. ANDRIESSEN, and W. GÜNDEL (Ber., 1928, 61, [B], 1583—1591; cf. A., 1927, 1193).—The behaviour of different preparations of caoutchouc towards continuous extraction with flowing ether has been examined. "Total caoutchouc" is dissolved to the extent of 65–70% in about 40 hrs.; at this point an inflexion of the time-amount dissolved graph occurs and dissolution subsequently proceeds very slowly. The residual "gel caoutchouc" appears approximately homogeneous. Caoutchouc derived from latex preserved with ammonia and subjected to dialysis followed by coagulation and extraction with acetone, is much more slowly soluble in ether and the inflexion occurs after much more prolonged extraction. A very similar graph is obtained for the dissolution of Para crêpe, which is soluble to the extent of about 52%. The same crêpe, after extraction with acetone and subsequent preservation under carbon dioxide to prevent disintegration by the solvent, dissolves comparatively very readily in ether and leaves about 16.8% of gel skeleton. If, however, preservation is considerably prolonged, the residue amounts to 28.1% of the original material, indicating a re-formation of the gel caoutchouc originally present. The effect of the acetone is mainly attributable to the temperature employed in the extraction. The graph for "smoked sheet" rises steeply and shows a fairly well-defined inflexion at 70% after 60–70 hrs.; the end-point is reached after 700 hrs., the sol caoutchouc amounting to 86%. The high content of the latter is due to the exposure of the crude caoutchouc to a temperature of 40–50° during smoking. The initial fractions are intensely orange coloured, but the colourless third fraction affords pure caoutchouc practically free from nitrogen. The subsequent fractions contain a small but increasing proportion of nitrogen. The gel skeleton appears to contain about 20.4% of protein. The numerical relationship of "sol" to "gel" caoutchouc must be determined in each sample; an equilibrium exists which can be attained from either side. Gel formation is regarded as a process of orientation of colloid-chemical or possibly crystallographical nature due to extra-molecular forces. It is considered most probably as an association and not as polymerisation due to main valencies. H. WREN.

Preparation and mol. wt. of isocaoutchouc-nitron. VIII. R. PUMMERER and W. GÜNDEL (Ber., 1928, 61, [B], 1591—1596).—*iso*Caoutchouc-nitron is

most readily prepared by the action of nitrosobenzene on caoutchouc dissolved in the minimum quantity of cold benzene in an atmosphere of nitrogen or carbon dioxide. The solution rapidly loses viscosity and the reaction is complete in 1–2 days, after which the solution is poured in a thin stream into an excess of light petroleum (b.p. 40°). The product is thus obtained in pale yellow flocks which do not exhibit crystalline structure. It dissolves fairly readily and completely in cold benzene, but the solubility diminishes when it is preserved, probably owing to aggregation. It undergoes auto-oxidation much more readily than does caoutchouc. Determinations of mol. wt. in freezing benzene or nitrobenzene give values lying between 1200 and 1400 provided that measurements are not made until the properties of the solutions have become constant. This value corresponds well with a parent caoutchouc molecule of 8 isoprene groups which have reacted with 8 mols. of nitrosobenzene with loss of 16 atoms of hydrogen. The data thus agree closely with the lowest values observed for caoutchouc in menthol.

H. WREN.

Constitution of caoutchouc. H. LOEWEN (Kautschuk, 1928, 4, 163—164, 194—195).—A call is made for further investigation of the chemical constitution of caoutchouc as distinct from physical theories as to its structure. Volatile and crystallisable products of probable value for further elucidation of the constitution of caoutchouc have been obtained by the action of water on the ozonisation product of a chloroform solution of acetone-extracted crêpe rubber which had been treated previously with approximately one half of the theoretical proportion of hydrogen chloride.

D. F. TWISS.

Plasticity and elasticity of rubber. A. VAN ROSSEM and H. VAN DER MEYDEN (India-rubber J., 1928, 76, 360—363).—Compression-recovery tests indicate that masticated rubber at 16° does not show real plasticity, but only pseudo-plastic flow with an elastic after-effect, whereas at 70° real plasticity is observed without appreciable elastic after-effect. With vulcanised rubber also the three properties of instantaneous elastic recovery, slow elastic after-effect, and permanent plastic deformation can be discerned; for under-vulcanised rubber (92:1:74) the first two are less marked than the last, but with increasing degree of vulcanisation the elastic recovery increases, and at 18° may attain 100%, but at 147° the maximum observed was 65%, the elastic after-effect and plasticity being 7% and 28%, respectively.

D. F. TWISS.

Thermoplastic products resembling gutta-percha and shellac, from rubber. F. KIRCHHOF (Kautschuk, 1928, 4, 142—149).—The thermoplastic products derived from rubber by the action of sulphuric acid, organic sulphonic acids or their chlorides (cf. Fisher, B., 1928, 61) are in principle identical with those described earlier by the author (e.g., B., 1921, 91 A), whose experiments have also included rubber latex. The resinous African rubbers differ from *Hevea* rubber in that with sulphuric acid they can yield a shellac-like product. The designation "thermoprene" and "thermoplastic substance" for these products is unsatisfactory, and an alternative classification is suggested for the more important types

of thermoplastic polypropylenes or *cyclocäoutchoucs* based on their method of formation. D. F. TWISS.

Abrasion tests of rubber stocks containing various types of carbon black. W. B. PLUMMER and D. J. BEAVER (Ind. Eng. Chem., 1928, 20, 895—899).—Using the type of abrasion-testing machine described by Williams (B., 1927, 635), it is found that the abrasion loss per unit of work done increases with increase in the size of the abrasive up to 0.45 mm. and then decreases rapidly; this may explain frequent discrepancies between laboratory and road tests. Comparison of an ink-making black, lamp black, thermatomic black, acetylene black, and two gas blacks in vulcanised rubber shows the greatest abrasion-resistance to be given by a gas black. Ageing at 70° causes a marked decrease in resistance to abrasion; the percentage degradation is not uniform, however, and is generally higher for the mixings of greater abrasion resistance. After ageing, indeed, the relative position of two mixings containing different blacks may be reversed. D. F. TWISS.

