

now generally considered most effective. The horizontal board was hexagonal, six feet in diameter (radius of the inscribed circle), surrounded by a vertical rim which extended six inches below the plane of the board. It was supported at a height of a little more than two feet above the head of the speaker.

After a considerable number of preliminary trials, all of the same general character, a final comparative test was conducted as follows:

Eight hearers assisted, distributed through seats *G*, *N*, *U*, and the gallery. The speaker stood in his appointed place, and read a list of disconnected words from a spelling book, while each hearer noted down the number of words not understood. The speaker then read a short passage, of a known number of words, from the chosen oration, the hearers noting, as before, the words missed. The hearers then changed places, those in *G* going to *N*, those in *N* to *U*, etc., and again a list of words was read from the spelling book, and a passage from the oration. This was continued until each of the eight hearers had sat in each of the assigned seats. The number of words understood by a hearer in a given seat in any one trial was expressed as a percentage of the whole number read during that trial. The average of the percentage numbers for all the eight hearers was taken as the acoustic efficiency of the seat.

Two such sets of experiments were made, the speaker standing, in experiment I., at the front edge of the chancel floor, in the middle; in experiment II., in the pulpit, under the sounding board.

	<i>G</i>	<i>N</i>	<i>U</i>	Gallery
Unconnected words:				
I. On chancel floor..	96	89	80	66
II. In pulpit.....	98	91	82	62
Connected discourse:				
I. On chancel floor..	99+	98+	95	80
II. In pulpit.....	100	99	96	80

The two sets of experiments should be strictly comparable, as they were made in the same afternoon, and involved the same speakers and the same hearers in the same places. The results follow. The figures represent in

each case the average percentage of words understood by the eight hearers.

These results seem to show that the beneficial effect of a sounding board in this place is very small or inappreciable. This is perhaps no more than was to be expected, for it is difficult to give any reason why a sounding board should greatly diminish the reverberation in an auditorium.

The experiments described afforded a considerable amount of other information, with regard to the most advantageous pitch of the speaker's voice, the rate of speaking, and other phases of the subject, but as such results would apply only to the auditorium studied and would have no general value, they have not been discussed.

FRANK P. WHITMAN

WESTERN RESERVE UNIVERSITY,
October 25, 1913

THE AMERICAN CHEMICAL SOCIETY
ROCHESTER MEETING

III

DIVISION OF PHARMACEUTICAL CHEMISTRY

B. L. Murray, *Chairman*

F. R. Elred, *Secretary*

B. L. MURRAY: *Chairman's Address. Legislation Affecting Pharmaceutical Chemistry.*

A. W. BENDER: *The Determination of Mercuric Iodide in Tablets.*

Several methods and modifications of methods were tried on the tablets with very unsatisfactory results. The difficulty experienced was due in a large measure to the other ingredients in the tablets, namely, terra alba, potato starch, talc and gelatine. The method which was finally found to give satisfactory results is a modification of the sulphide method.

The method consists in dissolving the mercuric iodide by the use of HCl and KClO₃, filtering, making the filtrate alkaline with ammonia, and precipitating with H₂S.

The method was also found to be useful for the assay of mercuric iodide and oleate of mercury.

J. B. WILLIAMS: *The Insecticidal Value of Fluid Extract of Larkspur Seed.*

Fluid extracts of larkspur seed on the market at the present time show great variation in physical, chemical and insecticidal properties.

Fluid extracts obtained by extracting the seed

with various menstrua, assaying for fixed content and alkaloidal strength and testing insecticidal value on bed-bugs indicate that this preparation owes its insecticidal value more to the fixed oil content than to its alkaloidal strength.

H. V. ARNY and H. H. SCHAEFER: *The Ferric Alum Estimation of Casein.*

CHARLES BASKERVILLE: *Some Physico-chemical Considerations in Reference to Inhalation Anesthetics.*

F. O. TAYLOR: *Amyl Nitrite, Its Preparation, Purity and Tests.*

LOUIS HOGREFE: *The Chemico-legal Interpretation of United States Pharmacopœia.*

Deals with the interpretation of the National Pure-food Law, wherever it is based on the United States Pharmacopœia, especially with the interpretation of the term "drug" as defined by the law, and as understood by the U. S. P. Also the interpretation of "adulteration" as defined by the law. The paper also considers the tests laid down by U. S. P., and their interpretation according to law. Taken as a whole the paper is a brief of sec. 6 and sec. 7 of the pure-food law, as construed by the writer, alike a member of the legal profession and the profession of chemistry.

