BOOK REVIEWS

Cours de cinématique. By R. Garnier. Vol. 1, *Cinématique du point et du solide. Composition des mouvements.* 2d ed. Paris, Gauthier-Villars, 1949. 4+235 pp.

Vol. 2, *Roulement et viration. La formule de Savary et son extension à l'espace.* 2d ed. Paris, Gauthier-Villars, 1949. 8+287 pp.

Vol. 3, *Géométrie et cinématique cayleyennes.* Paris, Gauthier-Villars, 1951. 12+376 pp. 3000 fr.

Kinematics, as a domain linking geometry and mechanics, has always been a favorite subject of French geometers. These lectures by Garnier provide a new general presentation following the work of Mannheim and Koenigs, somewhat in the manner of G. Darboux's classical work on differential geometry.

After an introduction to vector analysis the first volume begins with point kinematics with many geometric applications, e.g. to geodesics. In the kinematics of the one-parameter continuous motions of a rigid body the distributions of velocity and acceleration at each instant are investigated in detail. The third chapter covers composition of motions and the theorem of Coriolis. The final chapter of this volume is devoted to the determination of a one-parameter motion by integration of its infinitesimal elements.

In the second volume, chapter 5 discusses plane motions, roulettes and the Euler-Savary formula for the curvature of paths, with applications to cycloids. Chapter 6 discusses spherical motions in a corresponding way. The next chapter discusses one-parameter motions in space, again in infinitesimal form and only as far as they depend only on derivatives of the first order. The last chapter of this volume contains corresponding considerations for derivatives of the second order.

The third volume is especially original, containing kinematical considerations for non-euclidean geometry, introduced either in the projective fashion of Cayley and Klein or by conformal mapping into euclidean space. In the elliptic case Garnier also uses the spherical mapping of Hjelmslev, Fubini, and Study. Chapter 10 is devoted to this geometrical introduction of non-euclidean geometry and its motions. Chapter 11 contains differential-geometric investigations of curves and surfaces, velocity and acceleration distributions. Chapter 12 contains among other things a translation of the Euler-Savary formula. The concluding chapters 13 and 14 contain differential-

geometric considerations of first and second order for motions in space, beginning in particular with the study of ruled surfaces and axial planes, then of orbits and envelopes.

There is an appendix containing two notes, one on the concepts of surface area and volume, the other on non-euclidean mechanics of points and rigid bodies. Numerous exercises and figures and a detailed index enliven and facilitate the use of this distinguished work. Many-parameter motions and integrals of kinematics are hardly touched upon.

W. BLASCHKE

Dictionary of mathematical sciences. Vol. 1, German-English. By Leo Herland. New York, Ungar, 1951. 235 pp. $3.25.

This is an ambitious and fairly successful attempt to provide mathematicians with the English equivalents of German mathematical terms. The arrangement, the typography, the elaborate system of cross-references and illustrative phrases are all excellent. In most cases the author has avoided the obvious pitfalls of using the English cognate word instead of the English idiom, or of always using the same translation for the same German word. Thus for example *Fakultät* comes out correctly as "factorial," and *Satz* in compounds is "theorem," "law," or "condition" according to the context. Presumably for the benefit of anyone who has to listen to lectures in German, the spoken use of such words as *hoch* (as in *fünf hoch ein Viertel*) is included. The chief adverse criticisms which have to be made are a lack of completeness and a lack of accuracy, both of which could have been avoided if the author had consulted specialists in several branches of mathematics, as he did consult specialists in commerce and statistics for the technical terms in these fields. The dictionary also covers such fields as logic, physics, and astronomy to some extent, but the comments in this review will be confined to its coverage of mathematics proper.

According to the preface this dictionary centers "about the major subjects of mathematics and geometry" [one wonders what the author considers mathematics to be, if geometry is not a part of it]; it "does not claim completeness, although the aim has been to include all important terms." As far as concerns arithmetic, elementary algebra, the less specialized forms of geometry, calculus, the elements of set theory and of the theory of functions, the coverage is quite thorough; a brave attempt has been made to cover abstract algebra; but topology and applied mathematics are practically omitted. The latter omission seems particularly serious since applied mathematics