Evaluation of variable-temperature cures [in the vulcanisation of rubber]. J. R. SHEPPARD and W. B. WIEGAND (Ind. Eng. Chem., 1928, 20, 953—959).—It is generally difficult to foretell with any exactitude the relative effect of different "stepped cures," i.e., of different vulcanisation processes effected with variable temperature. Assuming that the intensity of curing or vulcanisation action is doubled for each rise of 8.3°, it is possible to evaluate mathematically the total effect of a vulcanisation process occurring over a range of steadily varying temperature. Formulae and graphs are given to facilitate such calculations. D. F. TWISS.

Carbon black. JOHNSON.—See II.

PATENTS.

Vulcanisation of [rubber] latex. I. G. FARBERIND. A.-G. (B.P. 288,206, 2.4.28. Ger., 4.4.27).—Latex, containing an aromatic sulphonic acid or sulphonate of the type obtained by the condensation of naphthalene, formaldehyde, and sulphuric acid (cf. B.P. 7138; B., 1914, 366), or a sulphonated mineral oil, aliphatic tar oil, naphthenic or fatty acid, or a fat splitter as dispersion medium, is vulcanised by treatment with sulphur dioxide and hydrogen sulphide at ordinary temperature.

D. F. TWISS.

Vulcanising natural or artificial rubber. METALLBANK U. METALLURGISCHE GES. A.-G. (B.P. 291,438, 12.5.28. Ger., 2.6.27).—Products with high resistance to abrasion are obtained by vulcanising rubber in the presence of organic compounds formed from hydrogen selenide, ammonia, and aldehydes, with or without the additional presence of other known accelerators.

D. F. TWISS.

Manufacture of rubber and the like. P. SCHIDROWITZ, Assr. to VULTEX, LTD. (U.S.P. 1,682,857, 4.9.28. Appl., 14.3.23. U.K., 14.9.22).—See B.P. 208,235; B., 1924, 142.

Comminuting rubber (B.P. 295,435).—See I.

XV.—LEATHER; GLUE.

Depilation of skins by means of alkaline solutions. R. H. MARRIOTT (J. Soc. Leather Trades' Chem., 1928, 12, 281—303; cf. B., 1928, 580).—Alkaline solu-

tions containing reducing agents, e.g., sodium sulphite sodium sulphide, can only loosen the hair on skins if the final liquor has $p_H > 11$. The effect of the hydroxylion concentration on hair is very complicated. The nitrogen-containing fraction hydrolysed by a soak liquor at about p_H 10 differs from that split off at p_H 9.0—9.5 since the loss of the nitrogen fraction over this range inhibits the subsequent action of the sodium sulphide. Cystine, especially in a reduced form, is fairly rapidly decomposed by lime suspensions giving rise to ammonia, and it appears to affect the decomposition of gelatin, but only in the early stages of the reaction. The addition of sodium sulphide, though reducing cystine, inhibits the decomposition of the amino-acid. The presence of gelatin tends to preserve sodium sulphide. Tests with other alkalis on cystine show the following order of diminishing effect in hydrolysing cystine:—lime water and lime suspensions, hydroxides of barium, strontium, sodium, potassium, and magnesium, and sodium carbonate. This is also the order of diminishing depilatory powers. Lime is more effective in breaking down cystine and in producing active reducing agents than are the other alkalis. Lime suspensions do not produce much ammonia from gelatin, urea, glycine, or aspartic acid. Gelatin yields less ammonia than egg or blood albumin when treated with lime liquor. More ammonia is obtained from coagulated egg albumin than from uncoagulated. Coagulation liberates sulphhydryl groups. Experiments with collagen, hair, collagen and hair, collagen and cystine, and cystine, respectively, with lime suspensions, also collagen and sodium sulphide, show that the ammonia content rises rapidly at first and then the rate of increase becomes less with increasing time. More ammonia is produced from hair than from collagen. Sodium sulphide produces less ammonia from collagen than does lime, and less ammonia is produced from collagen when hair is present. Probably lime and sodium sulphide attack the protein molecule in different ways. It does not necessarily follow that lime has a more vigorous action on collagen.

D. WOODROFFE.

Permeability of hide and leather. II. Permeability to gases. M. BERGMANN and S. LUDWIG (Collegium, 1928, 343—351; cf. B., 1928, 205).—Measurements have been made of the volume of gas forced through various leathers; the experimental error was 1%. As the gas permeated the leather the latter absorbed up to 9% of moisture in 100 hrs. and the permeability fell by 53%, showing that the greater the moisture content of the leather the lower is the permeability to gases. The permeability to gases is independent of the gas pressure and practically independent of the position of the leather (grain or flesh side). The diminishing order of permeability of a number of samples of leather is as follows:—alum-tanned goatskin, chrome-tanned sheep, sumach-tanned sheep, chrome-tanned goatskin, chrome-tanned calfskin, iron-tanned leather, crust-tanned hide, finished hide, long-process pit-tanned hide. Patent leather was quite impermeable to gases.

D. WOODROFFE.

Electrically determining the penetrability of sole leather for water. J. N. GERSSEN (Collegium, 1928, 337—343).—An improvement of Jablonski's apparatus

(*ibid.*, 1925, 616), in which a copper plate is in contact with the under-side of the leather and a small electric current is passed when the water has just penetrated; this current is increased by means of a transformer and made to give automatic notification. D. WOODROFFE.

Tanning materials of the British Empire. IV. (Bull. Imp. Inst., 1928, 26, 311–322).—A number of lesser-known tanning materials are dealt with, which are not at present in commerce but appear worthy of consideration. A bibliography and an index to the series are included.

Formaldehyde as tanning material. B. A. TARACHOVSKI (Vestnik, 1925, [2], 102–103).—The skins (100 pts.) are placed in a closed drum with water (80 pts.) and a slightly alkaline formaldehyde solution (10 per 100 pts.); the concentration of formaldehyde during tanning is 0.5–3.5%. CHEMICAL ABSTRACTS.

