versines, these valuable tables being thus now readily accessible. The author also includes short tables of refraction and dip, sufficient for beginners in navigational astronomy. There is a brief description of the use of the tables, and a five-page collection of useful numbers and physical constants. The tables are carefully compiled and skilfully arranged, and seem thoroughly serviceable and trustworthy.

STATICS IN THE MIDDLE AGES.

Les Origines de la Statique. By P. Duhem. Vol. i. Pp. iv+360. (Paris: A. Hermann, 1905.) Price 10 francs.

THIS book is sure to arouse the interest of all who study the history of natural science, and it may cause a certain amount of controversy owing to the nature of its conclusions; but even if some of these have to be modified, enough will remain to shed a new light on the progress of mechanics in the middle ages. The main result, and this is established beyond all reasonable doubt, is that the mechanics of the fifteenth and sixteenth centuries must not be regarded as a sudden achievement, but as a development of ideas current in the thirteenth and fourteenth centuries, many of which were unscrupulously reproduced without acknowledgment.

Who, then, are these predecessors to whom even Galileo and Descartes probably owed more than they ever confessed? In the first place, Jordanus Nemorarius, or more properly Jordanus de Nemore. Nothing is known of his personal history; Moritz Cantor is inclined to identify him with Jordanus Saxo, but Prof. Duhem conjectures that he may have been an Italian, Giordano of Nemi, and this is plausible enough to deserve further investigation. Manuscript evidence tends to show that his works were composed in the twelfth century at latest. Prof. Duhem's researches lead him to the following conclusions about Jordanus and his mediæval successors. Jordanus wrote a treatise of which the proper title seems to have been "Elementa Jordani super demonstrationem ponderis"; of this there is a thirteenth-century fragment and a fifteenth-century text apparently complete. He had studied Aristotle, and the "De ponderoso et levi" attributed to Euclid; but his treatise seems to be original, and not a translation from the Greek. He discusses the equilibrium of the lever by a method which is essentially that of virtual velocities, and even seems to be on the brink of discovering the infinitesimal calculus.

Jordanus's treatise became classical; it was associated with the "De canonio" (attributed to Euclid), and transformed in various ways by commentators without improvement. But there is another work, attributed to Jordanus, "De ratione ponderis," which is of still greater interest and importance. It contains the notion of the moment of a force, the correct theory of a bent lever, and the solution of the statical problem of two weights connected by a string and resting on two different inclined planes. Prof. Duhem is probably right in saying that this was not written by Jordanus, but by an unknown successor whom he calls the "precursor of Leonardo da Vinci." The main argument is that some errors of the "Elementa" are here corrected. It is not impossible that Jordanus wrote it *after* his other treatise, tacitly amending his previous mistakes; however this may be, the author was familiar with Jordanus's "Elementa," and his work is contained in a thirteenth-century MS.

The next great figure to appear on the scene is that of Leonardo da Vinci. It is not very easy to decide how much of theoretical statics Leonardo found out for himself; he had a clear notion of moments, but, on the other hand, his ideas about the composition of forces were vague and incorrect. He does not appear to have added anything essential to what was already known in the thirteenth century; but it is likely enough that his manuscripts suggested valuable ideas to some of those into whose hands they fell.

The later chapters of the book deal with the facts relating to Galileo, Stevinus, Roberval, and Descartes; this period is better known, and it is needless to go into details here. The main point is that, however much we owe to sixteenth-century mathematicians, it is wrong for us to regard them as the founders of an absolutely novel theory of statics; and although this conclusion may somewhat dim our mental picture of the glories of the Renascence, it will deepen our piety towards those *obscuri viri* who cultivated science and learning when they were most in danger of extinction. It is noteworthy that in other directions, such as the history of painting, the same kind of verdict on the Renascence appears to be forming.

The teaching of mechanics to average students is a very difficult and often ungrateful task. One is often tempted to lose one's temper, and unfairly blame the pupil for his stupidity. It is a wholesome corrective to think of the slow progress of the theory and of the extraordinary mistakes made in connection with it by men of unusual ability. Thus it took years of controversy to establish the fact that a uniform bar, supported at its centre of mass, is in neutral equilibrium; and it was long taken for granted that a two-pound weight fell to the ground twice as fast as a one-pound weight. G. B. M.

SPECTROSCOPY.

Spectroscopy. By E. C. C. Baly. Pp. xi+568; illustrated. (London: Longmans, Green and Co., 1905.) Price 10*s.* 6*d.*

THIS important addition to the well-known series of text-books edited by Sir William Ramsay will be welcomed by all who are interested in the progress of spectroscopy, and especially by students of physics and chemistry who may desire to engage in spectroscopic study and research. The book, indeed, fills a gap in spectroscopic literature which has long existed, providing in a moderate compass a comprehensive guide to modern methods of investigation, the theory of the instruments employed, and the principal results which have been arrived at in the application of spectroscopic methods to chemistry and physics. In each of these departments the explanations are gene-