

"make" and each "break" must occur with a constant velocity. The contact must be made and broken suddenly and firmly and there must be no vibration at the contact points.

Martin's key¹ has proved to answer these qualities but is not so compact as the key here described. Erlanger's key² designed to be used as a "knock over" key is not suitable for use except with a pendulum.

Such a large number of keys have been described that one hesitates to add another. It seems, however, that the simplicity of this principle and the ease with which this key may be used merits description.

In this key the well-known principle of induced magnetism is employed. The current for the coils (C and C') is obtained from a dry cell battery (A) so connected through an ordinary push-button key (V) that when one button is down the current passes through one coil (C); when the other button is down the current passes through the other coil (C'). The coils contain soft iron cores (x and x'). One iron core (x) has a brass pin projecting from its center which prevents the steel band

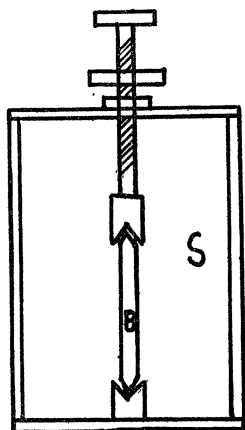


FIG. 2.

(B) from touching the core, thus eliminating any possibility of a "dead center" in the swing of the steel band. The contact points prevent the steel band from touching the other

core. The steel band swings in an adjustable brass socket (S), the details of which are shown in Fig. 2. From the steel band a light spring wire (W) leads to a post (F) thus permitting free swing. For contact points, platinum iridium is used (P and P'). The one (P) is soldered onto the steel band and has a flat contact surface. The other (P') is soldered onto an adjustable brass pin (D) and has a convex contact surface. T and T' are the terminal binding posts from which connections are led to the induction coil. The whole is mounted on black fiber $\frac{3}{8}$ " thick, the connecting wires being imbedded on the under side.

The key has not been tested out with the string galvanometer, but has been used in making calibrations and found to give satisfactory results.

R. E. LEE GUNNING

NORTHWESTERN UNIVERSITY

MEDICAL SCHOOL

THE AMERICAN CHEMICAL SOCIETY

ORGANIC DIVISION

C. G. Derick, *Chairman*

H. L. Fisher, *Secretary*

The Synthesis of p-Cymene Monocarboxylic Acids and of certain of their Derivatives: M. T. BOGERT AND J. R. TUTTLE.

The authors have prepared the two possible ring isomers, cymene 2-carboxylic acid and cymene 3-carboxylic acid, from the corresponding bromo derivatives by the Barbier-Grignard reaction, using CO_2 under pressure, and have studied these acids and the following derivatives thereof: Na, K, Ba, Ca, Cu and Ag salts, methyl and ethyl esters, acid chlorides, amides, anilides, hippuric ester and acid compounds, hydrazides, furo- and thio-diazoles. Small amounts of the 2-acid have been obtained heretofore by other investigators and a few salts have been recorded, but we believe that this is the first time that the acid has been prepared in sufficient amount for more extended study. The isomeric 3-acid appears to be entirely new.

Benzoylene Urea and Some of its Nitro Derivatives: M. T. BOGERT AND G. SCATCHARD.

The preparation of benzoylene urea from anthranilic acid, through o-ureidobenzoic acid, has been improved. The nitro derivatives were prepared either from the corresponding nitro anthranilic acids or by direct nitration of benzoylene urea itself. These nitro benzoylene ureas are struc-

¹ Martin, *Am. Jour. Phys.*, XXIX., 1910, 181.

² Erlanger and Gerrey, *Am. Jour. Phys.*, XXXV., 1914, 384.

turally related to the nitro phenols, and certain of them have been found to be very sensitive indicators for the determination of hydrogen ion concentrations.

A New Group of Azo Dyestuffs: M. T. BOGERT.

It has been shown by various investigators, including the author, that azo dyestuffs may be prepared from quinazolines carrying a primary Bz-amino group, by diazotizing this amino group and coupling the resulting diazo bodies with any of the well-known couplers. It has now been found that quinazolines themselves may function as couplers and, by combination with various diazotized or tetrazotized bases, a new series of azo dyestuffs has been obtained.

Methylene Disalicylic Acid and Derivatives: ROBERT A. HALL.

The Addition Compounds of Phenols with Organic Acids: JAMES KENDALL.

Derivatives of l-Isocamphoric Acid—An Unusual Formation of a Methyl Ether of a Hydroxy Acid: WILLIAM A. NOYES AND GLENN S. SKINNER.