[Tannins in] pine bark. P. YAKIMOV and B. ANIKIN (Vestnik, 1926 [8-9], 68–79).—Exposure to rain or transportation of logs by water causes little direct loss of tannin, but storage in the damp state causes loss of tannin through mould growth. The total soluble matter, but not the ratio of tans to non-tans, decreases with increasing age and size of the tree. CHEMICAL ABSTRACTS.

Density of vegetable tannins and of the skin. D. SHURAVLIEV and D. ARBUSOV (Vestnik, 1926, [12], 41).—The densities of tannins vary with the source. Collagen has $d_{4}^{1.42}$. CHEMICAL ABSTRACTS.

Absorption of vegetable tannins by hide powder under different conditions. G. W. SCHILLER and B. SCHWARTZBERG (Vestnik, 1926, [1], 45–47).—Addition of acid increases both total and “irreversible” fixation of tannin; sulphitation decreases the former, but not the latter. Fixation increases with increase of the ratio of tannin to hide powder (for constant volume), and is independent of this ratio when the concentration of the solution is constant. CHEMICAL ABSTRACTS.

Tanning process. P. I. PAVLOVICH (Vestnik, 1926, [10–11], 60–65).—The maximum tannin fixation observed by Thomas and Kelley at p_H 7–8 is ascribed to subsequent washing of the hide powder with water at p_H 5.8. A procedure therefore employs pretanning at p_H 7–8, and re-tanning at the natural p_H value of the extract (about p_H 5.5). CHEMICAL ABSTRACTS.

Dry chrome tanning. N. KOTELNIKOV and I. BASS (Vestnik, 1926, [2–3], 45–47).—A procedure is described. CHEMICAL ABSTRACTS.

PATENTS.

Impregnation of leather. J. J. J. GUILLEMIN (B.P. 272,197, 26.5.27. Fr., 2.6.26).—The product used is prepared by mixing 20 pts. of fossil or vegetable resins or artificial gum at 150–300° with 45 pts. of a gum-dissolving oil, *e.g.*, linseed oil, at 130–150°, allowing the mixture to cool to 70–80°, and stirring in a mixture of 1 pt. of litharge in 34 pts. of turpentine or “white spirit.” D. WOODROFFE.

Drying of leather. V. G. WALSH (B.P. 295,804, 7.7.27).—Vegetable-tanned leather is drummed with a

non-volatile, non-injurious, acid substance having a high absorptive capacity for the colour of the tan, *e.g.*, a solution of a vegetable tannin saturated with alum, to which has been added sufficient alkali to precipitate some aluminium hydroxide, with or without addition of borate, glucose, and gum gattau. The leather is then dried in an atmosphere containing naphthalene. D. WOODROFFE.

Preparation of depilatory substances. R. BOTSON, Assr. to Soc. INDUSTRIELLE DES APPL. CHIM., Soc. ANON. (U.S.P. 1,683,442, 4.9.28. Appl., 19.8.26. Belg., 21.8.25.)—See B.P. 285,152; B., 1928, 342.

Method of slicking hides. W. C. WRIGHT (B.P. 296,219, 27.10.27).

XVI.—AGRICULTURE.

Potassium xanthate as a soil fumigant. E. R. DEONG and J. TYLER (Ind. Eng. Chem., 1928, 20, 912–916; cf. B., 1926, 207).—Experiments are described in which potassium xanthate was used against beetles and the root-knot nematode (*Caconema radiculicola*). The decomposition of xanthate by acids was more rapid when the theoretical amount was supplied as hydrochloric acid than when calcium superphosphate was used, more than 48 hrs. being required in the former case. The penetration of carbon disulphide from xanthate buried in soil with superphosphate amounted to 6.18 in. laterally and 5 in. downward in subsoils after 3–5 days. Wet soils absorb more carbon disulphide than dry ones, and clays more than sands. The % mortality-time curves of xanthate used alone or in conjunction with superphosphate or sulphur invariably showed a steady fall until about the fifth day, followed by a slight rise for the subsequent 5–6 days, and thence a final steady decline. In field experiments autumn fumigation was more efficient than in winter or early spring. Deep ploughing-in of a well incorporated mixture of xanthate (200–400 lb.), superphosphate (200–400 lb.), and sulphur (100 lb. per acre) is recommended. A. G. POLLARD.

Nitrification in Hungarian Szik (alkali) soils. F. ZUCKER (Z. Pflanz. Düng., 1928, 12A, 102–107).—Nitrification in Szik soils is an exceptional occurrence, and is confined to the upper layers. The determining factors are not as yet fully understood.

H. J. G. HINES.

Does the supply of root-soluble nutrients in manured and unmanured soils alter during a growing period? H. NEUBAUER, W. BONEWITZ, and A. SCHOTTMÜLLER (Z. Pflanz. Düng., 1928, 12A, 108–114).—Phosphoric acid and potassium available to plants, as determined by the seedling method, are not altered during the normal period of vegetative growth. Nine tenths of the potassium added as chloride or as dung was taken up by the seedlings. The uptake of phosphoric acid from superphosphate and basic slag was about three tenths of the added quantity.

H. J. G. HINES.

Nutrient action of iodine in Chile sodium nitrate [dressings for sugar beet]. H. ELLEDER (Z. Pflanz. Düng., 1928, 12A, 97–101).—In a field experiment with sugar beet little difference between synthetic and

Chilean sodium nitrate could be detected. Further additions of potassium iodide in conjunction with heavy nitrogenous manuring depressed the yield of roots and increased the yield of leaves. H. J. G. HINES.

Carbohydrate changes during ripening of plantains. S. RANGANATHAN, JUN. (J. Indian Inst. Sci., 1928, 11A, 80—83).—No diastatic activity in ripening plantains was observed, and no inhibitive matter could be extracted from the pulp. Oxygen seems essential to the ripening process. A. G. POLLARD.

