

gins at the beginning, by explaining what is meant by a field of force, and then gradually leads the reader up to a clear comprehension of the principles used in the actual construction of a dynamo. He promises to resume this subject in a future notice. Finally, the speeches of MM. Bassot, Poincaré, and Loewy at the unveiling of the monument to Tisserand are printed in full, M. Poincaré giving a short account of the services rendered by Tisserand in the domain of celestial mechanics.

One important change, which it is hoped may become universal, has been made—that of reckoning the day from midnight to midnight, and numbering the hours from 0 to 24. This is already adopted in some European railway time tables. The great convenience of this plan will probably induce the editors of official publications, such as the Nautical Almanacs, to adopt it at a not very distant date.

ERNEST W. BROWN.

*Elements of Precise Surveying and Geodesy.* By MANSFIELD MERRIMAN. New York, John Wiley & Sons, 1899. 261 pp.

PROFESSOR MERRIMAN'S latest work will be found to be of considerable value to one who wishes to become a practising surveyor and may be said to be almost indispensable to a candidate for a post on the Coast and Geodetic Survey. In the government service operations are frequently on a much larger scale than in private practice, and the work culminates in the measurement of a meridian arc—a process requiring extreme care to obtain the accuracy demanded today.

There are eleven chapters, the titles of which will sufficiently indicate the scope of the work. They are: least squares, precise plane triangulation, base lines, leveling, astronomical work, spherical geodesy, spheroidal geodesy, geodetic coördinates and projections, geodetic triangulation, figure of the earth, tables. In these not only are the mathematical parts of the subject fully and clearly set forth, but the practical details so necessary for successful results are so described that the reader may recognize their relative importance. On page 8, however, a remark is made which is somewhat dangerous for a beginner, namely, that observations affected with mistakes must be rejected. A "mistake" should be very clearly defined. It is true that this remark is qualified by a fuller statement on pp. 44, 45, but a warning should be inserted then and there that this rejection must never take place without very good cause. Much astronomical work has been looked on with

suspicion where its authors have rejected doubtful observations. Professor Merriman recommends that negative characteristics for logarithms should be used in computations. This is largely a matter of custom; most computers prefer the use of positive characteristics, inserting  $-10$  when there is likely to be any doubt.

One of the most interesting chapters is that on spherical geodesy, containing a short historical account of the measurement of meridian arcs and the gradual approach to our present knowledge of the form and dimensions of the earth's surface. The whole work is fully illustrated by solved problems, and the references to government reports and other works on allied subjects will enable the reader to obtain everything necessary for understanding every part of the subject.

ERNEST W. BROWN.

*Premiers Principes de Géométrie Moderne.* Par ERNEST DUPORCQ. Paris, Gauthier-Villars, 1899. vii + 160 pp.

THIS useful book is intended to give to students who have some acquaintance with analytic geometry, a liking for the purely geometric point of view. It is not a work on pure geometry as a self-contained science freed from arithmetic; for instance, the notion of imaginary points is sketched in the preliminary chapter from the historic algebraic standpoint. A purist (say von Staudt) would energetically oppose such statements as: "Le point \* \* \* ne représente rien de géométrique lorsqu'il est imaginaire" (p. 9); and would proceed, at any cost, to give a geometric meaning to a point however imaginary.

The book takes, then, a middle path. The ground won by the application of algebra to geometry shall be handled geometrically whenever convenient. That it is very frequently convenient is to be shown, in a way that shall strengthen the geometric sense. For the cultivation of the geometric sense is a very important\* aim of a mathematical course, toward which algebraic methods contribute little.

The ground to be covered is that of the simpler transformations, viz., homography, correlation, inversion, quadratic transformation of a plane, Lie's transformation of lines into spheres.

The body of the book (Chapters II.-V.) is devoted to homography and correlation, and covers the principal proper-

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\* According to the author's introduction, it is the principal aim; which seems too strong a statement.