The method employed in the preparation of l-isocamphoric acid was that outlined by Noyes and Knight.⁶ The methyl ester of isoaminocamphonic acid was prepared according to the procedure of Noyes and Littleton⁷ with slight modifications.

The above ester was decomposed with nitrous acid and the following compounds have been found: (1) The methyl esters of two unsaturated acids, (2) the methyl ester of a hydroxy acid, and (3) the methyl ether of a hydroxy acid. Difficulties were encountered in the purification of the products. However, it has been shown without much doubt that one of the unsaturated acids is lauronic acid. The physical constants of the hydroxy acid obtained by saponifying the ester correspond in the main to those of cis-camphonic acid. The keto acid obtained by oxidation of this acid with chromic acid shows a like resemblance to camphonic acid.

The formation of the ether acid under the conditions of the experiment is, so far as we are aware, unparalleled. Its identity has been established by analysis and by the determination of the methoxy group according to the method of Zeisel. Its configuration has not been determined. The study of these compounds is being continued.

Researches on Pyrimidine-Nucleotides. New Developments: TREAT B. JOHNSON.

⁶ *J. Am. Ch. Soc.*, 32, 1669.

⁷ *Ibid.*, 35, 75.

The Action of Ferric Chloride and other Ferric Compounds upon Cellulose: LOUIS KAHLENBERG.

It has long been known that ordinary solutions of ferric chloride and other ferric salts have some solvent action upon cellulose. That action has hitherto been found to be but slight. However, a very concentrated solution of ferric chloride, such as is obtained by melting the usual commercial hexahydrate, dissolves cellulose with great ease. In fact, it is the best solvent for cellulose thus far discovered. The action begins at the melting point of the hydrate and proceeds very well at 50° centigrade. On heating to somewhat higher temperatures the action is very greatly accelerated. At the temperature of the water-bath it is a simple matter to dissolve 5 per cent. of cellulose in the concentrated solution resulting from the melting of the hexahydrate. More cellulose will be taken up until the whole mass becomes an exceedingly stiff syrup. On allowing the material to solidify it may be pulverized, and it will be found that it has to a very large extent lost its hygroscopic properties, which would indicate that a combination between the ferric salt and the cellulose has taken place. Attempts to isolate such a combination have been made and are still in progress.

When the solution of the cellulose in the concentrated ferric chloride solution is poured into water there separates out a precipitate of hydrated cellulose, which fact has been determined by careful analysis. Only a portion of the cellulose, however, is thus precipitated. The remainder stays in solution, having been converted into glucose. By heating the 5 per cent. solution of cellulose in the strong ferric chloride solution for two to three hours on the water-bath, all of the cellulose is converted into glucose. The ferric chloride may best be removed from such solution by diluting, treating with an excess of freshly precipitated basic lead carbonate, warming and filtering. Final traces of iron and lead are removed from the filtrate by means of ammonium sulphide. The filtrate then contains the glucose and some ammonium salts, but the latter do not interfere seriously with the characterization of the glucose by means of the test with phenyl hydrazine. Excellent crystals of glucosazone of characteristic melting point may be thus obtained from the solution.

Very concentrated ferric bromide and ferric sulphate solutions act similarly, but they are by no means equal to the ferric chloride in their solvent action. Not only may simple cellulose, like cotton and filter paper, be dissolved in the very

concentrated ferric chloride solution, but also compound celluloses, like woody fibers of all kinds, are thus disintegrated.

The entire subject is being pursued further, particularly as applied to the study of the compound celluloses and the various products that are associated with them in the various woods and woody fibers of different plants.

Similarly, concentrated solutions of the chlorides of other metals, like those of copper, cobalt, nickel, aluminum, calcium, magnesium, etc., have also been tested as to their solvent action upon cellulose. While these have some action upon cellulose, the action is quite slight as compared with that of ferric chloride. The action of ferric chloride upon cellulose, therefore, is a highly specific and unique one.

This entire subject is being studied further, especially as to its possible practical applications in isolating and utilizing various plant products.

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

H. E. Howe, *Chairman*

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

The Determination of Ash in Coals with a High Percentage of Calcium Carbonate: S. W. PARR.
The Mechanical Sampling of Illinois Coal: S. W. PARR.

A New Form of Adiabatic Calorimeter: S. W. PARR.

Report on Last Year's Progress of the Industrial Fellowship System of the Mellon Institute: R. F. BACON.