Influence of soil reaction on results obtained by the Neubauer method. B. DIRKS (Z. Pflanz. Düng., 1928, 12A, 65—96).—Potassium chloride extracts of zeolitic and non-zeolitic soils when titrated with lime water show but little difference in the titration curves. On boiling, however, the curves of zeolitic soils flatten between the range p_H 8.0—8.3. The length of this flat portion of the curve is a measure of the amount of zeolites in the soil. Values of p_H obtained on the unheated extract give little guide to the lime requirement. On the boiled extract the value 8.3 is taken as the critical p_H , and further additions of lime would prove injurious. Part of this injurious action is ascribed to soluble calcium bicarbonate. The Neubauer results are not influenced by reaction so long as the p_H of the boiled extract does not exceed 8.3. The easily soluble calcium bicarbonate can be removed by heating the soil on a water-bath, and soils so treated give better results by the Neubauer method. H. J. G. HINES.

Determination of the lime requirement of soils. GAY [with P. MÜLLER and O. ROOS] (Z. Pflanz. Düng., 1928, 7B, 393—434).—The various existing methods for determining lime requirement of soils are compared from the point of view of their limitations and the differences between experimental results and those of field trials. Results of numerous comparative tests are recorded and a form of group classification is adopted. The best representation of the "lime condition" of a soil is obtained from a consideration of the analytical figures for chalk, exchangeable calcium, and hydrolytic and exchange acidities. All four values are necessary in order completely to specify the soil condition. Determinations of p_H values, though not necessary, serve to amplify the above results when used in conjunction with the titrimetric acidity determinations. The *Azotobacter* reaction in its present form is not trustworthy. A. G. POLLARD.

Determination of carbon dioxide in carbonates in soil. A. RIAD (Analyst, 1928, 53, 486—487).—Hepburn's modification of the Van Slyke method of determining carbon dioxide in carbonates (B., 1927, 42) has been successfully applied to soils. Precautions should be taken to minimise the period of contact between the baryta and atmospheric air, and a pressure reduced to 6—7 cm. of mercury instead of 2 cm. will suffice. D. G. HEWER.

Determination of iodine in soils. R. V. NORRIS and D. A. R. RAO (J. Indian Inst. Sci., 1928, 11A, 75—79).—The method of Hercus, Benson, and Carter (J. Hygiene, 1924, 24, 321) does not yield absolute results for iodine in soils, the presence of much ferric oxide leading to loss of iodine. The method adopted is

as follows:—A nickel boat containing at least 5 g. of the soil is placed in a combustion tube inside a silica electric furnace and heated at 850° in a stream of oxygen. The end of the combustion tube is drawn out to a capillary which enters the absorption vessel containing 10% sodium hydroxide solution. After heating for 1 hr. the alkali solution is neutralised with sulphuric acid, 2 c.c. of carbon tetrachloride are added, and the iodine is liberated by the addition of 3—5 drops of nitro-sulphuric acid (nitrous fumes from treatment of starch with nitric acid absorbed in sulphuric acid). The carbon tetrachloride solution is separated, washed twice with very small quantities of water, treated with 2 c.c. of sodium acetate solution, and titrated with N/1270-sodium thiosulphate solution. By this method 5 p.p.m. of iodine in soil can be detected and larger amounts determined. A. G. POLLARD.

Methods of preparation of soil for mechanical analysis. A. N. PURI and B. M. AMIN (Agric. Res. Inst. Pusa, Bull. No. 175, 1928, 15 pp.).—In using the Robinson pipette method for mechanical analysis of soils (cf. B., 1922, 990 A), disturbance of the suspension during sampling is minimised by bending the tip of the pipette at right angles to its length and by using an automatic suction apparatus. Mutual interference of particles during settling occurs in suspensions of clay soils of concentrations greater than 1%. Tables are provided whereby the effect of temperature on settling velocity can be corrected. In the preliminary treatment of soil for analysis, treatment with hydrochloric acid is necessary; 0.05N-acid (cold) suffices for this purpose, and the use of hydrogen peroxide (English official method) or of hot 0.2N-hydrochloric acid (Hissink) is unnecessary and too drastic. A. G. POLLARD.

PATENTS.

Root-filling substance. E. G. HEDSTRÖM (U.S.P. 1,678,940, 31.7.28. Appl., 13.11.26. Swed., 27.9.26).—A natural asphalt, preferably Syrian asphalt, is dissolved in benzol, chloroform, or other solvent, which is then partially evaporated. The addition of bismuth salts, or a noble metal in colloidal condition, enables the position of the filling to be detected by Röntgen rays. F. G. CLARKE.

Preparation of an [earth] worm-killing composition. PREMIER OIL EXTRACTING MILLS, LTD., and W. E. WATERHOUSE (B.P. 296,608, 19.12.27).—Mowrah seed, cake, or meal is extracted with hot water under raised pressure, and the extract is filtered and evaporated to dryness under reduced pressure. L. A. COLES.

XVII.—SUGARS; STARCHES; GUMS.

Adsorption properties of bone char. T. B. WAYNE (Ind. Eng. Chem., 1928, 20, 933—940).—Sugar solutions were tested for ash and invert sugar content before and after filtration through various samples of bone char, of which the analyses and p_H values are given. Char carbon, freed from ash by acid treatment and washing, was found to adsorb no ash. If heated or made alkaline with lime some adsorption occurs. The adsorptive power of char ash is high. With increasing alkalinity of the char ash adsorption is

increased up to a point. A similar effect is obtained by increasing the alkalinity of the syrup. Invert sugar disappears to a greater extent with the more alkaline chars. Chars containing calcium carbonate and underburned were found to lower the p_H value, probably owing to hydrolytic adsorption. The effect of increasing the proportion of char to liquor was to increase ash adsorption, but the p_H value was unchanged. This indicates the probability of exchange adsorption reactions. The effect of change of temperature was also studied.

C. IRWIN.

PATENT.