GASTON DUBOIS: *The Chemistry and Properties of Glycerophosphates.*

A. R. L. DOHME and H. ENGELHARDT: *Purity of Chemicals and Quality of Vegetable Drugs during 1912.*

H. ENGELHARDT and O. E. WINTERS: *Spirit of Nitrous Ether.*

GEO. O. BEAL and EDW. A. GLENZ: *The Composition of the Fruit of the Virginia Creeper, Ampelopsis quinquefolia.*

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

G. D. Rosengarten, *Chairman*

Geo. P. Adamson, *Vice-chairman Presiding*

S. H. Salisbury, Jr., *Secretary*

NORMAN A. DUBOIS: *The Protection of Iron and Steel by Paint Films.*

The theories of corrosion of iron and steel are noted and briefly considered from the standpoint of the paint technologist.

Experiments are described to illustrate the greater protecting qualities of paint films rendered less permeable to the corrosion accelerating gases of the atmosphere. Photographs are shown of exposure tests illustrating the relative increased protection of films containing diffusion retarders.

PERCY H. WALKER and S. S. VOORHEES: *Some Tests of Paints for Steel Subjected to Alternate Exposure to Air and Fresh Water.*

Fifteen paints were included in this series of tests. The tests being designed to compare pigments, the same oil and drier were used throughout. The paints were made up to a definite viscosity and applied to cleaned steel at definite spreading rates. After thorough drying the plates were placed in tanks which were filled with water each afternoon and emptied each morning. Tests were all in triplicate and all represented one, two and three coat work. Details of method of preparation of paints and plates, of painting, exposing and of inspection are given.

CHARLES H. HERTY and C. W. WILLIARD: *The Effect of Resene on Soap Solutions.*

CHARLES H. HERTY and J. O. GRAHAM: *Isoprene from Commercial Turpentine.*

HARRY MCCORMACK: *The Milling of Wheat and Testing of Flour.*

HARRY MCCORMACK: *A New Design of Coke Oven and a New Method of Coking.*

H. C. ALLEN: *The Electrolytic Reduction of Iron for Permanganate Titration.*

J. C. HOSTETTER: *A Method for the Determination of Magnesium in Calcium Salts.*

The essential part of this method is the concentrating of the Mg into a precipitate which contains but a small amount of Ca; after this, the ordinary methods of separation may be employed. This concentrating is effected by precipitating the Mg as $Mg(OH)_2$ with excess of solid $Ca(OH)_2$. The neutral chloride solution of the Ca salt (10 g. to 100 per cent.) is treated with the CaO made by igniting 0.5 gram $CaCO_3$; the solution is heated to boiling and then filtered. The precipitate is dissolved in HCl ; the Ca, etc., removed by a double precipitation with NH_4OH and $(NH_4)_2C_2O_4$; and the Mg determined in the filtrate by precipitating as ammonium magnesium phosphate. Determinations of Mg in some 30 highest grade Ca salts are given.

E. S. MERRIAM: *Methods for the Examination of Natural Gas for the Production of Gasoline.*

The natural gas used for the production of gasoline is a mixture of the first 5 or 6 hydrocarbons of the paraffine series. The exact analysis of such a mixture seems possible only by fractional distillation at very low temperatures.

By determining the solubility of the gas in kerosene empirical relations between solubility and actual yield can be established.

By use of a weighed absorption vessel filled with

olive oil, the mean molecular weight of part of the condensable hydrocarbons can be calculated.

Chemical methods are not wholly satisfactory. A small laboratory compressor holding 4 liters of gas and capable of withstanding pressures up to 500 lbs. is described. By its use the yield of liquid gasoline obtainable from any gas under any working conditions of temperature and pressure can be determined quite accurately.

GEORGE A. BURRELL and FRANK M. SEIBERT: *The Condensation of Gasoline from Natural Gas.*

SIDNEY D. WELLS: *Some Experiments on the Conversion of Long-leaf Pine to Paper Pulp by the Soda and Sulphate Processes.*

One hundred and fifty small autoclave cooks were made to study the influence of various factors in the cooking operation of the sulphate process. It was found that the more caustic soda or sodium sulphide, in use, the greater the concentration, the higher the temperature and the longer the time of cooking, the lower the yields of pulp and the lighter and easier to bleach. Caustic soda had twice the reducing power possessed by sodium sulphid.

Nineteen larger semicommercial cooks were made and with a yield of pulp of 49 per cent. of the dry weight of the wood a kraft paper was made stronger and tougher than the usual imported kraft papers. Paper could be made from soda pulps of the same wood as strong but not as tough and the yields of pulp were much less.

CHAS. P. FOX: *Syrian Autoburning Limestone.*

Examination of a sample of Syrian self-burning limestone, obtained from U. S. Consul Whiting at Jerusalem, Palestine, and described by him in *Daily Consular Report* of July 21, 1911.

This rock belongs to the fossiliferous bituminous limestone formation of the Hauran district in the upper Jordan Valley.

In this section lime burning, on account of the quantity of raw material, quality of product and low cost of production, is an important industry.