An Investigation of Composition Flooring: R. F. BACON AND R. R. SHIVELY.

A Contribution to the Chemistry of Laundering: H. G. ELLEDGE.

On the Use of Certain Yeast Nutriments in Bread Making: H. A. KOHMAN.

On Hydrated Lime: J. F. MACKEY.

On the Prevention of Glass Pot Corrosion: S. R. SCHOLES.

On the Behavior of Manganese in Glass: S. R. SCHOLES AND E. W. TILLOTSON.

Further Experiments on Volatilization of Platinum: G. K. BURGESS AND R. G. WALTENBERG.

This paper is a continuation of previous work on the loss in weight on heating of platinum laboratory ware. It is shown that all grades of platinum contain at least traces of iron, that there is no appreciable loss in weight of crucibles heated to 900° C., but that above this temperature the loss increases rapidly with temperature, is

greatest for platinum containing iridium and least for platinum alloyed with rhodium.

The Isomeric Lactones, Caryophyllin and Urson:

FRANCIS D. DODGE.

Caryophyllin ($C_{10}H_{16}O$)_n, constituent of clove buds, was thought to be an alcohol, $C_{10}H_{20}(OH)_4$, but the present work indicates that it is more probably an oxy-lactone, $C_{30}H_{48}O_8$. Salts, two mono-acetyl and a diacetyl derivatives have been prepared. Oxidation with nitric acid gives caryophyllic acid, $C_{30}H_{48}O_9$; and acetylation of this acid gave an acetyl derivative, m. 210°, probably from an oxy-di-lactone derived from caryophyllic acid by the loss of one molecule of CO_2 and of H_2O .

Urson, a constituent of bear-berry leaves (*Uva Ursi*), $C_{30}H_{48}O_8$, is probably an isomer of caryophyllin.

Both lactones give the color-reaction of Liebermann for the cholesterol series.

Tautomeric Equilibrium Constants and Chemical Structure. A Measure of Valence in Terms of Energy: C. G. DERICK.

Preparation and Characterization of Trimethylene Oxide: D. W. BISSEL AND C. G. DERICK.

Trimethylene oxide was successfully prepared by two methods. The first used was by the action of trimethylene chlorhydrine on fused potassium hydroxide at 140°, yield 6-8 per cent. The other method was by the action of the acetate of trimethylene chlorhydrine upon fused potassium hydroxide at 100-110°, yield 22 per cent. The oxide is purified by fractional distillation after removing unsaturated products by bromination. Its structure follows from the fact that it yields hexanol-1 with propyl magnesium bromide; and trimethylene chloride with phosphorus pentachloride. Trimethylene oxide is a colorless, mobile liquid; miscible with water and having a pleasing odor. B. P. 47.8° (corr.); D_4^{25} 0.893; $(N)^{25}$ 1.389 by Abbé instrument with ordinary light.

The Action of Metallic Oxides on Trimethylene Halides and of Heat upon $ClCH_2CH_2CH_2O-Mg-I$: E. H. VOLLWEILER AND C. G. DERICK.

Lead oxide acts on trimethylene bromide at 200°, giving a substance boiling at 50-60° which consists mainly of unsaturated compounds. The yield was poor. A polymer of trimethylene oxide, boiling at 180° under 50 mm., is obtained. Its structure follows from the fact that it gives hexanol-1 with propyl magnesium bromide.

Mercuric and silver oxide react similarly, yielding no appreciable quantities of monomolecular trimethylene oxide. Trimethylene iodide can not

be used as it decomposes and the chloride reacts too slowly.

$\text{Cl-CH}_2\text{CH}_2\text{CH}_2\text{-O-Mg-I}$ prepared by the Grignard reaction decomposes at 270° , giving mainly trimethylene iodide and a small amount of product boiling at $70\text{--}100^\circ$ which is partly ethyl iodide and partly some unidentified mixture of iodine compounds.

The Behavior of β -Phenoxy Ethyl Bromide in Wurtz-Fittig Synthesis: ST. ELMO BRADY.

The type of ether, $\text{C}_6\text{H}_5\text{-O-CH}_2\text{CH}_2\text{Br}$, was prepared from sodium phenolate and ethylene bromide and the reaction so regulated as to obtain a maximum yield of the bromethylphenyl ether instead of the diphenoxy ether which under certain conditions has an equal chance for formation with the bromethylphenyl ether. The regular Wurtz-Fittig synthesis was carried out with the single modification of varying the amount of sodium used. The products were ethylene gas, sodium phenylate, and α , δ -diphenoxybutane in 10 per cent., 20 per cent. and 30 per cent. yields respectively.