Removal of hydrochloric acid from sugar solutions. F. KOCH, ASST. to INTERNAT. SUGAR & ALCOHOL Co., LTD. (U.S.P. 1,678,819, 31.7.28. Appl., 9.5.25. Ger., 15.5.24).—The sugar solution is sprayed against a hot stream of fluid, *e.g.*, oil or air, and is subsequently separated therefrom. The addition of sulphuric acid facilitates the process. F. G. CLARKE.

XVIII.—FERMENTATION INDUSTRIES.

Wines from grapes attacked by *Eudemis*. II. J. H. FABRE and E. BRÉMOND (Ann. Falsif., 1928, 21, 323—339; cf. B., 1928, 104).—The action of alkali carbonates and calcium carbonate as neutralising agents for these infected wines has been investigated with a view of obtaining data which will enable the fraudulent neutralisation of such wines to be detected. Results of analyses of several wines of this type of different origin, and also of the difference in taste of the wines at different periods of time after treatment with these carbonates, are tabulated. By comparing the density and the analytical values obtained for fixed acidity, total ash, soluble ash, total tartaric acid, and total alkali and calcium with those given in the tables, the neutralising agent which has been used can be detected.

T. M. A. TUDHOPE.

Determination of manganese in Peloro [Messina] wines. (SIGNA.) G. SOLARINO (Boll. Chim. farm., 1928, 67, 481—483).—The dry ash from 100 c.c. of the wine is taken up in concentrated nitric acid, the solution being diluted with water, treated with about 0.5 g. of lead dioxide, boiled, allowed to settle, and titrated with 0.01N-oxalic acid to determine the permanganic acid formed; 0.1 c.c. of 0.1N-oxalic acid corresponds with 0.00012 g. Mn. In 20 wines, containing between 12.2 and 14% of alcohol by vol., the manganese content varied from 0.0011 to 0.0024 g. per litre.

T. H. POPE.

Character in pot still whisky. II. S. H. HASTIE and W. D. DICK (J. Inst. Brew., 1928, 34, 477—490; cf. B., 1926, 604).—The presence in whisky of furfuraldehyde, which is one of the chief character-giving substances, is ascribed to its production towards the end of the first distillation by the local superheating or partial charring of the pentoses in the presence of the acids contained in the wash. In the second distillation the shape of the still head and lyne arm have a limited effect, the transfer of furfuraldehyde being controlled mainly by the temperature of distillation corresponding to a more or less definite strength of distillate. When the alcoholic content of the charge of

the spirit still is in practice 20% by vol., the maximum transfer takes place at 201° F. with the strength of the distillate approx. 50% of alcohol by vol.

C. RANKEN.

Importance of hydrogen-ion concentration for the distillery. W. DIEMAIR and K. SICHERT (Biochem. Z., 1928, 198, 1—18).—The hydrogen-ion concentration of raw and stewed potatoes, of acid and ripe yeast, and of the mash at different stages of fermentation is determined, and titration curves are constructed. For the determination of buffering power the hydrogen-ion concentration and titratable acidity, determined against azolitmin, phenolphthalein, and neutral-red, are obtained. In the raw and stewed potato extracts, formol-titratable and total soluble nitrogen are determined. The hydrogen-ion concentration, titratable acidity, and buffering power increase during the mashing process. By bringing the degree of acidity of acid yeast to 1.0, the acidity is regulated for the mash and an optimum produced for diastase (p_H 4.8—5.0). The behaviour of mash during fermentation may be characterised by the following three stages: (a) (24 hrs.) chief fermentation in which hydrogen-ion concentration and titratable acidity increase, complex proteins are split up, and organic acids and primary phosphate are formed; (b) (48 hrs.) the p_H value and titratable acidity remain practically constant and fermentation slows off; (c) (72 hrs.) a slight increase of hydrogen-ion concentration, a decomposition of formed hydroxy-acids, and a slight decrease of titratable acidity.

P. W. CLUTTERBUCK.

Anti-ferments. HARVEY.—See XX.

PATENTS.

Manufacture of yeast. ZELLSTOFF-FABR. WALDHOF, and O. LÜHRS (B.P. 287,052, 6.3.28. Ger., 12.3.27).—Substances containing sugar are fermented and the yeast is collected for withdrawal at the centre of the bottom of a vat by imparting to the lower layer of the liquid a rotatory or gyratory movement which is limited by baffles to the lowermost zone of the vat. The gyratory movement may be produced by the admission of mash or other liquid at the bottom of the vat.

C. RANKEN.

Medicinal products obtained from yeast. I. S. MACLEAN (B.P. 295,757, 23.5.27).—An activated medical product is obtained by incubating yeast in a solution containing phosphates and carbohydrates and subjecting the resulting sterols or sterols and fats to ultra-violet light.

C. RANKEN.

Urease preparation. O. LIND (U.S.P. 1,679,250, 31.7.28. Appl., 3.9.27. Ger., 15.9.26).—Soya beans, or other vegetables containing urease, are extracted with water to which alkali phosphates are added before or after the extraction, and the separated extract is dried by atomising into a dry and heated gas stream.

F. R. ENNOS.

Production of an alcoholic stimulant. T. D. KELLY (B.P. 295,822, 29.7.27).—A mixture of fermented materials, such as ethyl alcohol, with a small quantity of glycerol is subjected to the action of ultra-violet rays, an alkaline substance, soluble in the liquid, being added to counteract any tendency towards acidity. The

stimulant may be solidified by the addition of substances of a colloidal or farinaceous nature, raising the temperature to 50–80°, and finally cooling suddenly.

C. RANKEN.

XIX.—FOODS.

Influence of temperature on rate of corrosion of copper by milk. G. N. QUAM, E. I. SOLOMAN, and A. HELLEWIG (Ind. Eng. Chem., 1928, 20, 930–931).—The solubility of copper in milk, the time of contact being 30 min., increases with rise in temperature to a maximum at 85–90° and decreases with further rise. The break in the curve is probably due to decreasing solubility of oxygen in the milk. The disagreement with the observations of Rice and Miscall (J. Dairy Sci., 1928, 1, 320), who found that the solubility of copper in milk at b.p. was less than at room temperature, is due to the use of a longer time of contact by these workers, whereby the change in composition of the milk at the higher temperature became an important factor.