Analysis of sample shows calcium carbonate, phosphoric acid, nitrogen, sulphur and organic matter, a portion of which is of asphaltic nature.

The original limestone has a fuel value equal to one fourth that of good coal. When properly prepared it forms a *compounding material* suitable for use in the production of black rubber goods.

The presence of notable quantities of plant food associated with the physical characters of the rock classifies it as an important soil maker, a fact proven by the rich grain fields of Syria.

CHAS. F. FOX: *An Improved Laboratory Burner.*

A description, illustrated by photograph, of a

useful attachment (combined wind shield and crucible support) for laboratory burners.

J. CULVER HARTZELL: *The Correlation of Chemical, Structural and Thermal Analyses of Steels.*

In this paper the author presents the subject from the viewpoints of pure and applied science. In a recent trip which occupied several weeks, the author made a study of testing laboratories and heat-treatment plants and was impressed with the necessity of a better correlation of laboratory results with works results. Refinement of laboratory technic must be maintained; but there is need of better recognition of the limits of refinement in the hardening-room and high-speed-steel furnaces. While the latter should be brought up to and maintained at their highest efficiency, the refinement of the laboratory should not be expected; but the instructions sent down from the laboratory should contain reasonable working limits compatible with the best practical results obtainable.

E. LEHMAN JOHNSON: *If the Chemists Manufactured Cotton-seed Meal.*

If chemists, familiar with the need of balancing rations, had the exclusive manufacture of cotton-seed meal, instead of turning out a product altogether too rich, too concentrated, for ordinary feeding of any kind, as the southern cotton-oil mills are doing, they would make it in more sensible, more scientific fashion, more nearly like the cereals, corn and oats.

To insist, as some states already do and the national government is trying to do, upon compelling a high protein or nitrogen content of cotton-seed meal (higher than linseed meal, for instance) is an arbitrary abuse of power, good for neither producer, manufacturer or consumer. All three of these classes should look to the chemist for guidance in this matter, not to old habit or prejudice.

IRVING C. ALLEN: *The American Petroleum Society.*

IRVING C. ALLEN: *Flash Testing.*

HORACE C. PORTER and O. C. RALSTON: *A Study of the Oxidation of Coal and of the Process of Combustion.*

The rate of oxidation was studied for different kinds of coal at temperatures from 40° to 200° C. Large differences in rate were found which are in general parallel to the differences in inflammability and ease of ignition. The rapid increase of rate with rising temperature was shown. A study was made also of the products of oxidation, and evidence obtained which strongly supports the theory of the preliminary formation, in the early stage of combustion, of an addition complex of coal

with oxygen. This complex is unstable and decomposes by rise of temperature so as to form water, CO_2 and CO . Below 200°C . water is the principal product of the oxidation of coal. Carbon dioxide and carbon monoxide are formed in increasing amounts at 110°C . and above, by decomposition of the intermediate complex.

The bearing of the results on deterioration and spontaneous combustion, inflammability of coal dust, methods of analysis of coal, and problems of mine ventilation and mine fires is brought out.

DIVISION OF PHYSICAL AND INORGANIC CHEMISTRY

S. L. Bigelow, *Chairman*

R. C. Wells, *Secretary*

R. C. WELLS: *Observations on the Electrochemical Behavior of Minerals.*

It has been found that pyrite, which is a common constituent of most ore deposits, is capable of functioning to some extent as an unattackable electrode, so that chemical differences between solutions in ore deposits may be equalized through electrical action over appreciable distances as well as by direct mingling of the solutions. Such action would, however, require some sort of a liquid circuit in addition to the conducting mineral. A solution of sodium sulphide in contact with pyrite constitutes an anode combination of sufficient power to precipitate gold, silver, mercury and copper from their soluble salts upon a cathode of pyrite in an arrangement like a "chemometer." In fact, pyrrhotite and chalcocite in water alone suffice as anodes for the same purpose. The action of the more attackable minerals is due principally to their own solution-products so that the additional effects possible with unattackable electrodes are less marked.

EUGENE C. BINGHAM: *Fluidity and van der Waals's Equation.*

Batschinski³ has proved that the fluidity ϕ of an unassociated liquid is a linear function of its volume (v) only, up to the critical temperature, i. e., $v = \omega + c\phi$, where ω is a constant which is the sum of the atomic constants, and c is a constant which may be calculated. Substituting this value into the equation of van der Waals we obtain a relation between the fluidity of a liquid and the temperature and pressure

$$T = \frac{pk}{R}\phi + \frac{p}{R}(\omega - b) - \frac{a/Rc}{\phi + \omega/c} + \frac{ab}{R(\omega + c\phi)^2}$$

and all of these constants may be obtained without

³ *Ann. Soc. d'encourag. sciences exper.*, Supplement, 3, 1913.

further viscosity measurements. Hence it is theoretically possible to calculate the fluidity of any non-associated liquid as soon as its expansion coefficients are sufficiently well known.