The interesting fact observed in this synthesis was the unvarying yield of α , δ -diphenoxybutane with increasing amounts of the reacting materials and an increase in the yield of ethylene gas under the same conditions. The yield of ethylene gas is directly proportional to the amount of sodium used.

Preparation and Characterization of ϵ -Acetylcaproic Acid: ST. ELMO BRADY AND C. G. DERICK.

Trimethylene bromide and acetoacetic ester were condensed, molecular proportions of the reacting substances being used. The resulting condensation product was hydrolyzed with 20 per cent. hydrochloric acid and the nonhydrolyzable matter separated. The aqueous portion is treated with solid sodium carbonate and the separating product removed and purified. This is γ -acetylbutyl alcohol. The alcohol is brominated and the bromide condensed with malonic ester. The 1, 1 dicarboxethyl heptanone-6, after purification, is hydrolyzed with 20 per cent. hydrochloric acid and the resulting dicarboxylic acid heated to 170° . By the loss of carbon dioxide the ϵ -acetylcaproic acid is formed. The acid is easily soluble in alcohol, ether and water and is somewhat hygroscopic. It melts at 28° and boils constant at 145° under 1 mm. pressure. The ionization constant is $1.638 \cdot 0005 \times 10^{-5}$.

Preparation and Characterization of δ -Acetylvalerianic Acid: R. W. HESS AND C. G. DERICK.

Trimethylene glycol was converted into the

bromide by refluxing with aqueous HBr. By using the proper proportions the yield was increased from 50 per cent. to 80 per cent. γ -Brombutyronitrile was made from the trimethylene bromide and KCN. When a mixture of water and alcohol was used as a solvent the yield was 20–25 per cent., but with absolute methyl alcohol it was 40–50 per cent. The action of γ -brombutyronitrile on sodium acetoacetic ester gave two new products, the one desired, δ -cyano- α -acetylvaleric ethyl ester and another 1, 7, -dicyano-4-aceto-4-carboxethyl heptane. The latter boils at 200° under 5 mm. pressure; melts at 73.5° and is insoluble in most organic solvents. An excess of acetoacetic ester prevents the formation of this substance. The former distills at 154° under 2 mm. pressure and hydrolyzes to δ -acetylvalerianic acid with constant boiling HCl. B. p. 181° under 25 mm. pressure; m. p. 36.5° ; ionization constant 1.93×10^{-5} .

A Study of the Isomeric Aminoethylbenzenes and Certain of their Derivatives: O. S. KEENER, O. KAMM AND C. G. DERICK.

Syntheses in the Naphthalene Series: OLIVER KAMM AND H. B. McCLUGAGE.

A Study of the Equilibrium in the Friedel and Craft Reaction: OLIVER KAMM AND S. D. KIRKPATRICK.

On the Reactions of the Formamidines. V. On some Pyrazolone Derivatives: F. B. DAINS, H. R. O'BRIEN AND C. L. JOHNSON.

Contributions to our Knowledge of Dichlorether. Part II.: G. B. FRANKFORTER AND S. J. REICHERT.

The Action of Aluminum Chloride on the Alcohols and Carbohydrates Alone and in the Presence of Other Organic Compounds: G. B. FRANKFORTER AND V. KOKATNUR.

A Catalytic Decomposition of Some Phenol Salts: W. H. HUNTER.

Some Work on the Reimer-Tiemann Reaction: W. H. HUNTER.

Notes on the Use of the Multiple Unit Electric Furnace and of a Modified Carbon Dioxide Generator in the Dumas Method for the Determination of Nitrogen: HARRY L. FISHER.

The furnace has excellent temperature control with all ranges, the units are well insulated, and it has a nickel trough which is permanent and does not stick to melted glass. The combustion tube can be inspected at any time.

The generator is arranged for either pressure or vacuum work and can be constructed of varying capacity and in a compact form. It consists of two round-bottomed flasks, the upper being in-

verted and connected with the lower one with a T-tube, which allows equalization of pressure in both flasks, and a 3-way stopcock. By means of the latter sulfuric acid may be dropped upon sodium bicarbonate in water or the acid in the upper chamber replenished or removed.

The Relations in Composition of Petroleum, Coal and Natural Asphalts: C. F. MABERY.

