

REVIEW OF AMERICAN CHEMICAL RESEARCH.

VOL. VI. NO. 8.

ARTHUR A. NOYES, Editor.

REVIEWERS: Analytical Chemistry, H. P. Talbot and W. H. Walker; Biological Chemistry, A. G. Woodman; Carbohydrates, G. W. Rolfe; General Chemistry, A. A. Noyes; Geological and Mineralogical Chemistry, W. O. Crosby and M. L. Fuller; Inorganic Chemistry, Henry Fay; Metallurgical Chemistry and Assaying, H. O. Hofman; Organic Chemistry, J. F. Norris; Physical Chemistry, H. M. Goodwin; Sanitary Chemistry, E. H. Richards; Industrial Chemistry, A. H. Gill and F. H. Thorp.

METALLURGICAL CHEMISTRY.

H. O. HOFMAN, REVIEWER.

The Montana and Denver Reduction Company's Mill at Bearmouth, Mont. BY F. D. SMITH. *Eng. Min. J.*, 69, 348-350.—The paper is an illustrated description of the mill which aims to do custom work on gold ores. It contains 5 ore-receiving bins of 20 tons' capacity, a Blake crusher 9 × 15 in., an elevator, a pair of rolls, a Vezin mechanical sampler, 4 storage bins with a capacity of 25 tons sowing 4 five-stamp batteries, a hydraulic seizer, 4 double-deck Wilfley tables, 4 cyanide tanks of 100 tons' capacity with the necessary zinc boxes, storage tanks, etc. The mill has a capacity of 60 tons in 24 hours, and is driven by an 80 horse-power engine, steam being furnished by two 50 horse-power boilers.

Hydraulic Amalgam Squeezer. BY FRAZER AND CHALMERS. *Eng. Min. J.*, 69, 499.—This apparatus, in use at the Treadwell mill, Douglas Island, Alaska, serves to free the gold amalgam collected from the mortar, plate, etc., more effectively from the surplus quicksilver than is possible when done by hand.

A Clean-up Trolley for Gold Mills. BY FRAZER AND CHALMERS. *Eng. Min. J.*, 69, 436.—This device consists of a trolley with cages and bucket. It is used for handling amalgam, shoes, dies, etc., during a clean-up, and thus facilitates the work and permits the collecting and cleaning of the amalgam to be done in one room under proper supervision.

Oxygen in the Cyanide Process. BY W. JONES. *Eng. Min. J.*, 69, 404.—The author emphasizes the necessity of supplying cyanide solutions with air, if they are to extract gold from slimes that have been stored for some time and thus have become contaminated with organic matter.

GENERAL AND PHYSICAL CHEMISTRY.

A. A. NOYES, REVIEWER.

Physical Reactions and the Mass Law. BY AZARIAH T. LINCOLN. *J. Phys. Chem.*, 4, 161-187.—A large part of the article is devoted to a summary of the previously published considerations of Bancroft (*Phys. Rev.*, 3, 21), who assumed that certain cases of heterogeneous physical equilibrium can be expressed by exponential formulas somewhat analogous to those which the Mass Action Law requires in the case of homogeneous chemical equilibrium. Thus, the quantities x and y of two non-miscible liquids which are present in a homogeneous mixture of them with a definite constant quantity of a third liquid miscible with both, at the point when separation into two layers just begins to take place, are assumed to be related to each other, in the way expressed by the equation $x^n y = C$, where n and C are arbitrary constants which may have any positive value whatever. In order to confirm the idea that this formula is not merely an empirical one, but is the expression of a "newly discovered Law of Nature," the author shows by experiments more accurate than those previously published that the formula does express, in most cases with a difference of less than one-third of a per cent. between the found and calculated values of one of the components, the condition of equilibrium between benzene, water, and ethyl alcohol at the point of saturation. The reviewer must, therefore, again call attention to the fact (see *Tech. Quart.*, 8, 306) that any two-phase heterogeneous equilibrium is determined by the composition of *both* phases, and that if the composition of both of them is variable, as is the case in the example above cited, a formula like that proposed which takes into account the composition of only one of them *can* have only an empirical significance.

On the System Water, Phenol, and Hydrochloric Acid. BY W. H. KRUG AND FRANK K. CAMERON. *J. Phys. Chem.*, 4, 188-192. The authors have determined the temperature at which solid phenol separates from the liquefied phenol layer formed when solid phenol is placed in contact with water and aqueous solutions of hydrochloric acid of various concentration. The freezing-point of the phenol was 1.365° with the pure water, and 17.195° with the most concentrated hydrochloric acid used, which contained 131.3 grams per liter. The results have no quantitative significance from a theoretical standpoint, for the authors have chosen for their investigation a phenomenon which is the resultant of two independent effects—first the reduction of solubility of the water in the phenol by the hydrochloric acid dissolved in the water,

and second, the lowering in melting-point of the phenol by the water dissolved in it.