It can be shown that the above formula works out admirably in practise. Since in ordinary viscosity measurements, the pressure is constant and the last term of the equation may be neglected, we have

$$T = A\phi + C - \frac{B}{\phi + D},$$

where A , B , C and D are constants. An equation of this form will reproduce⁴ the observed fluidities of the 85 substances measured by Thorpe and Rodger with a mean deviation for no substance equal to 0.1 per cent. In fact for most substances D may be made equal to zero, and satisfactory results obtained with the simple formula

$$T = A\phi + C - B/\phi.$$

The measurements of Phillips⁵ confirm the view that the ϕ , p , T curves are similar to the familiar v , p , T curves up to the critical temperature. Beyond the critical temperature ϕ does not increase as the pressure is lowered, as is true of the volume. This leads to interesting and hitherto unnoticed relations between "collisional" and "diffusional" viscosity.

E. C. MCKELVY and F. A. WERTZ: *The Solubility of Water in Hydrocarbons.*

The critical solution temperature in certain systems of two liquids varies greatly with small additions of moisture. Solubility curves were determined for the systems methyl alcohol-turpentine, methyl alcohol-ligroin and ethyl alcohol-kerosene, with the dry hydrocarbons. The curves showing the variation of the maximum with small additions of water were then plotted. The hydrocarbons being saturated with water at any given temperature, the critical solution temperature found gives from these curves the amount of water dissolved in the oil. Calcium chloride was found to be most effective in drying the oils without otherwise changing their composition.

L. M. DENNIS and B. J. LEMON: *Electrolysis of Solutions of the Rare Earths.* (Lantern.)

WILDER D. BANCROFT: *Action of Light on Copper Sulphate Solution.*

WILDER D. BANCROFT: *Catalysis of Acetic Acid.*

E. C. MCKELVY: *The Critical Solution Temperature and Its Use in the Estimation of Moisture.*

The variation of the critical solution temperature of two liquids on the addition of a third com-

⁴ *Zeitschr. f. phys. chem.*, 66, 238 (1909).

⁵ *Proc. Roy. Soc. London*, 87A, 56 (1912).

ponent has had very little application in analytical chemistry. The solubility curve of the system ethyl alcohol-kerosene has been determined and the curve, showing the variation of the maximum with small additions of water, plotted. The change for 1 per cent. is 17.05° , but the variation is not quite linear. With careful manipulation the critical solution temperature can be determined repeatedly to 0.01° and so may be used to indicate a change of less than 0.001 per cent. in the water content of the alcohol. If the moisture in the substance to be examined can be transferred to anhydrous ethyl alcohol by some suitable means, a very delicate quantitative method is at hand. Since ethyl alcohol forms a mixture of minimum boiling point containing about 5.5 per cent. water, all alcohols, containing less than this amount of water, will tend to distil off between 78.0° and 78.3° . Distillation of the moist substance with anhydrous alcohol would be effective for the transfer of the moisture. Standing with the alcohol at room or higher temperatures might answer with certain substances. The method has been used in moisture determination in coal, wool, cotton, starch, sugar and offers possibilities in the examination of food products, soap, gelatin, shellac, oils, various textiles, etc.

GEORGE A. PERLEY and G. F. LANE: *The Analysis of Basic Lead Sulphates.*

EDGAR T. WHEERY: *Variations in the Compositions of Minerals.*

The old definition of a mineral species as a definite chemical compound is, in the light of recent work, no longer tenable. Instead it should be: a natural substance whose chemical and physical properties are constant within certain limits which vary considerably from one case to another. Colloid minerals may vary by reason of adsorption; meta-colloids (colloids which have become crystalline) and crystalline ones by isomorphous replacement, solid solution and sub-microscopic intergrowth. The group of ferric phosphate minerals is discussed as an illustration.

PAYSON BARTLETT: *The Increase in the Oxidizing Potential of Dichromate Ion on Platinum Caused by Certain Reducing Agents. An Improved Method for the Electrometric Titration of Ferrous Salts.*

Certain reducing agents increase the oxidizing potential of the dichromate ion on platinum by amounts up to two tenths of a volt. No other oxidizing agent was found which would give a similar effect.

The potential continues to increase up to the

very endpoint of the reaction and is highest when the dichromate concentration is least. A final drop of 0.1 normal reducing agent often depresses the potential by half a volt.

The duration of the effect varies with the reducing agent used from a few seconds to many hours. Chlorides are fatal to the permanency owing apparently to a side reaction.

The phenomenon may be plausibly explained by assumptions of catalytic action.

An improved apparatus and method for titrating dichromate and ferrous salts, based on the phenomenon, is suggested.

