this point on they devote themselves almost exclusively to hyperbolic plane geometry in general, and Lobachevsky parallels in particular. It is needful to show a number of things about parallels, notably that if l is one of the parallels to m, through a point P, it is one of the parallels through every other point on itself. Much attention is given to the three types of pencils of lines, those through a point, those all parallel to one another, and those all perpendicular to a given line. The main object is to develop the formula for the parallel angle, and so the method for drawing parallels. The leading idea is taken from Engel, and consists in establishing a correspondence between a right triangle, and a quadrilateral with three right angles.

The hyperbolic circle first appears on page 62 and is defined as the locus of the reflection of a point in the lines of a pencil. When the pencil consists in concurrent lines this gives the proper circle, when it is a parallel pencil, this is the queer circle called a horocycle, when the pencil is made up of lines perpendicular to a given line this should give the equidistant curve, i.e. the locus of all points at the same distance as the given point from the given line. It will, however, only give one half of that locus. Next comes an elaborate study of the concept of area, and of trigonometry. Twice we find the functional equation

$$f(x)+f(y)=f(x+y).$$

We are told that it is "geometrically evident" that this function is continuous, hence the solution is $f(x)=rx$. But if we were content with those things which are "geometrically evident" we should not bother with non-euclidean geometry at all, for it is sufficiently evident geometrically that if Euclid's parallel axiom is not true, the amount of its falsity is not enough to disturb the equanimity of sensible people. It is not thus that real mathematics is made. The subject of three-dimensional geometry is covered in eight pages at the end. Of such interesting subjects as Clifford parallels, not a trace.

Such is the book. Interesting and clear, and impregnated with the spirit of the founders, but, at best, one of many, presenting no striking advances over others already available.

J. L. COOLIDGE

The Principles of Thermodynamics. By George Birtwistle, Fellow of Pembroke College, Cambridge. Cambridge University Press, 1925. 163 pp.

The book is a careful presentation of the subject to students who are presupposed to have only a general knowledge of the physical science. For this reason the relation of statistical mechanics to thermodynamics, and the connection between magnetism and temperature, for which a special knowledge of dynamical or physical theory is required, are not included. The third law of thermodynamics is likewise not considered. The work is prefaced in its first chapter by concise historical and descriptive statements relating to the theory of heat, temperature measurement, laws of Boyle, Charles and Avogadro, and the conception of a perfect gas. The work really begins with the two laws of thermodynamics, Carnot's cycle, and Kelvin's temperature scale. This is followed by chapters relating to the dissipation of mechanical energy, thermodynamics of a fluid, change of state, equilibrium of systems, osmotic pressure, thermoelectric phenomena, gas theory, and radiation, as well as chapters bearing on the application in engineering, refrigeration, and the porous plug experiments.

The material covered is such that a chemist or a mathematician should possess and is of the kind a student of physics or engineering would welcome as the first ground to be covered for his more advanced study. As a book to be used by students in American colleges it would find a place for our Junior Honor students. It is well written and has enough of historical statements to connect the various phenomena treated to make it of interest to the general student properly qualified with a fair knowledge of physics and calculus. The book can be well adapted to use for the class of scientific workers for whom it is particularly written, namely, those whose work would require some knowledge, though not exhaustive, of the subject of thermodynamics. The author might well have included further applications of thermodynamics in physical chemistry.

A. F. KOVARIK

Géométrie du Compas. By A. Quemper de Lanascol, with a preface by Raoul Bricard. Paris, Blanchard, 1925. xx+406 pp. 24 fr.

Professor Bricard begins his preface with the striking sentence "Le cercle est prestigieux." The statement is a true one historically and it is equally true scientifically. In nature, in decoration, and in geometry, "the circle is fascinating," and M. Bricard appropriately calls attention to its perennial interest by referring to the work of our Professor Coolidge on the circle and the sphere as a "témoigne de la vitalité de ce culte." The esteem in which the figure was held in the philosophical schools of the Greeks is well known; the geometry of a single opening of the compasses, which occupied so much attention in the Middle Ages is less often considered; while Mascheroni's classical treatise, *Geometria del Compasso* (1797) seems never to have received the recognition that it deserved. Written by one who was at the same time a priest, poet, physicist, philosopher, and mathematician, it naturally showed something of the dilettante in its style and was lacking in mathematical succinctness, but nevertheless it was a work of much originality and of genuine merit. Attracting the notice of Napoleon, it was by him brought prominently to the attention of the French mathematicians of the early days of the empire, and was translated into their language by Carette (1798), thereafter attracting the attention of such eminent scholars as Delambre and Monge.

What M. Quemper de Lanascol has done is to take the work of Mascheroni as a foundation on which to build, to add to it a large number of other constructions that have appeared in various books and journals during the past century and a quarter, and to increase the offering further by many original problems. He has replaced the prolixity of Mascheroni by a succinctness of statement that is much more in harmony with modern tastes in matters mathematical. Indeed he comments with much justice