

The presentation is clear, logical, and rigorous as would be expected from a French scientist of the standing of Painlevé. The book deserves a prominent place on the reference shelf of every serious student of mechanics.

The only serious criticism I would offer could be made against almost all books on mechanics. It seems to me that the presentation of Newtonian mechanics lends itself to a degree of unity and integration comparable to that of the theory of relativity. The entire subject could be based upon a single fundamental principle from which all other principles, laws, and theorems could be derived as was done by Lagrange in his *Mécanique Analytique*. In such a presentation the geometric addition of forces, for example, would not be elevated to the status of a fundamental principle any more than the geometric addition of other vector magnitudes, such as velocities and accelerations.

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*Balistique Intérieure Théorique et Tables Numériques.* By G. Sugot. Paris, Gauthier-Villars, 1928. xxx+130 pp.

This book falls into two parts which may be characterized respectively as formal and experimental. That is to say, the first part develops a theory in terms of certain parameters and functions which may depend upon the gun or the ammunition or both. The second part deals with the methods for determining these parameters or functions from the measurable quantities obtainable either in routine firings or in special experimental firings. It is not "experimental" in the sense of describing apparatus.

The first part begins with a chapter on the two fundamental equations of interior ballistics, namely, the energy equation and the expression of the law that the linear rate of burning of smokeless powder is proportional to a fixed power of the pressure. It is somewhat remarkable that practically all treatments of interior ballistics accept this form of the law of burning, although there is such wide diversity in the power selected, the exponent varying from unity down to one-half, or lower. At this stage Sugot makes no selection of exponent. His second chapter is a short one on ballistic similitudes. The third deals with the special case of powders of constant surface, that is, powders of such a grain form that the burning surface remains constant as the size decreases. The single perforated cylinder used in rifle powder approximates to this requirement. The fourth chapter deals with other grain forms, and is in this respect a generalization; but it is specialized in another direction by the assumption that the exponent in the law of burning is equal to unity, and by certain minor assumptions not made before. These are selected in such a way as to reduce the problem to the solution of a first-order linear differential equation. The third and fourth chapters consist largely in the discussion of the curves representing pressure, energy, fraction of powder burned, etc. as functions of projectile-travel, or a related variable, particularly as these curves are affected by changes in the conditions of loading or the design of the gun.

The subject matter of the second part, called by the author "Outillages Balistiques," may be described as dealing with the best ways of making bricks without straw. That is to say, the phenomena which actually take place inside a gun when it is fired are of such complexity that the meager data obtainable from measurable quantities leave a great part of the theory indeterminate. Thus