When the endpoint of this reaction is determined with a ferrieyanide indicator, 0.0003 gram excess of ferrous iron in each hundred cubic centimeters of solution is present when the blue color barely develops within thirty seconds.

W. S. HUBBARD: *Equilibrium between Pyridine, Silver Nitrate and Water.*

While working on a silver-plating bath where pyridine was used instead of cyanide, it was noticed that under certain conditions of concentration and temperature long silky, needle-shaped crystals separated out. Brewer⁶ found that there were three well-defined compounds formed with pure pyridine and silver nitrate, but their description in no way resembles the one found in this case.

With 3 c.c. pyridine, 5 gm. silver nitrate and made up to 100 c.c. with water, the crystals form at 19.70° C. Using 4 c.c. of pyridine, they form at 25.35° , with 5 c.c. they separate at 27.35° and with 6 c.c. pyridine at 27.75° .

The exact composition has not been determined, but the method will be to determine the total nitrogen and nitrate nitrogen and then determine the silver electrolytically. The water can then be determined by difference or by drying in a desiccator since it thus loses its water of crystallization and becomes a fine powder. However, some of the pyridine might thus be lost.

PHILIP ADOLPH KOBER: *New Precipitants for Copper.*

Two new precipitants for copper are proposed which form very insoluble compounds of copper (less than .6 part in one million remain unprecipitated). These are amino acids, phenylglycine and normal amino caproic acid which may be useful in estimating Fehling's and other solutions for unreduced copper and in removing copper quantitatively from substances which interfere with its idiometric titration.

⁶ *J. Phys. Chem.*, 12, 283.

E. W. WASHBURN and S. J. BATES: *The Electrochemical Equivalent of Iodine and the Value of the Faraday.*

H. C. P. WEBER: *The Reduction of Chromium Chloride.*

T. W. B. WELSH and H. J. BRODERSON: *Anhydrous Hydrazine as a Solvent.* (Presented by A. W. BROWNE.)

The solubility of 120 elements and compounds in anhydrous hydrazine was studied. Of the metallic elements employed, the alkali metals are the only ones appreciably acted upon and dissolved. The solubility of the halogen compounds increases with increase in the atomic weight of the halogen. The chlorides of the alkali metals are the least soluble. Carbonates and oxides are, as a rule, insoluble. Nitrates are generally soluble. Sulphates and sulphides are insoluble. Ammonium compounds are soluble with the exception of the tertiary phosphate. The solution of ammonium salts is accompanied by *hydrazinolysis* with evolution of ammonia. A large number of compounds dissolve, and at the same time react with the solvent.

T. W. B. WELSH and H. J. BRODERSON: *Chemical Reactions in Anhydrous Hydrazine.* (Presented by A. W. BROWNE.)

Metathetical reactions take place between soluble salts of zinc, or cadmium, and hydrazine sulphide, with formation of the metallic sulphides. In fact, solutions of these salts in anhydrous hydrazine may be titrated with solutions of hydrazine sulphide, using the brownish-yellow color of the latter as indicator. By the action of the *hydrazo-base*, sodium hydrazide, upon zinc chloride in hydrazine solution, a solid which is in all probability zinc hydrazide, is precipitated. Hydrazobases are neutralized in hydrazine solution by hydrazine salts, which under these conditions act as acids. For example, sodium hydrazide reacts with hydrazine chloride, yielding sodium chloride and hydrazine. Metallic sodium will precipitate metallic cadmium, zinc and iron, from solutions of their salts.

T. W. B. WELSH: *Electrolysis of Solutions of Sodium Hydrazide in Anhydrous Hydrazine.* (Presented by A. W. BROWNE.)

Solutions of sodium hydrazide (prepared by the action of either sodium amide or metallic sodium upon hydrazine) in anhydrous hydrazine have been electrolyzed, in absence of air and moisture, under such conditions as to permit measurement

and analysis of the gases evolved at the electrodes. In general nitrogen and hydrogen were obtained at both electrodes. For each gram atom of copper deposited on the coulometer cathode, from 1.1 to 1.5 gram atoms of nitrogen were liberated at the anode when the electrolyte was dilute, and from 2.1 to 2.6 when the concentration was higher. A blue color due to metallic sodium was in some experiments transitorily observed at the cathode. A characteristic yellow coloration was (reversibly) obtained in the neighborhood of the cathode.

A. R. HITCH: *Electrolysis of Silver Trinitride in Liquid Ammonia.*

A. R. HITCH: *Thermal Decomposition of Various Trinitrides.*

HAROLD EATON RIEGGER: *The System Hydrazine Trinitride, Hydrazine.* (Presented by A. W. BROWNE.)

