combined time, and cooperating at each phase of the work, we should accomplish a far better result?

Lamb's Statics keeps to the middle road of presenting the subject as a branch of natural science, largely deductive because of the paucity and simplicity of the fundamental laws. It is a work on physics rather than on engineering or mathematics; it should afford a fine introduction whether to applied mechanics of the more technical sort, to the theory of structures, to more advanced physical theories, or to analytic statics.

To show the breadth of treatment the titles of the chapters may be quoted: Theory of Vectors, Statics of a Particle, Plane Kinematics of a Rigid Body, Plane Statics, Graphical Statics, Theory of Frames, Work and Energy, Analytical Statics, Theory of Mass-Systems (centers of mass and moments of inertia), Flexible Chains, Laws of Fluid Pressure, Equilibrium of Floating Bodies, General Conditions of Equilibrium of a Fluid, Equilibrium of Gaseous Fluids, Capillarity, Strains and Stresses, Extension of Bars, Flexure and Torsion of Bars, Stresses in Cylindrical and Spherical Shells. This is a considerable program; it is well and consistently carried through —as should be expected by all who have known his other writings and particularly his companion volume on *Dynamics*, noteworthy for the same Greek characteristic *σωφροσύνη*.

These books, *Statics* and *Dynamics*, are not written for the writing; they are products of teaching, for they are based on lectures delivered at the University of Manchester. If the matter were taken slowly enough, satisfactory results would attend their use in our American institutions, provided our teachers had an all round interest in the elements of mathematics, of physics, and of engineering, and a fine contempt for superficial ground-covering in any of the three.

E. B. WILSON.

Principes usuels de Nomographie avec applications à divers problèmes concernant l'artillerie et l'aviation. Par Lieutenant-Colonel Maurice d'Ocagne. Paris, Gauthier-Villars, 1920. 67 pages.

This pamphlet, as the title indicates, is a short exposition of nomography in which the illustrations are taken from artillery and aviation. Nomography is the general theory of the graphical representation of equations of any number of vari-

ables: the end of such a representation is to replace all kinds of numerical computation by readings made on the graph. If an equation contains three variables x, y, z, say, then by giving a value to z and using x and y as rectangular coordinates a curve can be constructed. If these curves are constructed for various values of z then a set of values x, y, z satisfying the equation will be found by taking the coordinates x, y of any point together with the value of z which corresponds to the curve passing through that point. If the z-curves are constructed reasonably close together it is possible to interpolate. The corresponding values are then determined as the intersection of three curves. If then instead of point coordinates, tangential coordinates are used corresponding values will correspond to points on a line. D'Ocagne has introduced a particular kind of tangential coordinates which makes the constructions very simple. This is the alignment chart and has many advantages over the construction first mentioned. The drawing of curves is replaced by the construction of scales and, for the case of four variables, the whole drawing can be made on a single sheet of paper. The first half of the pamphlet deals with the theory of the construction of these charts.

The second part applies the theory to the actual making of charts for formulas used in artillery and aeronautics. The charts are arranged according to the simplicity of the construction. Among the charts we find the following: the coefficient of adjustment, $K = D/A$; the angle of sight, $\tan z = Z/D$; the initial angle of fire,

$$(1 + \cos 2\varphi) \tan \epsilon = \sin 2\varphi - \sin 2\alpha;$$

the limiting velocity for arming fuses, $\frac{1}{4}K\pi D^2 = p/V^2$; the interior pressure in the autofrettage,

$$\omega + 1492 = \frac{\lambda_1}{\rho^n} + \frac{\lambda_2}{\rho^2}.$$

These give an idea of the kind of formulas handled. The charts are well constructed and the explanations are very clear. On the whole this little pamphlet makes delightful reading and, now that graphical charts are so much used, the teacher of mathematics should no longer be ignorant of the subject.

C. L. E. MOORE.