W. J. BOYD.

Textures of ice creams as influenced by some constituents. M. H. GIVEN (Ind. Eng. Chem., 1928, 20, 966–968).—The addition of gelatin (0.3%), raw eggs (2.5%), or dry egg yolk (0.3%) to the ice-cream mix increases the viscosity of the mix and improves the texture of the final product. Gelatin (0.5%) gives a product which is almost gummy and therefore objectionable. The use of 22% of evaporated milk in place of 18% of market milk and 4% of cream gives a product similar in viscosity and texture to that made with 0.3% of gelatin.

W. J. BOYD.

Water in cream. A. F. LERRIGO (Analyst, 1928, 53, 488–489).—Out of 21 samples bought as cream or preserved cream, not sterilised or clotted, 19 contained less than 8.0% solids-not-fat in serum, 18 less than 7.5%, 13 less than 6.5%, 8 less than 5.5%, and 2 less than 4.5%, the cream having been thinned with water.

D. G. HEWER.

Determination of added phenol and cresol in milk. H. T. FAWNS (Analyst, 1928, 53, 489–490).—Added phenol and cresol may be detected in milk by an application of Mumford's method (cf. B., 1913, 671). To 50 or 25 c.c. of milk 2 c.c. of concentrated sulphuric acid are added to precipitate casein and sulphonate the phenolic compound. The precipitate is collected, and filtrate and washings are heated at 85° for 10 min., cooled, and the coagulated albumin is removed by filtration. To the filtrate 5 c.c. of 10% potassium nitrate solution are added, nitration is effected at 80–90°, and the liquid filtered if necessary, cooled, and made alkaline with ammonia solution (*d* 0.880). A yellow coloration due to ammonium picrate (which can be determined colorimetrically) indicates the presence of phenol. The reaction is quantitative for additions of phenol of 0.1–0.005 g. per 50 c.c. of milk.

D. G. HEWER.

Effect of dry skim milk on baking quality of various flours. E. GREWE (Cereal Chem., 1928, 5, 242–255).—Besides increasing the nutritive value of bread the addition of dried skim milk (4%) to the dough gives a decided improvement in the baking quality of certain wheat flours. Flours differ in their

reaction to the use of dried skim milk in bread making. In some the baking qualities are improved, and in others they are not. Hard spring-wheat flours react more favourably than hard winter-wheat flours. The range of fermentation time in which doughs give good bread is increased by the use of dried skim milk. The lactose present imparts a good colour to the crust, and the general texture of the bread is improved.

T. M. A. TUDHOPE.

Applications of spectrophotometric methods to baking problems. E. L. STEPHENS, A. M. CHILD, and C. H. BAILEY (Cereal Chem., 1928, 5, 256–268).—The colour of baked products containing flour and molasses was examined spectroscopically, and the percentage reflection of light measured between 500 and 620 mμ. The colour is influenced to a small extent by the colour of the molasses used, and to a greater extent by the amount of sodium bicarbonate present; the colour darkens with increase of alkalinity and with increase of temperature of baking. T. M. A. TUDHOPE.

Chemical changes accompanying the western yellow blight of tomato. J. T. ROSA (Plant Physiol., 1927, 2, 163–169).—The total nitrogen, alcohol-insoluble nitrogen, and diastatic activity of the leaves decrease, whilst the reducing sugars, sucrose, starch, and alcohol-soluble nitrogen increase. Carbohydrates accumulate and total and alcohol-soluble nitrogen increase in the stems and roots, whilst diastatic activity disappears. The inception of blight appears to be connected with inability to translocate nitrogen and to synthesise higher nitrogen compounds.

CHEMICAL ABSTRACTS.

Vitamin-B content of avocados. L. S. WEATHERBY and E. W. WATERMAN (Ind. Eng. Chem., 1928, 20, 968–970).—Feeding experiments on rats showed that the fresh pulp of avocados has about one twelfth the vitamin-B content of dry yeast.

W. J. BOYD.

Fumigation tests with ethylene dichloride-carbon tetrachloride mixture [on foodstuffs etc.]. L. F. HOYT (Ind. Eng. Chem., 1928, 20, 931–932).—A mixture of 3 pts. of ethylene dichloride and 1 pt. of carbon tetrachloride was used in the proportion of 7 lb. per 500 cub. ft. for the fumigation of cereals and food products infested with *Tribolium* and Indian meal moth. Complete control of the insects was obtained. After fumigation for 24 hrs. the germinative power of wheat, oats, peanuts, and clover was practically unaffected, whilst that of beans was considerably reduced. Unwrapped foodstuffs, especially those rich in fat, absorbed considerable amounts of the fumigant, but were edible after 1–8 days. Bread baked from fumigated flour was indistinguishable in appearance and taste from the controls. A similar concentration of fumigant gave a 100% kill of house-moth larvæ in furniture.

A. G. POLLARD.

Tests for incipient rancidity of fats. DAVIES.—See XII.

PATENTS.

Treatment of wheat. L. E. SMITH, Assr. to INTERNAT. MILLING Co. (U.S.P. 1,679,099, 31.7.28. Appl., 28.5.25).—The rapid ageing of wheat is brought about by allowing it to flow by gravity in a thin sheet through a vertical

tank, which contains a series of hopper cones below each of which is an inverted, perforated, distributor cone. The wheat is subjected to independently regulated currents of moist air from pipes placed below each distributor cone. F. R. ENNOS.

Preservation of eggs. A. H. PENFOLD (B.P. 296,012, 23.5.27).—Liquid egg or egg yolks are mixed with 10–20% of dextrose, cooled to -26° , and kept at about this temperature during storage. F. R. ENNOS.