I have distilled Palmyra, C., coal in vacuo to compare the products with the constituents of Mahone petroleum which is in the same section. The distillates were composed of an oil heavier than water which was composed to a considerable extent of color substances which appeared during purification of the hydrocarbons in various shades of red, green, blue and violet. From the lighter oil was separated a number of hydrocarbons of the series C_nH_{2n} , C_nH_{2n-2} , C_nH_{2n-4} , resembling the hydrocarbons separated from Mahone petroleum, three years ago. A considerable proportion of solid hydrocarbons were separated, including some of the higher paraffines. Acetic aldehyde appeared in the lower distillates as it has been recognized in Mahone petroleum. I have also distilled Gilsonite in vacuo and obtained 56 per cent. of a thin oil from which a series of hydrocarbons similar to those in petroleum. Three classes of products were separated; the last mentioned, that evolve HBr copiously with bromine, forming a substitution lighter than water, a second, closely resembling hydrocarbons of a different character, that I mentioned 25 years ago as separated from acid sludge, and then alluded to as resembling the terpenes, giving with bromine hydrobromic acid and a product heavier than water, and a third class, composed of nitrogen derivatives like those I described 15 years ago as from California petroleum and recently identified in other varieties, especially in larger amount from Russian (Baku) petroleum. These products are at present under examination.

The Occurrence of Esdragol in Rosin: CHARLES H. HERTY AND V. A. COULTER.

On the Phenolsulphonphthalein Dyes and the Quinonephenolate Theory of Indicators: E. C. WHITE, H. A. LUBS AND S. F. ACREE.

On the Use of Viscose as a Dialysis Membrane: H. A. LEWIS AND S. F. ACREE.

On the Tautomeric Reactions of the Silver and Mercury Salts of 1-Phenyl-4, 5-dihydro-5-oxy-3-triazolyl Methyl Sulphone with Alkyl Halides: E. H. WIGHT AND S. F. ACREE.

On the Reactions of Both the Ions and Molecules of Acids, Bases and Salts: The Inversion of

Menthone by Sodium, Potassium and Lithium Ethylates: W. A. GRUSE AND S. F. ACREE.

The Galactan of Larix occidentalis: R. W. SCHORGER AND D. F. SMITH.

Further Evidence for the Electronic Formula of Benzene and the Substitution Rule: H. S. FRY.

Reactions in Non-aqueous Solvents: Chromyl Chloride and Phosphorus Halides: H. S. FRY AND J. L. DONNELLY.

Electronic Tautomerism: The Existence of Electrometers in Dynamic Equilibrium: H. S. FRY.

Partial Hydrogenation of Cotton-seed Oil: BEN H. NICOLET.

The Reaction between Alcohols and Hydrochloric and Hydrobromic Acids: JAMES F. NORRIS.

The Nitro Phenyl Ethers: HILTON IRA JONES AND ALFRED N. COOK.

The ortho and para nitro phenyl ethers have been studied and numerous errors corrected. Eighteen sulphonic acid salts have been prepared and seventy-two new phenyl ether dyes, several of which are of brilliant shade and have commercial possibilities. These are equally divided between the ortho and para ethers of the sulphonated and unsulphonated series. A new method has been devised for the preparation of potassium phenolate to all non-nitro phenols. The effects of the positions of the groups upon the properties of the compounds and colors of the dyes have been carefully studied and various interesting facts observed.

The Relations in Composition of Coal, Petroleum and the Natural Asphalts: C. F. MABERY.

In distilling Deerfield, O., coal in vacuo, and gilsonite, it is found that the distillates contain petroleum hydrocarbons of the series C_nH_{2n-2} , solid paraffines, the series C_nH_{2n-4} , and nitrogen compounds resembling those which have been separated from California, Russian and other petroleum. Intense colors appeared in some distillates. A series of terpenes appeared resembling those extracted by acid from petroleum. Naphthene acids were recognized. These products and also a new series of petroleum hydrocarbons, probably terpenes, separated twenty years ago in large quantity with the sulphur compounds, are under examination.

Esterification of Acids by Isomeric Mercaptans: J. W. KIMBALL AND E. EMMET REID.

It has long been known that alcohols of different structure show different velocities and limits of esterification, these values being much lower for secondary than for primary alcohols. It has also

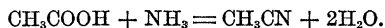
been shown that mercaptans are analogous to alcohols in esterification. In the present work the rates and limits of esterification of benzoic acid by normal, iso-, and secondary butyl mercaptans have been measured at 200° and the same relations found to hold with the mercaptans as with the alcohols.

