

125. They reminded him of experience with a Thomas machine in student days and of his wish then for a key-board instead of levers and for a carrying device for the quotient register. It may interest some readers to know that an American machine, the Monroe, supplies much of this that was left to be desired.

An article by P. E. Ludgate on "Automatic calculating machines," which will interest anyone who has seen a loom weaving the pictures of presidential candidates, say, into silk ribbon; an article by T. C. Hudson on "H. M. Nautical Almanac Office anti-difference machine"; and one on "Mathematical and calculating typewriters," complete section D.

Section E gives an abridgment of a classic article on "The abacus" by Dr. Cargill G. Knott, professor of physics, Imperial University of Tokyo, published in 1886 in the *Transactions of the Asiatic Society of Japan* and so almost unobtainable by us.

Space does not permit me further to enumerate the essays and notes, each written by a specialist and authoritative, concerning slide rules (25 pages), integragraphs, integrometers, planimeters, their use in naval architecture, differentiating machine, harmonic analysers, tide-predicting machine, etc., but I cannot pass unnoticed Section H on Ruled Papers and Nomograms by the editor and Professor M. d'Ocagne respectively, which are parts of the literature to be read by anyone who would know the subject; also Section I (26 pages) on Mathematical Models, and Section K, a catalogue of portraits, engravings and medals of the collection of Prof. W. W. Rouse Ball, author of the well-known *Short Account of the History of Mathematics*.

The volume closes with a list of contributors and exhibitors, Section M. The names of the former are sufficient guarantee of the value of the articles. Their authority will secure for the book wide use amongst those for whom it was published.

C. C. GROVE.

Tables and Formulas (revised edition). By WILLIAM RAYMOND LONGLEY. Ginn and Company, 1915. 37 pp. Price, 50 cents.

THE author states in his preface: "This collection of tables and formulas is intended for use as a handbook for solving numerical problems in connection with the courses in mathematics in technical schools and colleges." It is a good collec-

tion for such a purpose. It will fill a long-felt need of both teacher and student, not only because the most frequently used tables and formulas, which are usually found scattered throughout half a dozen text-books, are here found within the covers of a booklet easily carried in one's pocket, but also because the more extended tables are usually too cumbersome, and give results to a much higher degree of accuracy than is commensurate with the data of the problem.

The book contains four place tables of common logarithms, and the natural and logarithmic values of trigonometric functions (interval of 1°), three-place tables of radian equivalents of degree measure and the natural values of trigonometric functions (interval of 0.05 radians). There are tables of squares and cubes from 1 to 100, square roots and cube roots from 1 to 1,000, reciprocals from 1 to 10 (interval of 0.1), Napierian logarithms from 1 to 10 (interval of 0.1) and from 10 to 100 (unit interval), and values of the exponential and hyperbolic functions from 0 to 10 (interval of 0.1). The collection of formulas contains the ordinary ones from algebra, geometry, trigonometry, analytic geometry, and the calculus, the last including some standard series, formulas for differentiation, and a well-chosen, well-arranged table of 177 integrals. The booklet concludes with the formulas for the solutions of the differential equations of harmonic motion, and damped and forced vibrations.

The reviewer would like to see the following formulas included in the collection: the length of the arc of a circle, $s = r\alpha$ (radians), the products like $2 \sin u \cos v = \sin(u + v) + \sin(u - v)$, and the area of a triangle in terms of the three sides. One serious defect of the table of trigonometric integrals is that these are given as $\int \sin x dx$, etc., instead of $\int \sin ax dx$, etc., especially since $\int \sin u du$, etc., are nowhere given; the forms $\int \tan^n ax \sec^2 ax dx$, etc., should also be included since the form $\int u^n du$ is not given. Mention should also be made of the method of integrating rational fractions.

The type is clear and the tables are easily read. The many excellent qualities of the booklet, together with its small price, will commend it to the students in the mathematics courses in colleges and technical schools.

JOSEPH LIPKA.