An apparatus is also described for preparing absolute alcohol with lime.

When absolute alcohol is distilled from an excess of lime a little calcium passes over, probably as calcium ethylate.

Metallic sodium is not suitable for the preparation of absolute alcohol.

URBANA, ILLINOIS

NEW BOOKS

Aus meinem Leben (Out of my Life). By EMIL FISCHER. Julius Springer, Berlin, 1922. 201 pp. 3 portraits. 16 × 23.5 cm. Price M 300, bound.

In his "Reminiscences of Departed Friends" A. W. Hofmann has truly said: "The history of a scholar is the history of his specialty."

In 1922, the Julius Springer Press of Berlin published a two-hundred page book of reminiscences of Emil Fischer, edited by M. Bergmann. These were written by Fischer in 1918, a year so momentous for Germany, while he was on a trip for his health to Locano and Karlsbad, and later were to have been amplified into a complete autobiography. This intention he was unable to carry out and the manuscript, as thus edited by Bergmann, is the parting greeting to his friends and to the world of a man who had no peer in the field of organic chemistry, and who died as he had lived, unselfishly and with the kindliest of feeling towards all, but saddened in his last days by the personal losses which the war had caused in his own family and by the almost complete disruption of a lifetime's investigations, which were continuing to bear such a rich harvest for science.

Broken as he was in spirit and body, for already the seeds of the fatal malady which was soon to cause his death were at work, it seems strange that he could concentrate on these reminiscences all that fascinating power of intellect and keenness of humor, which in his younger days he possessed to so marked a degree. The explanation may perhaps be found in the words of Kussmaul:

"Musst du Gram im Herzen tragen
Und des Alters Schwere Last
Rufe dir aus jüngeren Tagen
Die Errinnerung zu Gast!"

The first chapter of the text describes Emil Fischer's early youth and introduces the reader to his parents. Born at Euskirchen, the son of a well-to-do merchant, Emil Fischer passed a happy childhood in the joyous Rhineland. After passing the examination preliminary to entering the University, following out the desire of his father, he began, with much misgiving, to study for the career of a merchant. Apprenticed to his brother-in-law, Friedrichs, a successful lumber merchant of a neighboring town, after a few months of running errands, sealing and stamping envelopes, Fischer became convinced that the life of a merchant had no at-

traction and that his future was to be found in the field of science. He succeeded in winning his father over to his point of view, especially when Friederichs declared that as an apprentice he was the "most miserable failure that he had ever seen, and would never amount to anything;" yet this lad was 33 years later, to be the recipient of the Nobel prize. So his father let him enter the University of Bonn with the admonition that since he was too stupid to become a merchant he might as well go to college as anything else.

Dissatisfied with conditions as he found them at Bonn, he later went to Strassburg where Adolf Baeyer had just begun to gather the equipment necessary for chemical instruction. From this time on, his progress was rapid and brilliant. In the succeeding chapters of the book, Emil Fischer gives a most fascinating and intimate series of pictures of the different periods which were milestones in his career, beginning with his work at Strassburg, then Munich, Erlangen, and Würzburg, to reach its culmination in Berlin. There is unfolded before the reader the whole development of the modern period of organic chemistry; he gets an intimate acquaintance with the masters who participated therein, and a glimpse into the very soul of Fischer himself.

In the words of Jacobsen with the passing of Emil Fischer "A life is ended in which there was no failure, no let-up in restless activity, no long groping about for something to accomplish. After one quick, clear vision of the goal the path led straight to its accomplishment, a chain of brilliant successes."

In his life he permitted nothing to distract him from the goal which he had set himself. This was not because of any lack of breadth. On the contrary he had a great fondness for art, he was by nature sociably inclined and companionable, and he followed public affairs with great interest. But to him it was almost a divine command to devote his whole talent and every ounce of his strength to the service of his science and for the benefit of mankind. He realized in all modesty what he was. To shorten by minor activities the time allotted him for his work more than the necessity of an occasional diversion urgently demanded seemed to him the neglect of duty, and he required surprisingly little mental relaxation.

Fischer's scientific investigations comprised an extraordinarily wide field and yet it is clear, as we view his life retrospectively, to what his research instinct irresistibly tended—the solving of the secrets of the products of life.

In an address in 1893 before the Royal Prussian Academy of Sciences, Fischer himself has said: "Still more enticing to some, among whom I include myself, is the hope to climb up out of the valleys to those passes seen afar off, which lead to vast and as yet unexplored countries." By these passes he had in mind the connecting link to the biological sciences.

He believed that organic chemistry must furnish to physiology the means of examining into the complicated processes of life itself, possibly even leading to the regulation by well understood chemical principles of the metabolism of our bodies when this is disturbed by illness, and it was his ambition to the limit of his power to take part in this important work.

Fischer once remarked: "No one is unreplaceable and a successor is always at hand who is ready to carry on the work of his predecessor." While this in general may be true, it may be some time before the science of organic chemistry will have an exponent who combines so accurate a vision with so high degree of manipulative skill, and such inexhaustible energy and power of application as did Emil Fischer.

W. L. JENNINGS

The Theory of General Relativity and Gravitation. By LUDWIK SILBERSTEIN, Ph.D. D. Van Nostrand Company, 8 Warren Street, New York, 1922. iv + 141 pp. 22.5 × 14 cm. Price $2.00.

This is one of the best accounts of Einstein's generalized theory of relativity and gravitation that has appeared in English. It covers much the same ground as Eddington's well-known "Report on the Relativity Theory of Gravitation," but has perhaps a somewhat more original and sophisticated mode of presentation. Throughout the book are to be found interesting comments as to the historical origin of different mathematical ideas and devices, and illuminating surmises as to the ideas which probably influenced Einstein in his choice of postulates.