Esterification of Acids by Isomeric Mercaptans: J. H. SACHS AND E. EMMET REID.

Since with a given alcohol, isomeric acids show different esterification velocities, the present work was undertaken to find whether the same relations hold when isomeric acids are esterified by the analogous mercaptans. The three toluic acids have been heated with ethyl mercaptan at 200°. Esterification progresses most rapidly with the meta isomer and most slowly with the ortho. The limits are nearly the same, 14.4, 13.2 and 13.3 per cent. for ortho, meta and para, respectively.

Catalytic Preparation of Nitriles: G. D. VAN EPPS AND E. EMMET REID.

It is known that when the vapors of acetic acid and of alcohol are mixed and passed over certain metal oxides at high temperatures, water is split off and ethyl acetate is formed. It is now found that when the vapor of acetic acid and ammonia gas are passed over alumina at 500°, water is eliminated and acetonitrile is formed up to 85 per cent. of the theoretical.



The Preparation of Nitriles: G. D. VAN EPPS AND E. EMMET REID.

Reid's method for the preparation of nitriles, which consisted in heating a mixture of the zinc salt of the organic acid and lead sulphocyanide, and which gave good results with aromatic acids, has been extended to aliphatic acids and good yields obtained. The preparation of acetonitrile was extensively studied, a large variety of modifications of the method being tried. Good yields have been obtained, but this method is rendered obsolete by the discovery of the catalytic method.

The Identification of Acids: E. EMMET REID.

p-Nitrobenzyl bromide has been found to be an excellent reagent for the identification of acids. One gram of this reagent is boiled an hour with an excess of the alkali salt of the acid in 15 c.c. of 63 per cent. alcohol. *E. g.*, $\text{O}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{CH}_2\text{Br} + \text{CH}_3\text{COOK} = \text{KBr} + \text{CH}_3\text{COO} \cdot \text{CH}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{NO}_2$.

The p-nitrobenzyl esters so formed crystallize well as a rule, have good melting points, and convenient solubilities. With the alkali salts of phenols, under the same circumstances, the same

reagent forms ethers which are convenient for the identification of phenols.

Some Anomalies in the Solidification Points of Fats: B. H. NICOLET AND L. M. LIDDLE.

On the Nitration of Toluene: I. W. HUMPHREY.

The Hydrolysis of Chloropentanes as affected by High Pressures: Synthetic Fusel Oil: H. ESSEX AND B. T. BROOKS.

The Effect of Sulphur on the Auto-Oxidation of Organic Compounds: B. T. BROOKS, I. W. HUMPHREY AND B. Y. LONG.

Two New Methods of Determining Acetylene in Gaseous Mixtures: G. O. CURME, JR.

Note on Lead Propionates: S. FRANK COX.

Neutral lead propionate is formed almost quantitatively when lead carbonate is treated with hot, dilute propionic acid. It is an amorphous, white solid, very soluble in water, insoluble in ether. If the tetroxide be treated with dilute propionic acid, the black dioxide is thrown out on boiling the mixture, and neutral lead propionate is formed practically quantitatively. If litharge containing a considerable percentage of carbonate be used, neutral lead propionate, rather than either of the basic propionates which are reported, is formed. Analysis shows that lead carbonate will give the purest propionate, and the yields in this case are also the most satisfactory. Lead and hydrogen determinations, also the reaction with chlor di methyl ether whereby lead chloride is formed quantitatively, were used to identify the salts prepared.

Crystalline β -Methyl Fructoside and Its Tetracetates: C. S. HUDSON AND D. H. BRAUNS.

A Fourth Crystalline Pentacetate of Galactose and Some Related Compounds: C. S. HUDSON AND J. M. JOHNSON.

The Isomeric Pentacetates of Glucosamine and of Chondrosamine: C. S. HUDSON AND J. K. DALE.

Indirect Measurements of the Rotatory Powers of Some of the Alpha and Beta Forms of the Sugars by Means of Solubility Measurements: C. S. HUDSON AND E. YANOVSKY.

Some Numerical Relations among the Rotatory Powers of the Compound Sugars: C. S. HUDSON.

DIVISION OF FERTILIZER CHEMISTRY

J. E. Breckenridge, *Chairman*

F. B. Carpenter, *Secretary*

Plant Food Deficiencies of Coastal Plain and Piedmont Soils: C. B. WILLIAMS.

CHARLES L. PARSONS,
Secretary

(To be concluded)