It has been found possible to prepare hydrazine trinitride (first prepared by Curtius) by each of three methods: (a) Interaction of anhydrous hydrazine and ammonium trinitride, (b) interaction of anhydrous hydrazine and anhydrous hydrogen trinitride, and (c) interaction of alcoholic hydrazine and ethereal hydronitric acid. A convenient method for the analysis of the compound has been formulated, and certain of its properties and reactions have been studied, including the behavior of the substance when heated in a sealed tube to 100°. The substance is very soluble in anhydrous hydrazine, and soon deliquesces when exposed to hydrazine vapor. A study of the solubility (T, X) curve for the system hydrazine trinitride; hydrazine yielded results that point toward the existence of a monohydrazinate of the formula $N_2H_4N_3 \cdot N_2H_4$, and to the probable existence of at least one higher hydrazinate.

W. J. MARSH: *Action of Various Oxidizing Agents upon Hydrazine in Liquid Ammonia Solution.*

The behavior of free hydrazine in liquid ammonia at -33° toward potassium permanganate, manganese dioxide, mercuric oxide (yellow), ammonium persulphate, sodium peroxide, ferric oxide, potassium chlorate, potassium iodate and ammonium perchlorate, respectively, has been studied with the aid of a modified nitrometer. All but the last three of these substances oxidize the hydrazine more or less rapidly, with formation of nitrogen and water as the oxidation products. Potassium permanganate is quantitatively reduced to manganous hydroxide and potassium hydroxide. In several cases the gas was evolved in two distinct

stages, the second stage occurring at a temperature somewhat above -33° . This may be attributable to the decomposition in successive stages of the oxidizing agent used, or possibly to the formation and subsequent decomposition of certain complex hydronitrogens as unstable intermediate products.

FRITZ FRIEDRICH: *Critical Phenomena in Binary Systems*. (Presented by A. W. BROWNE.)

FRITZ FRIEDRICH, A. E. HOULEHAN and L. J. ULRICH: *The System Ammonium Sulphate, Ammonia*. (Presented by A. W. BROWNE.)

FRITZ FRIEDRICH: *The System Mercuric Chloride, Ammonia*. (Presented by A. W. BROWNE.)

L. J. ULRICH: *The System Ammonium Iodide, Ammonia*. (Presented by A. W. BROWNE.)

G. J. FINK: *The System Ammonium Chloride, Ammonia*. (Presented by A. W. BROWNE.)

G. J. FINK: *The System Copper Sulphate, Ammonia*. (Presented by A. W. BROWNE.)

A. S. YOUNT: *The System Silver Trinitride, Ammonia*. (Presented by A. W. BROWNE.)

J. W. TURRENTINE: *The Structure of the Trinitride Radicle*.

SYMPOSIUM ON PHOTOGRAPHIC CHEMISTRY

This symposium was held at Kodak Park. Papers were presented as follows:

GEO. A. PERLEY: *The Production of Direct Photographic Positions*.

P. G. NUTTING: *Practical Sensitometry*.

Photography sensitometry is the determination of the relation between blackening and exposure. Blackening is measured as density $D = -\log$ transmission. Exposure is properly in ergs per sq. cm. of a specific wave-length but in meter-candle-seconds involving properties of the eye. The Hurter and Driffield curve, density against log exposure gives the two chief characteristics—speed and contrast sensibility. Plates are fast or slow, hard or soft working according to the shape of this curve.

Works tests are made by printing through a tablet of gray and colored squares of graduated density. Laboratory tests are made by exposure to a standard white light behind a rotating sector disk giving exposures of 1, 2, 4, 8 . . . 256, M-C-S. Densities are measured on a special photometer. High precision sensitometry requires many refinements of coating, exposure, development, etc.

S. E. SHEPPARD: *Some Applications of Quantitative Absorption Spectroscopy in Chemistry*.

Making use of the relations:

(i) $I_{\lambda} = I_0 a^{cd}$ (Beer-Lambert law), where I_{λ} = intensity of monochromatic light wave-length λ transmitted by an absorbing layer of thickness d cm., and of concentration c in grammes per liter, I_0 = intensity of light incident on same, a = a constant, the transmission-coefficient.

(ii) $M = C/a$ (Vierodt's equation), where M = molecular absorption ratio,

C = concentration in gram-molecules per liter,

a = transmission-coefficient of (i).

Then the absorption of light can be determined quantitatively in regard to both color (wave-length of light waves) and concentration of reacting molecules. The principal applications considered were as under:

(a) Analytical determination of amounts of dye-stuffs and colored salts in solutions.

(b) Technical: adjustment of ray-filters.

(c) Theoretical: application to problems of molecular constitution, of "solutions" and of photo-chemical change.

