

CHARBONNIER ON EXTERIOR BALLISTICS

Traité de Balistique Extérieure. By P. Charbonnier. Volume II. *Problème Balistique Principal, Troisième Partie; Les Théories Balistiques.* Paris, Doin, Gauthier-Villars, 1927. 797 pp.

This volume follows Volume I, (of 637 pages, 1921) devoted to *Les Théorèmes Généraux de la Balistique*, and is to be succeeded by a third volume in rational ballistics concerning secondary ballistic problems. Volume I was divided into four books and this volume also is divided into four books numbered from five to eight as follows: Book V, Monomial Resistance; Book VI, Flat Fire; Book VII, Ballistic Series; Book VIII, The Calculation of Trajectories by Successive Arcs. From the Introduction to Volume I, one learns that three further volumes on ballistic science are planned, Volume IV, Experimental Exterior Ballistics, Volume V, History of Exterior Ballistics (with bibliography), Volume VI, Tables. The subject of interior ballistics, which differs considerably in its problems and methods, is not to be touched upon in this series.

The present undertaking is essentially a careful (save for numerous misprints) revision with amplification of the author's two volume work (*Balistique Extérieure Rationnelle*) of 1907. Not only is the subject treated throughout in greater detail, but additional carefully written chapters on newer methods have been introduced. In 1907, Charbonnier's work placed him as one of the conspicuous ballisticians of the world. Since that time he has been made a general in the French Army, and is here progressing with customary French lucidity upon the most ambitious text on ballistics ever undertaken. This should ensure respectful consideration from the few technical scientists seriously interested in ballistics.

Works on ballistics from the time of Bashforth, tend to have a curiously provincial air. They can hope to be of significance chiefly to artillery officers, who, however, seldom have the preparation, interest, or opportunity to study them. Most experimental work is kept in confidential army files. There is also a strong patriotic tendency toward nationalistic bias that army training and army contacts naturally accentuate. Most books on ballistics give the reader the impression that progress in the subject is practically confined to the compatriots or even to the friends of the author. This is noticeable even since the war. This book is no exception.

Ballistics is inherently a branch of engineering. Not only are there a distractingly large number of physical factors present in the problem, but the number of independent variables that are actually taken into account in firing is so large, and these variable factors are to a great extent so uncontrollable, that simple accurate formulas are universally regarded as out of the question. Rules based on the normal probability curve are used in actual field conditions, and the numerical tables upon which original computations are constructed are themselves obtained by statistical methods involving more or less arbitrary assumptions. The only methods used in