

the reference to this subject in the preface there appears to be an oversight. The effect of a certain cycle of operations to be performed with the apparatus is described and then we read :—

“A connected series of vessels of this kind will enable the experimenter to apply a measured pressure of an amount depending on the number of vessels.”

Instead of a connected series of vessels, it is only necessary to repeat, time after time, with the one vessel, the cycle of operations which has been described; and this we understood to be Dr. Andrews's intention. The apparatus was not brought into actual use, nor even constructed; preliminary trials having shown that screw plungers working in mercury (which were an essential part of the design) could not be prevented from leaking.

The various papers in this volume, and especially the Presidential Address, show Dr. Andrews to have been not only an accurate and original worker, but a man of wide culture and refined literary taste. The editors have done their work carefully and well.

J. D. E.

#### MACH'S "HISTORY OF MECHANICS."

*Die Mechanik in ihrer Entwicklung historisch-critisch dargestellt.* (An Historical and Critical Sketch of the Development of the Principles of Mechanics.) By Dr. E. Mach, Professor of Physics in the University of Prague. Second Edition. (Leipzig: F. A. Brockhaus, 1889.)

THE first edition of this work, which forms Vol. LIX. of the "International Scientific Series," appeared in 1883. With the exception of a few short appendices and the correction of misprints, it is identical with the original edition; but we are glad to take the present opportunity of calling attention to a book which, while unpretentious in form, is one of exceptional value to students, and especially to teachers, of the subject with which it deals.

The book has not been translated into English, and we understand that the English publishers did not consider it sufficiently popular in form to be included in the English series. This is much to be regretted. The work is one which certainly ought to be translated, as it would be most helpful to a large class of students and teachers who are unable to read it in German.

In the course of rather fewer than 500 pages the author gives his readers a well-constructed outline of the development of the science of mechanics from Archimedes down to the present time, accompanied by well-reasoned criticisms and discussions of the significance and relative importance of the various steps which he chronicles. The first chapter is devoted to the development of the principles of statics, and we would specially direct attention to the masterly manner in which the author shows the fallacies underlying the attempts of some of the early philosophers to derive the principle of the parallelogram of forces, or an equivalent one, from *a priori* notions, without appeal to experiment. The proposition commonly known as the parallelogram of forces may either be proved by direct experiment or by deduction from some such experimental principle as Newton's second law of motion. The advantage of the latter method consists, as the author points out, in the fact that he nature and extent of the experimental evidence for

Newton's second law, or its equivalent, cause it to carry with it a greater certainty of its accuracy than is possible for a direct experimental demonstration of the proposition. This is a point to which it is most important to call attention, for, although Thomson and Tait have long since cleared away from the better class of text-books, and from the minds of the higher class of students, the fog which had accumulated around this essentially simple proposition, much of our school teaching is still enshrouded by it.

The second chapter treats of the growth of the principles of dynamics, understanding this in the more restricted sense of what Thomson and Tait called kinetics. This is of great interest and value throughout, but there are one or two points to which we would direct special attention.

The deduction of the approximate time of swing of a simple pendulum vibrating in a small arc, from a rectilinear simple harmonic motion, is, or at any rate should be, well known to students who have had the advantage of instruction from a Professor at one of our Universities; but it is quite time that this very simple method of obtaining an important relation should take the place of the artificial and cumbrous methods which still disfigure some of the elementary text-books in common use. The criticism of Newton's exposition of the ideas of time, space, motion, and mass, is also worthy of careful study. These two chapters are of quite an elementary character, and may be read with advantage even by students whose mathematical acquirements are of the slenderest.

The third chapter treats of the further application of principles, and the deductive development of mechanics. It does not, like the first two chapters, appeal to the beginner, but will be most helpful to a student who has already made some progress in the subject.

The fifth chapter bears the heading, "The Formal Development of Mechanics." It contains an interesting discussion of isoperimetric problems, and a brief account of the analytical method of treatment introduced by Lagrange. It also contains a section mainly devoted to an account of the theological vagaries of some of the great mathematicians and natural philosophers. This section is not of very great interest or value, and may have been inserted merely to give a popular flavour to what is essentially a scientific book.

The volume concludes with a very brief chapter on the relations of mechanics to other branches of knowledge.

G. W. DE T.

#### OUR BOOK SHELF.

*Das Klima des ausser-tropischen Südafrika, mit Berücksichtigung der geographischen und wirtschaftlichen Beziehungen nach klimatischen Provinzen dargestellt.* Von Dr. Karl Dove. 160 pp. and 3 charts. (Göttingen: Vandenhoeck and Ruprecht, 1888.)

METEOROLOGISTS must welcome the reappearance of the name of Dove among the contributors to climatological knowledge, and the present work does no discredit to the name. It is an endeavour to give a conspectus of the climate of South Africa as a whole; and the author ekes out the actual meteorological results, which are somewhat scanty in parts, by evidence derived chiefly from the indigenous flora of the several districts, which