L. A. JONES: *Some Notes on the Cylindrical Acetylene Flame as a Standard of Light*.

A good reliable standard light source is a necessity in photographic sensitometry. The old-style acetylene flame is not very satisfactory for this purpose, on account of its sensitiveness to air currents and the liability to parallax errors. A newer type of standard acetylene burner designed by Dr. Mees and Dr. Sheppard gives a cylindrical flame much more steady and reliable than the flat flame.

Careful photometric measurements made on this improved burner show that when properly adjusted the intensity of light is constant even when the gas pressure varies considerably. The results indicate also that with proper care in construction, especially in the width of slit used as screening diaphragm, different burners can be made that will give the same light intensities to within 3 or 4 per cent.

The investigation is not complete as yet, but unless unexpected difficulties arise, this form of burner will undoubtedly be found very satisfactory as a standard light source for sensitometric work.

ORIM TUGMAN: *The Sensitiveness Curves of Photographic Plates Exposed to X-Rays*.

According to the equation given by Hurter and Driffield for the relation between the exposure and the development density in photographic plates the density of a plate exposed to X-rays should be directly proportional to exposure because the ca-

capacity of the film to X-rays is negligibly small.

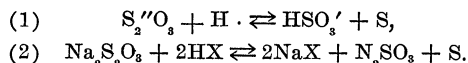
A series of exposures of three kinds of plates (Seed 23, 30 and X-ray) to light and X-rays have been made to determine this point. In all the fifteen exposures to X-rays the curves showing density against log exposure were practically similar to the curves obtained by light exposure. The equation

$$D = \gamma (\log E - \log i)$$

was found to fit the straight part of the curves as well as for light curves.

A. S. MCDANIEL: *The Theory of the Acid Fixing Bath.*

The amount and nature of free acid which can be added to a thiosulphate fixing bath is shown to be dependent upon the equilibrium conditions of either or both of the following reversible reactions, one of which takes place between ionized, the other between undissociated molecules:



According to equation (1) the absolute concentration of the hydrogen ions can be increased only by increasing the concentration of the HSO_3 ions at the same rate. Similarly, according to equation (2) the absolute concentration of acid can be increased only by keeping the ratio of the concentration of H_2SO_3 to HX above a certain definite limit, depending upon the solubility of sulphur.

In practise these conditions are fulfilled by adding sulphurous acid or a mixture acid or a mixture of sulphite and acid to the bath.

WILDER D. BANCROFT: *The Latent Image.*

WILDER D. BANCROFT: *Theory of Developer.*

G. B. FRANKFORTER and W. KRITCHEVSKY: *The Action of Chloral and Bromal on the Polycyclic Hydrocarbons in the Presence of Aluminium Chloride.*

G. B. FRANKFORTER and E. B. DANIELS: *The Action of Aluminium Chloride on Aliphatic Ethers.*

DIVISION OF FERTILIZER CHEMISTRY

Paul Rudnick, *Chairman*

J. E. Breckenbridge, *Secretary*

PAUL RUDNICK: *Chairman's Address. Fertilizer Chemistry. A Report of Progress.*

L. A. WATT and W. T. LATSHAW: *On the Use of Alundum Crucibles in the Determination of Phosphoric Acid.*

H. W. HILL and W. S. LANDIS: *The Analysis of Complete Fertilizers Containing Cyanamid.*

PAUL RUDNICK and W. L. LATSHAW: *On the Preparation of Neutral Ammonium Citrate Solution.*

SECTION OF INDIA RUBBER CHEMISTRY

D. A. Cutler, *Chairman*

Dorris Whipple, *Secretary*

D. A. CUTLER: *Chairman's Address. Crude Rubber.*

G. H. SAVAGE: *Some Refinements of the Ignition Method for the Determination of Rubber in Vulcanized Goods.*

WATER SEWAGE AND SANITATION SECTION

Edward Bartow, *Chairman*

HARRY P. CORSON, *Secretary*

EDWARD BARTOW and H. P. CORSON: *Manganese in Illinois Waters.*

The city supplies of Mt. Vernon and Peoria, Ill., contain manganese which has caused serious incrustation in pipes. The Mt. Vernon supply contains .5 part per million of the element while the wells of the Peoria supply contain from .02 to 1.2 parts per million of the element. Samples of incrustation examined contain as high as 38 per cent. of manganese.

EDWARD BARTOW and CLARENCE SCHOOL: *A Comparison of a Calcium Lime with a Calcium-Magnesium Lime for Water Softening.*

Experiments show that during the various stages of water softening there is a difference in the action of a calcium lime and a magnesium-calcium lime. Complete softening depends upon the amount of available calcium oxide which the lime contains.

EDWARD BARTOW and CLARENCE SCHOOL: *The Order of Reactions during the Softening of Water with Lime.*

CHARLES BASKERVILLE: *Ventilation of the Schools of New York City.* (Illustrated.)