On Two Theorems of Gibbs. BY PAUL SAUREL. *J. Phys. Chem.*, 4, 193-199.—The author shows that Gibbs' equation expressing the relation between changes of pressure and temperature in a univariant system is equivalent to the Clapeyron-Clausius formula, whatever may be the number of components; and that Gibbs' equation for bivariant systems can, when certain conditions are satisfied, likewise be brought into the same form.

The Relation of the Taste of Acids to Their Degree of Dissociation. II. BY THEODORE WILLIAM RICHARDS. *J. Phys. Chem.*, 4, 207-211.—The author shows that the facts previously noted by several investigators that weak acids and acid salts have, in comparison with hydrochloric acid, a much sourer taste than is consistent with the assumption of proportionality between sourness and concentration of the hydrogen ions, is readily explained in accordance with the dissociation theory, contrary to the belief of Kahlenberg (*this Rev.*, 6, 73), if it be assumed that the act of tasting removes hydrogen ions and that these are replaced by the production of new ones, at the expense of the undissociated acid or acid salt. This same explanation has been independently suggested by the reviewer (*this Rev.*, 6, 73).

Isohydic Solutions. BY WILDER D. BANCROFT. *J. Phys. Chem.*, 4, 274-289.—It is shown that the Mass Action Law requires that there be a displacement of the equilibrium of any reaction: $aA + bB + \dots + mM = a_1A_1 + b_1B_1 + \dots + m_1M_1$ by the addition to the mixture of any volume of one of the substances, such as A_1 , even if the concentration of the latter in the volume added is equal to that of it in the original mixture, *except* in the case where $a + b + \dots + m = b_1 + \dots + m_1$. If the right-hand member of this expression is *greater* than the left-hand member, the right-hand system will increase in concentration; if *less*, it will decrease. The author applies the principle theoretically to a number of special cases of gaseous and electrolytic dissociation. Gaseous ammonium carbamate may be here cited as an example: in this case $a + b + \dots + m = 1$ and $b_1 + \dots + m_1 = 1$ if ammonia is added to the equilibrium mixture, and $b_1 + \dots + m_1 = 2$ if carbon dioxide is added; consequently there will be no change in the equilibrium in the former case, and an increase in the dissociation (or amount of carbamate volatilized) in the latter. This principle is especially applied to the dissociation of diionic salts, which, as previously pointed out by Storch, are not subject to the simple laws of isohydic solutions by reason of the fact that the exponents occurring in the expression of the empirical dilution law are appar-

ently, at least, not identical with those required by the Mass-Action Law. The author calculates from the empirically determined exponents that on mixing hundredth-normal solutions of potassium and sodium chlorides the dissociation, and therefore the conductivity, of each salt should be reduced over one per cent. An experiment made by A. T. Lincoln showed that, instead of the theoretical decrease, an increase of 0.8 per cent. occurs.

ANALYTICAL CHEMISTRY.

ULTIMATE ANALYSIS.

H. P. TALBOT, REVIEWER.

The Technical Estimation of Zinc. BY ALBERT H. LOW. *J. Am. Chem. Soc.*, 22, 198-202.—The ore is treated with nitric acid, first with the addition of potassium nitrate, later with that of a cold saturated solution of potassium chlorate in nitric acid, and the whole is evaporated to dryness. The residue is treated with an ammoniacal solution of ammonium chloride, the filtered solution made acid with hydrochloric acid, and, after the removal of the copper and cadmium by sulphuretted hydrogen, the zinc is titrated for by means of potassium ferrocyanide solutions, using uranium nitrate as an indicator. When cadmium is absent, the copper may be thrown out by means of test lead.

The Repeated Use of the Double Chloride of Copper and Potassium for the Solution of Steel or Iron in Estimating Carbon. BY GEO. WM. SARGENT. *J. Am. Chem. Soc.*, 22, 210-213.—The author finds that if chlorine is passed into the double chloride solution after it has been used to dissolve iron, it regains its color and is more energetic in its solvent action than when freshly prepared. As many as eleven portions of drillings have been treated successfully with the same solution, by regenerating it each time after use. Oxidation by means of an air current, or by electrolytic methods, was less successful than that brought about by passing chlorine gas into the solution.

Notes on Selenium and Tellurium. BY EDWARD KELLER. *J. Am. Chem. Soc.*, 22, 241-245.—A method for the quantitative separation of selenium and tellurium is based on the fact that sulphur dioxide will throw down selenium alone from cold solutions of the two elements containing about 80 per cent. by volume of concentrated hydrochloric acid, or one hundred times as much acid as tellurium.