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Review

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zontal revolve round the vertical in the familiar experiment instead of falling down?

It cannot fall down without requiring a large angular momentum (the component of the angular momentum of the spin) about the vertical, and no torque is available to give it that momentum. So it cannot fall down. But why does it precess round the vertical?

The torque due to the weight produces at starting a slight rotation about a horizontal axis fixed in space. But this rotation involves, as already stated, a component angular momentum about the vertical axis: and there can be no angular momentum about the vertical axis.

So the particles settle it among themselves, and the gyroscope precesses at such a rate and in such a way, that the total angular momentum about the vertical remains zero. In an appendix (p. 134) an indication is given of how the particles settle it among themselves: this also forming a novel and valuable feature of the book.

The scheme of Mr. Crabtree's book is as follows: Some of the most striking phenomena of spinning objects are stated, as physical facts to be observed. The first principles of rotational dynamics are then developed, and applied in chapter III. to obtain the equation

$$I\Omega\omega = \text{Torque},$$

whereby the phenomena of uniform precession are explained.

The practical applications of rotating flywheels to the steering of torpedoes, the Brennan monorail, and Schlick's gyroscopic steadying of ships are dealt with in chapter v.

The first 78 pages, constituting the portion just described, are within the grasp of any careful reader with a slight knowledge of the main principles of mechanics. The remaining chapters, VI.-IX., dealing with the steady motion of the symmetrical top and with moving axes, make greater demands on the reader.

Reference must not be omitted to a graceful sonnet, which will be read with sympathetic appreciation by all Cambridge men, dedicating the book to Dr. Besant.

A few slight suggestions may be submitted for the author's consideration, in view of a second edition. At p. 36 does it *follow* that angular momentum obeys the parallelogram law? On page 60 there are two paragraphs. The second gives a most lucid explanation of the reason for precession; and might not the first paragraph be left out? Inertia causing a wheel to dip downwards may be justified by good authority, but so much activity in inertia seems itself to require explanation.

Owing to a familiar optical illusion, by which a rounded curve may be imagined as having its concavity either way, the indication of sense of rotation in several of the diagrams is not free from ambiguity.

Everyone interested in the phenomena of spinning bodies should make a point of studying this book, which constitutes a distinct advance towards the goal which our descendants, if not ourselves, will reach of finding the motion of a top intuitively clear.

C. S. J.

**Examples in Elementary Mechanics.** By W. J. DOBBS. Pp. xii, 344. 5s. 1908. (Methuen & Co.)

The special feature of this book is the attention given to simple quantitative experiments. Many members of the Mathematical Association will recollect that Mr. Dobbs gave a demonstration, with apparatus designed by himself, at the annual meeting in 1907. Everyone present must have been impressed by the simplicity of the means employed, which yet in the right hands give excellent results.

The pious founder has always had a weakness for bricks and mortar. Educational authorities are torn between love of inspectors and a passion for expensive apparatus. Mr. Dobbs does a special service to the cause of education at the present time by impressing on us the positive value of simplicity and directness as well as the negative merit of economy. Interspersed with the examples are many useful practical hints, from which there are few teachers who will not derive some benefit. One little slip

occurs at p. 23 and elsewhere. Lamé is an honoured name among mathematicians : but not as that of the proprietor of Lami's theorem. C. S. J.

**Cassell's Elementary Geometry.** By W. A. KNIGHT, M.A., B.Sc. Pp. 253.

The ground covered by this book is about that of the first six books of Euclid. The arrangement is, first, definitions, then Experimental Geometry (which the author has given in reasonable space—only really useful constructions being given), and then Theoretical Geometry. Euclid's first 32 propositions appear in this order—13-15, 28-30, 32, 4, 5, 8, 26, 6, 18-20, 24-25, and the Problems. Playfair's Axiom is used, and, throughout the book, where a different proof of a proposition is given, Euclid's proof is added as an alternative.

The second book of Euclid is treated as geometrical illustrations of algebra. Many of the less interesting of Euclid's propositions in the 3rd and 6th books disappear, and in their place we get others, such as the concurrence of the medians of a triangle, etc., etc.

The author is careful to explain fully the really important ideas, such as congruent triangles, tangents, symmetry, etc., and the explanations are lucid. The treatment of ratio is confined to commensurable ratios. There is a good selection of examples, but not too many. Most of them are necessarily old friends, but there are a few new faces too, and Ptolemy's Theorem is relegated to a position among the examples.

The author has managed his task of compressing Euclid into one manageable text-book very well.

**The Elements of Geometry in Theory and Practice, Parts I.-III.** By A. E. PIERPOINT, B.Sc. Pp. 387, including answers and indices. 3s. (Longman.)

This book is most elaborately got up, and provided with 345 figures in white lines on a black ground. It contains the substance of the first four books of Euclid, with a little about Scales, Graphs, Field Book, and other small matters. The sequence of the propositions of Euclid I. very nearly agrees with that of Mr. Knight, and is designed to suit the schedules at Oxford, Cambridge, and London.

The book is well written, and thoroughly modern in every way. Each part contains an Experimental, a Theoretical, and a Practical section in that order. The Experimental sections, which are a great feature in the book, lead the pupil by measurement to discover the truth of the theorems before he is given their formal proofs in the Theoretical sections. There are no less than 373 "experiments" to be done. The examples are over 1200 in number, and Part I. contains 30 sets of "drill" questions as well. These statistics will show that the method of the book is on the grand scale. One cannot help feeling that for the ordinary pupil the book is over elaborate, but to the teacher it should be a mine of ideas and examples, provided as it is with almost every kind of question it is possible to conceive—some of course very easy, but some quite fresh. To those teachers—and there are many—who do not take kindly to the "new geometry" the book should appeal very strongly.

W. M. ROBERTS.

**Elementary Mechanics.** By C. M. JESSOP and T. H. HAVELOCK. Pp. vii, 277. 4s. 6d. 1909. (Bell & Sons.)

This volume is a revised form of Mr. Jessop's "Elements of Applied Mathematics," omitting the portions of the earlier work dealing with Hydrostatics. There are useful additions in the shape of sections on bending moment, harmonic motion, and shearing force, with a new chapter on the energy of rotating bodies. We notice that many examples have been added to the various chapters. But throughout the book there is little or no sign that the movement for reform in teaching the subject has penetrated so far north as Durham. This will not, however, prevent the book being useful in the hands of a good teacher in charge of an experimental course. Indeed it is possible that it may be a very good exercise to set a class of sharp boys to detect the unrealities in a volume that a few years ago was considered an