Lippmann's achievements. There are many who know the results of his practical work as director of the large sugar refinery at Halle, and of his researches in the laboratory, as comprised in his exhaustive two-volume treatise "Die Chemie der Zuckerarten," but there are fewer, perhaps, who know what he has done during leisure hours in the study along historical and cultural lines, as exemplified in his masterful book "Die Geschichte des Zuckers" and in these two volumes of scientific papers and essays. To be technologist, chemist, historian and scholar, and all surpassingly well, is a record of accomplishment such as few men have realized. Adapting a phrase from that ancient "father of science," Aristotle, of whose works Professor Lippmann **is such an enthusiastic** commentator, we may say: it is a record of accomplishment, "four-square and truly good."

C. A. Browne

SCIENTIFIC JOURNALS AND ARTICLES

The July number (Vol. 14, No. 3) of the *Transactions of the American Mathematical Society* contains the following papers:

L. E. Dickson: "Proof of the finiteness of modular covariants."

R. D. Carmichael: "On transcendentally transcendental functions."

M. Fréchet: "Sur les classes V normales."

G. R. Clements: "Implicit functions defined by equations with vanishing Jacobian."

Dunham Jackson: "On the approximate representation of an indefinite integral and the degree of convergence of related Fourier series."

L. P. Eisenhart: "Certain continuous deformations of surfaces applicable to the quadrics."

The concluding (July) number of volume 19 of the *Bulletin of the American Mathematical Society* contains: Report of the April meeting of the Society, by F. N. Cole; Report of the twenty-third regular meeting of the San Francisco Section, by W. A. Manning; "The total variation in the isoperimetric problem with variable end points," by A. R. Crathorne; "A note on graphical integration of a function of a complex variable," by S. D. Killam; "The unification of vectorial notation," by E. B. Wilson; "Shorter Notices": Kowalewski's Grundzüge der Differential- und Integralrechnung, by R. L. Borger; Vivanti-Cahen's Fonctions polyédriques et modulaires, by G. A. Miller; Markoff-Liebmann's Wahrscheinlichkeitsrechnung, Carvallo's Calcul des Probabilités et ses Applications, and King's Elements of Statistical Method, by A. C. Lunn; "Notes"; "New Publications"; Twenty-second Annual List of Published Papers; Index of Volume XIX.

THE RUTHERFORD ATOM

To explain the observations made by Geiger and Marsden[1] on the scattering of α particles through large angles by metal foils, Rutherford[2] suggested that in such cases the deflection of each ray was due to an intimate encounter with a single atom of the matter traversed. It was necessary to assume that the positive charge is highly concentrated in a very small volume at the center, surrounded by an equal amount of negative electricity distributed throughout the remainder of the volume of the atom. To compare the theory with experiment, suppose we consider the effect of allowing a narrow pencil of α rays to strike a thin metal foil from a direction perpendicular to its surface. The probable number of reflected or deflected rays which may be expected each second to strike any given square centimeter of a spherical screen whose center of curvature is the point of bombardment, was shown by Rutherford to be, according to his theory,

$$P = \frac{Qnt}{4r^2}\left(\frac{NeE}{mv^2}\right)^2 \operatorname{cosec}^4\frac{\phi}{2},$$

where:

Q = number of α rays striking the foil per second;

nt = number of atoms in the foil per unit area;

r = radius of the spherical screen;

ϕ = angle between the radius vector to the area and the direction of the striking beam of rays; or the angle of deflection;

Ne = central charge of the bombarded atom;

[1] *Proc. Roy. Soc.*, 82A: 495, 1909; 83A: 492, 1910; *Manchester Lit. and Phil. Soc. Proc.*, 1910.

[2] *Phil. Mag.*, 21: 669, 1911.