Treatment of liquids such as milk etc. with rays, particularly ultra-violet rays. G. HOFFMANN (B.P. 279,902, 31.10.27, Aust., 30.10.26).—The milk is caused to trickle in a thin layer down over a cylinder of wire gauze or other grid-like structure within which is the source of radiation. B. M. VENABLES.

[Spreading device for] drying apparatus for maize, tea, barley, wheat, etc. T. CLARKE and DAVIDSON & Co., LTD. (B.P. 296,221, 29.10.27).

Drying of hay, straw, etc. C. LYON (B.P. 296,162, 4.7.27).

Preserving food (U.S.P. 1,680,934).—See V. Margarine etc. (B.P. 295,884).—See XII.

XX.—MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Presence of *o*-arsanilic acid in technical arsanilic acid. N. G. POZDNIakov (J. Chem. Ind., Moscow, 1928, 5, 530).—Technical arsanilic acid contained over 4% of the *o*-isomeride. This is seven times as soluble in water as the *p*-compound, and advantage is taken of this difference in solubility for the purification of the latter. R. TRUSZKOWSKI.

The genus *Mentha*. XVI. **Non-volatile constituents of *Mentha aquatica*, L.** S. M. GORDON (Amer. J. Pharm., 1928, 100, 433–449, 509–524).—The dried ground leaves (13.78 kg.) of *M. aquatica*, L., were extracted with alcohol and a black extract (2.6 kg.) was obtained. Steam-distillation of the extract gave 108 g. of volatile oil [d_{20}^{20} 0.8649, n_D^{20} 1.4588, acid value nil, ester value 39.79, ester value after acetylation 120.5, ester (as linalyl acetate) 13.93%, alcohol (as linalol) 36.43%] containing furfuraldehyde and sesquiterpenes. The aqueous distillate contained a relatively large amount of acetic acid and a small quantity of trimethylamine. The residue from the distillation consisted of a dark aqueous liquid containing potassium nitrate (58 g.); formic acid; a yellow pigment (0.08 g.), m.p. 250–253°; dextrose (3 g.); succinic acid; rhannose; betaine (4.1 g.); choline; a glucosidic material; and a black oily resin from which the following substances were isolated: methylamine; ammonium chloride; linalol (34 g.), obtained by steam-distillation after alkaline hydrolysis; dotriacontane (3 g.), m.p. 69.5–70°; a phytosterol, m.p. 133.5–134°, presumably α -sitosterol; 66 g. of an oil boiling over a large range and yielding pronounced sterol colour tests; lupeol, m.p. 210°; a substance ($C_6H_{12}O$)_x, m.p. 212°; "aquaticol" (6 g.), m.p. 273°, possibly identical with micromerol; a compound, $C_{26}H_{42}O_3$, m.p. 261°; a compound $C_{22}H_{36}O_3$, m.p. 258°; a compound, m.p. 319°; and 644 g. of fatty acids consisting of butyric, hexoic, heptoic, linoleic, linolenic, oleic, palmitic, and possibly stearic

(m.p. 86.5°), and myristic acids, and an acid, $C_{25}H_{50}O_2$ (?), m.p. 82–83°. E. H. SHARPLES.

Constituents of Indian essential oils. XXIV. **Essential oil from rhizomes of *Curcuma zedoaria*, Roscoe.** B. S. RAO, V. P. SHINTRE, and J. L. SIMONSEN (J.S.C.I., 1928, 47, 171–172 T).—Distillation in steam of the rhizomes of *C. zedoaria* yielded 0.94% of oil, of which approximately one third was heavier than water; it had d_{20}^{20} 0.9724, n_D^{20} 1.5002, acid value 1.3, saponif. value 3.0, saponif. value after acetylation 66.6. The oil was shown to have the following composition: *d*- α -pinene 1.5%, *d*-camphene 3.5%, cineole 9.6%, *d*-camphor 4.2%, *d*-borneol 1.5%, unidentified alcohols trace, sesquiterpenes 10.0%, sesquiterpene alcohols 48%, residue (probably mainly sesquiterpene alcohols) 21%.

Russian essential oils. A. TSCHERNUCHIN (Masloboino-Shirowoje Djelo, 1927, [3–4], 57–60; Chem. Zentr., 1927, II, 2122).—The best yield of oil containing the maximum quantity of menthol is obtained from *Mentha piperita* by using the half-blossomed plants. Plants in full bloom give the smallest yield of oil and the lowest menthol content. For the purification of the oil it is shaken with freshly precipitated aluminium hydroxide, and after keeping for 3–5 hrs. is filtered.

E. H. SHARPLES.

Essential oils as anti-ferments. E. H. HARVEY (Amer. J. Pharm., 1928, 100, 524–529).—The anti-ferment efficiency of 32 typical essential oils has been measured by methods similar to those previously described (B., 1924, 845). Acetic acid is an efficient anti-ferment at concentration above 1.5%. Exposure of essential oils to ultra-violet light lowers their anti-ferment efficiency. E. H. SHARPLES.

PATENTS.

Manufacture of organic arsenic compounds. G. NEWBERRY, and MAY & BAKER, LTD. (B.P. 295,744, 23.3.27).—*o*-Acylaminophenolarsinic acids are condensed with chloroacetic acid (or its esters or amide) to give the corresponding aryloxyacetic acids, which on removal of the acyl group are converted into benzo-*p*-oxazine derivatives. Thus, 3-acetamido-4-hydroxybenzenearsinic acid and chloroacetic acid yield 3-acetamido-4-carboxymethoxybenzenearsinic acid, from which by hydrolysis with alkali 3-hydroxybenzo-*p*-oxazine-6-arsinic acid is obtained; chloroacetamide gives 3-acetamido-4-carbamylmethoxybenzenearsinic acid and the same oxazine. 3:5-Diacetamido-4-carboxymethoxybenzenearsinic acid and 8-amino-3-hydroxybenzo-*p*-oxazine-6-arsinic acid are similarly prepared. C. HOLLINS.

