geometry. Chapters V–VII contain a logical analysis of the method of superposition as applied to geometrical proofs. After the axioms of congruence of Pasch, the development of congruence in terms of previous concepts is given, after Lie, by consideration of congruence groups and their subgroups. Metrical geometries are then treated with reference to the absolute, and the kind of a metrical geometry obtained from the congruence group is shown to depend upon an assumption concerning the nature of the absolute.

The proofs are usually only sketched and the reader is left to complete the details. The work could be improved by a more formal statement of the theorems and the exact group of axioms upon which each theorem depends. For the reader who has some knowledge of the general methods used and the point of view, the book should serve as a very useful compilation of results from many sources.

<div style="text-align: right">F. W. OWENS.</div>

Lectures de Mécanique. Première Partie. By E. JOUGUET. Paris, Gauthier-Villars, 1908. x + 210 pp.

THIS book is based upon the idea that " it is very instructive for one who wishes to comprehend the nature of the principles and laws of mechanics to follow the history of their development." The subject matter is presented mainly by long quotations from the original authors, interspersed and followed by comments of the writer, who believes it is interesting to study the classic writers on mechanics as one studies the classic writers in literature. The quotations occupy about 163 of the 210 pages in the text. M. Jouguet has in view the physical aspect of the subject and limits himself to the fundamental principles and essential laws. The first part is devoted to the beginnings of mechanics. After a brief introduction on the mechanics of the ancients there are three chapters on statics and four on dynamics.

The chapters on statics are devoted to the lever, the parallelogram of forces, and the principle of virtual work. The conception of each physical law is traced in the problems which have suggested it, the final statement of the law being given in the words of the author who first formulated it definitely. For example the first suggestion of the principle of virtual work is found in Aristotle's treatment of the lever. The evolution of ideas leading to the statement of the principle is then

traced by quotations from the writings of Leonardo da Vinci, Cardan, Galileo, and others, its final formulation being given by Descartes.

The first chapter on dynamics contains long quotations from Galileo and Descartes presenting the idea of inertia. The second chapter deals with the phenomena of direct impact from which are deduced the law of action and reaction and the determination of the velocity after collision. The last two chapters treat of the center of oscillation, force and acceleration, and kinetic energy.

Throughout the book attention is called to the different ways of reaching a conclusion, the contrast being particularly striking in the development of the law of inertia, where the method of Descartes is characterized as metaphysical while the inferences of Galileo are drawn from physical observations and experiments. Some of the false conclusions of the early thinkers are presented in connection with the correct results which have led to the statement of modern fundamental principles.

W. R. LONGLEY.

Cours d'Astronomie. Seconde Partie : *Astronomie pratique.* By H. ANDOYER. Paris, A. Hermann & Fils. 1909. 299 pp.

THIS volume completes the course, of which the first part deals with theoretical astronomy. As a text-book for a first course in practical astronomy, the subject matter of the second part is well chosen. Only the common instruments, namely, the theodolite, the equatorial, and the meridian transit are treated in detail, the more special instruments, such as the heliometer and the siderostat, receiving very brief mention. No cuts of astronomical instruments appear in the book and the question of construction is dismissed with the remark that a few hours' acquaintance with the instrument itself is more profitable than a study of the most minute description. The theory of the constants and errors of the instruments and their adjustment is thoroughly worked out. Very naturally the problems which receive the most attention are those connected with the determination of the geographical position of the observer, although a rather brief discussion is given of the observations used in the determination of the fundamental constants, including refraction, aberration, nutation, precession, obliquity of the ecliptic, position of the vernal equinox, and parallax of moon, sun, and stars. In addition to the subject