clear and definite notions concerning the mathematical and mechanical principles underlying the construction of the many types of machines designed to perform automatically the operations of addition, subtraction, multiplication, and division.

No great mathematical or technical knowledge is required to read the book with ease; though it possesses much more of scientific interest and spirit than one might expect to find in a so-called " popular " treatise.

Representative machines, mostly of German or American make, varying in complexity from the abacus to the Burroughs —all designed to add or subtract—are described in detail, and the mechanical principles according to which they operate are discussed. Similarly there are separate chapters on machines designed to perform multiplication and division, the highest type of which is represented by the " millionaire " computing machine so often found in our mathematical laboratories. The text is illustrated by 45 excellent figures.

The author summarizes the present state of development to which mechanical computation has been carried; points out many imperfections which still exist, and suggests the requirements which the ideal machine should fulfill. He closes with a rather brief discussion of the principles underlying the construction and use of the slide rule. It seems to the reviewer that this chapter is rather inadequate and hardly up-to-date.

<div style="text-align:right">ERNEST W. PONZER.</div>

Die mathematische Ausbildung der Deutschen Landmesser.
  Von PH. FURTWÄNGLER und G. RUHM. Band IV, Heft 8,
  I. M. U. K. Leipzig, Teubner, 1914. vi+50 pp.

IN this pamphlet is given a summary of the training, both practical and theoretical, together with the courses of study prescribed for the German engineer who wishes to specialize in land surveying. Though the various German states differ in their minimum requirements for the holder of this office, who must pass a rigid examination, yet nowhere are there evidences of the existence of an elective sinecure such as is represented by that of our own county surveyor, an office too often filled by some derelict engineer with a political pull. The work is systematized and is more of the grade of that of our Coast and Geodetic Survey.

Special courses are offered at the technical high schools in

the different states for the training of this class of engineers. The authors go into these in detail. A composite cross-sectional view of present practise would show about the following.

At least one or two years of practical training under the guidance of a regularly appointed surveyor. This practical experience may precede or follow the course of instruction in the technical schools. An average of about four semesters in a technical school offering the special courses required. An opportunity to advance in the profession. Advancement based solely on merit.

The courses offered necessarily include trigonometry, algebraic analysis, analytic and descriptive geometry, the calculus, mechanics, sometimes the method of least squares, astronomy, geodesy, drafting, map-making, seminar.

A general survey is made of the methods of handling these various subjects. And one is not surprised to find that throughout there are emphasized all those which aim to develop the order, accuracy, simplicity, and efficiency so desirable in any engineer.

Among suggestions intended to secure a greater efficiency the authors include such as the founding of higher schools, a three-year course of study, and a longer apprenticeship.

<div align="right">ERNEST W. PONZER.</div>

Algebraic Invariants. By LEONARD EUGENE DICKSON. (No. 14, Mathematical Monographs, edited by Mansfield Merriman and Robert S. Woodward.) New York, John Wiley and Sons, 1914. x+100 pp.

IN this brief introduction to the classical theory of invariants Professor Dickson puts the reader under a further debt of gratitude for the excellent and entertaining way in which he is led to a first acquaintance with the important subject of invariants. It is difficult to conceive how one could be more comfortably drawn into a knowledge of invariants and covariants than by the gradual and lucid processes of the early part of this book. In the first ten pages there is a progressive approach to the full notion of invariant, carried forward from things well known to the beginner by means of processes and ideas which are of intrinsic interest and value in themselves. After a similar gradual development of the notion of covariant the formal definitions of invariants and covariants are given on pages 14 and 15.