FRANK E. HALE and W. MELIA: *Winkler's Method for the Determination of Oxygen in Water; the Effect of Nitrite and its Prevention.*

H. W. REDFIELD and C. HUCKLE: *A Comparative Study of Methods for Determining Sulphur in Peptone.*

Various methods for determining the total sulphur in peptone and for determining a part of the sulphur only have been compared.

For total sulphur the Liebig-Koch method has been found to give the most accurate and most consistent results in peptone; while for determining the easily oxidized part of the sulphur, digestion with a saturated solution of potassium chlorate in nitric acid has proved most valuable.

H. W. REDFIELD and C. HUCKLE: *The Determination of Sulphur in Certain Culture Media.*

A study has been made of the amount of total

sulphur broken down in simple peptone media by the so-called putrefactive bacteria, of the forms of sulphur most readily used by them and of the forms in which the sulphur exists after the action of the bacteria, whether as fixed sulphur, or as loosely bound sulphur, or as easily oxidized sulphur, or as a volatile sulphur compound such as hydrogen sulphide, when culture flasks of different size and shape were used and when air or carbon dioxide was passed over the cultures.

E. M. CHAMOT: *The Value of Testing for Hydrogen Sulphide Production in the Bacteriological Examination of Potable Waters.*

E. M. CHAMOT and H. W. REDFIELD: *A Study of the Best Conditions for Hydrogen Sulphide Production in Peptone Media.*

The method for the detection in water of the bacteria producing hydrogen sulphide has been studied in a systematic manner as regards the concentration of possible ingredients, and a culture medium has been devised by the use of which the time required in which to get evidence of the presence of these organisms has been greatly reduced.

The method furnishes a means of detecting certain organisms which do not produce gas in lactose media, but which are found in sewage-polluted water.

E. M. CHAMOT and R. C. LOWARY: *The Influence of the Composition of Carbohydrate Culture Media on the Amount and Character of the Gases formed by Fecal Organisms.*

E. M. CHAMOT and C. M. SHERWOOD: *A Study of the Stokes Neutral Red Reaction.*

J. CULVER HARTZELL: *Further Notes on Standards of Potable Waters.*

In this paper the author states that he has collected further data on the necessity for regional standards of potable waters, and that the feeling is growing that standards are not only possible and desirable, but necessary.

ATHERTON SEIDELL and PHILIP W. MESERVE: *The Determination of Minute Amounts of Sulphur Dioxide in Air.*

The amounts of sulphur dioxide which it was desired to determine varied from about 1 to 15 parts per million, which is about the concentration just detectible by the odor. Experiments showed that at this dilution, various modifications of the iodine titration methods, involving the use of an excess of iodine and back titration directly or with an excess of thiosulphate and then to appearance of the blue starch color with iodine, were imprac-

tical on account of the variability of the end point when approached in opposite directions. It was found that satisfactory results could be obtained by adding about 5 c.c. of water containing starch paste to the 2,500 c.c. bottle containing the sample and titrating to appearance of the blue starch color with $N/1,000$ iodine. A correction for the blank determination in the bottle containing air free from sulphur dioxide, and one for the apparent incompleteness of the reaction at this dilution must be applied. With these corrections for a 2,500 c.c. bottle, 1 c.c. of $N/1,000$ iodine corresponds to 4.1 parts SO_2 per million. On account of the rapid oxidation of SO_2 to SO_3 , even in bottles as dry as can conveniently be obtained, it is necessary to make the titrations within a short time after collecting the samples. When relatively minute amounts of SO_2 are liberated in rooms and the air actively stirred, less than one half the calculated percentage in the air has so far been found. The complete disappearance of the liberated SO_2 may occur in less than one half hour, depending upon the amount of moisture, nature of walls, etc.

J. W. SALE and W. W. SKINNER: *Comparison of Methods for the Determination of Dissolved Oxygen.*

A comparison of the Winkler and modified Levy methods with the gasometric method for the determination of dissolved oxygen indicates that in pure and moderately polluted saline waters the Winkler method gives accurate results while the Levy method gives results that are too low. The Winkler method also gives closely agreeing results in duplicate and triplicate determinations on such waters, for the most part within .02 c.c. oxygen per liter. Only that modification of the Levy method in which sodium carbonate is used to precipitate the iron salts was compared.

W. D. COLLINS and W. W. SKINNER: *The Quantitative Use of the Spectroscope in Water Analyses.*

By careful attention to details of manipulation described in the paper quantitative results for lithium and potassium may be obtained by use of the spectroscope in very much less time than is required for separation of the alkalis in a water analysis. The errors may be 5-10 per cent. of the amounts determined. The results in connection with other quickly made determinations make possible the furnishing of a fairly complete water analysis with a comparatively small amount of work.

F. L. RECTOR: *Longevity of B. Typhosus in Water.*
CHARLES L. PARSONS,
Secretary