Manufacture of aliphatic auromercaptocarbonylic acids. CHEM. FABR. AUF ACTIEN, FORM. E. SCHERING (B.P. 266,346, 15.2.27, Ger., 17.2.26. Addn. to B.P. 265,777; B., 1927, 349).—A β -thiol-aliphatic acid (e.g., cysteine hydrochloride reduced with sulphurous acid) is treated with an auric salt (potassium bromoaurate). C. HOLLINS.

Manufacture of complex [organic] metallic compounds. W. CARPMAEL. From I. G. FARBENIND. A.-G. (B.P. 295,734, 17.3.27).—An alkali salt of pyrocatechol mono- or di-sulphonic acid, pyrogalloldi-sulphonic acid, or protocatechuic acid is treated with the

hydroxide, oxide, or carbonate of a metal (excluding alkali and alkaline-earth metals, and also excluding antimony and bismuth with all except pyrogallol-disulphonic acid), alkali or an amine being added to give a neutral complex salt. The additional alkali is unnecessary when cadmium is the metal used. Copper, arsenic, cadmium, manganic, stannous, vanadyl, aluminium, ferric, antimony, bismuth, and lead complex salts are described (cf. B.P. 213,285; B., 1925, 691).

C. HOLLINS.

Manufacture of metal salts of sulphoarsenol. F. LEHNHOFF-WYLD (U.S.P. 1,674,711, 26.6.28. Appl., 9.11.25).—See B.P. 232,612; B., 1925, 970.

Medicinal products (B.P. 295,757). **Alcoholic stimulant** (B.P. 295,822).—See XVIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Chemical development and fixation of latent finger prints. G. POPP (Z. angew. Chem., 1928, 41, 1005—1007).—The iodine method for fixing finger prints on documents, letters, etc. is difficult of application. The process recommended is to fix the iodine-print with a 0.001% solution of palladium chloride. After removing excess of the reagent and drying slowly, the print appears in a deep brown marking. Alum or tannin may be added to the reagent to prevent the effacement of the print by water-soluble inks. In some cases the paper ground becomes tinted by the iodine, and the use of palladium chloride is inadvisable. The print may be fixed with dilute ammonia solution.

A. G. POLLARD.

PATENT.

Production of photographic plates, films, etc. for indirect three-colour photography. E. A. LAGE (U.S.P. 1,683,560, 4.9.28. Appl., 13.3.26. Ger., 23.10.25).—See B.P. 266,468; B., 1927, 349.

XXII.—EXPLOSIVES; MATCHES.

Explosive properties of hypochlorites. WEICHERZ.—See VII.

PATENT.

[Granulation of] explosives. O. MATTER (B.P. 296,600, 25.11.27).—The explosive is dissolved in a solvent and the solution is added with stirring to a liquid that mixes in all proportions with the solvent, but does not dissolve the explosive. Thus, pentaerythritol tetranitrate and tetranitromethylaniline are dissolved in acetone and the solution is poured into water maintained continuously in motion.

S. BINNING.

XXIII.—SANITATION; WATER PURIFICATION.

Pollution of tidal and non-tidal waters. J. H. COSTE (J.S.C.I., 1928, 47, 133—139 t).—The general effect of pollution of all kinds is to degrade the normal life of affected streams so that a river may become unable to support fish life, or become a nuisance or even a

danger to health. The ecology of polluted rivers has been studied to some extent, and three types of association have been observed, characterised respectively by the water shrimp *Gammarus*, the *Sialis* group, and by tube-forming worms and midge larvæ, the last-named group usually occurring in the blackmud of badly-polluted waters, whilst *Gammarus* and snails are associated with pure water and form a large part of the food of fishes. The one point common to all organic pollution is that the polluting matters need oxidation. Apart from oxygen liberated by photo-synthesis the only source of this element is the air. The amount of oxygen dissolved by water from the air is very small—only about 1/100,000 of the weight, or 7/1000 of the volume of the water at 15°. The rate at which this can be taken up is also very limited. When polluting matter enters a tidal reach, it will travel upwards, so that a long stretch of water above and below is affected, whilst the final escape of pollution is much retarded. Although these effects of tide are unfavourable to the rapid removal of pollution, the continual disturbance of the river bottom prevents the accumulation of foul mud and the movement of the water is favourable. The chief causes of unfitness of water for supporting fish life are:—(1) deficiency or great excess of oxygen; (2) presence of specifically toxic substances or of fine suspensions which will foul the gills of fish; (3) absence of necessary salts; (4) an unsuitable temperature. It appears that of all fish the *Salmonidae* need the most oxygen, and eels and other bottom-living fish the least. The high requirements of salmon account for their abandonment of rivers which have, by reason of pollution, become depleted of dissolved oxygen. It is probably useless to expect salmon and their allies to frequent waters containing less than 70% or other fish less than 50% of saturation of this element. Pollution of rivers has, to some extent, been restrained, or sought to be restrained, by enactment. The earlier Acts only dealt with the matter from the point of view of public health, but in 1923 the Salmon and Freshwater Fisheries Act, which affords some protection to fish, was passed. The question of standards of purity to be applied to rivers is considered. Whether they are based on analytical figures or on behaviour, they should be in such form that they may easily be understood. It is not necessary that they should be unvarying, but changes should be infrequent and tactfully introduced. The economic necessity of any specific form of pollution, and the possibility of recovery of useful products, should be considered before distinctly purificatory treatment is adopted. Sewage should offer little real difficulty, but industrial effluents need a full understanding of the features of each case. The system adopted by the Ministry of Fisheries of interesting local people in river surveys, and of arousing civic and æsthetic consciousness, is more likely to remedy the evils of pollution than premature resort to legal proceedings.

PATENT.

Treatment of water. J. W. M. BOURGOGNION and C. L. PHILIPS (U.S.P. 1,683,521, 4.9.28. Appl., 17.5.27. Holl., 10.5.26).—See B.P. 271,079; B., 1928, 770.