The development of the tensor algebra presented by the author differs from that of Eddington by delaying the introduction of the metrical tensor $g\,i\,j$ as long as possible,thus giving greater generality to the treatment and giving a more natural starting point for considerations such as those of Weyl. The developments of Weyl, however, are not presented on the ground that they are still a matter of controversy.

The author seems rather sceptical as to the advantages of presenting gravitational theory from the point of view of Hamilton's principle. He devotes only 2 pages to this subject, and lays no stress on the desire for unity in method throughout the whole field of mathematical physics which has undoubtedly inspired the numerous attempts to treat gravitational theory from the Hamiltonian point of view. He is presumably influenced in this matter by the feeling that the choice of the quantities which are to serve as generalized coördinates, velocities and momenta in the analogs of the Lagrangian and Hamiltonian equations, seems more forced than natural.

The author presents an interesting discussion of the theory of the shift of spectrum lines to be expected in the gravitational field of the sun and comes to the conclusion, in contradiction to that of Einstein, that a nega-

tive result would not necessarily be a contradiction to any essential part of the theory.

It is interesting to note that no mention is made of the author's own attempt to develop a gravitational theory without the equivalence hypothesis [Silberstein, *Phil Mag.*, **36**, 94 (1918)]. Indeed, the introduction of the equivalence hypothesis is made in an unusually clear and understandable manner.

RICHARD C. TOLMAN

Fluidity and Plasticity. By EUGENE C. BINGHAM, Ph.D., Professor of Chemistry at Lafayette College, Easton, Pennsylvania. International Chemical Series, H. P. Talbot, Ph.D., Sc.D., Consulting Editor. McGraw-Hill Book Co., Inc., New York, 370 Seventh Ave.; London, 6 and 8 Bouverie Street, E. C. 4; 1922. xi + 440 pp. 96 figs. 14.5 × 21 cm. Price $4.

This book, like ancient Gaul, is made up of three parts. Part I treats of viscometry in general, the chapter headings being as follows: I. Preliminary. Methods of Measurement; II. The Law of Poiseuille; III. The Amplification of the Law of Poiseuille; IV. Is the Viscosity a Definite Physical Quantity? and V. The Viscometer. Part II, dealing with fluidity and plasticity, comprises twelve chapters bearing the respective titles: I. Viscosity and Fluidity; II. Fluidity and the Chemical Composition and Constitution of Pure Liquids; III. Fluidity and Temperature, Volume, Pressure. Collisional and Diffusional Viscosity; IV. Fluidity and Vapor Pressure; V. The Fluidity of Solutions; VI. Fluidity and Diffusion; VII. Colloidal Solutions; VIII. The Plasticity of Solids; IX. The Viscosity of Gases; X. Superficial Fluidity; XI. Lubrication; XII. Further Applications of the Viscometric Method. Part III is made up of a series of appendices treating of Practical Viscometry and Plastometry, Technical Viscometers, the Measurements of Poiseuille and a comprehensive bibliography.

In his preface the author writes, "Our knowledge of the flow of electrical energy long ago developed into the science of Electricity but our knowledge of the flow of *matter* has even yet not developed into a coördinate science.... Even from the first the flow of liquids has been a subject of practical importance, yet the subject of Hydraulics has never become more than an empirical subject of interest merely to the engineer. Unfortunately, the theory is complicated in that the flow of matter may be hydraulic (turbulent), viscous (linear), or plastic, dependent upon conditions.....Considering the confusion which has existed in regard to the character of flow, it is not surprising that there has been uncertainty in regard to precise methods of measurement and that exact methods have been discovered, only to be forgotten, and rediscovered independently later.....If we are to have a theory of flow in general, we must consider matter in its three states. No such general theory has appeared, although one is manifestly needed

to give the breath of life to the dead facts about flow. The author offers the theory given in the following pages with the utmost trepidation."

As might be expected, Dr. Bingham has brought together in his book a large amount of experimental evidence in support of those views of which he is known to be the protagonist, namely, that fluidity, and not viscosity, is the additive property in solutions, and that viscous flow is sharply differentiated from plastic flow, the latter having been shown by him to be dependent upon two factors, internal friction and mobility.

In his discussion of the relation of fluidity to volume, we find this suggestive passage (p. 145):

"Given two substances with the same outer molecular volume, it is evident the one with the larger molecular kernel will have the smaller fluidity. It is, therefore, natural to expect that the limiting molecular volumes should be additive, as Batschinski has found to be the case. This opens the way to a study of the relation between fluidity and chemical composition and constitution which is most fascinating. It is very simple to measure the outer molecular volume, and if this with the fluidity will give a certain and easy method for determining the inner molecular volume, it is a result much to be desired."

The reviewer has found the chapter devoted to the fluidity of solutions extremely interesting, especially the discussion of so-called "negative viscosity."

The chapter on colloidal solutions is replete with material of interest, particularly the sections treating of crystalline liquids and emulsions.

Both the chemist and the engineer will find a large amount of valuable information in the chapter on lubrication.

The detailed directions given in the appendix for carrying out precise measurements of viscosity and plasticity with the instrument designed by Bingham and Green are of special value to the laboratory worker.

As we compare the contents of this book with that of the well-known monograph of Dunstan and Thole published 8 years ago, we are impressed with the advancement of knowledge which has taken place in this field within a comparatively short time. To this advancement Dr. Bingham and his students have been among the most generous contributors.

The author is to be congratulated upon having written a book which fills a real hiatus in the literature of physical science and which emphasizes the importance of viscosity in connection with a wide variety of problems of interest to both the chemist and the physicist.

FREDERICK H. GETMAN