Review

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An interesting substitute for the compass is described in Saegmuller's solar attachment to a theodolite, which automatically carries out the process given in books on navigation of finding compass error by observation, thus dispensing with the necessity for any computation. An auxiliary telescope is set, by means of the known latitude and the known declination of the sun, into such a position relative to the principal telescope that when the auxiliary telescope is on the sun the principal telescope, and with it the zero line on the bottom plate of the theodolite, are necessarily in the meridian. The true N. and S. line thus determined enables the observer to read off the true bearing of any object. The same instrument furnishes a simple means of finding the time by observation. A table annexed gives the effect of an error of one minute in latitude or declination on the resulting azimuth. A chapter is devoted to modern methods of "stadia" surveying, and the work concludes with a set of tables, accompanied by some notably careful and intelligible directions for their use. C. S. JACKSON.

Die Technische Mechanik. First Part: Mechanics of Rigid Bodies. By P. STEPHAN. Pp. 344. (Teubner, Leipzig.)

In the preface of this work the author states that his book is primarily intended for use in Schools of Machine Design. Statics is treated of before Dynamics, partly in order that the most simple technical questions, such as friction, may be considered as early as possible, but chiefly in order that too many new ideas and definitions may not be brought forward at the commencement.

The use of the Calculus is avoided throughout the volume, and "dodges" for circumventing its use are freely indulged in. Thus two pages (66 and 67) are devoted to the determination of the Centre of Gravity of a parabolic segment. As another illustration mention might be made of the proof of the

Roof Truss with Stress-diagram.—Stephan's Notation.

formula $T = T_0 e^{\mu \alpha}$ for the tension of a rope coiled round a rough surface. The proof, which we do not recollect having seen before, is ingenious and obtains the well-known result as the limiting value of $T_0 \left(1 + \mu \frac{\alpha}{n}\right)^n$ when n is increased indefinitely (pp. 169-171). Proofs of this kind are going more and more "out of fashion" in English text-books, and in this we are wholly in sympathy. In "dodging" the Calculus and attempting to find an easier path, we find that at each step the difficulties get greater and greater. While in mastering the Calculus all the difficulties lie in the initial stages, and when the fundamental notions are fairly grasped the subsequent path is an easy one. When all is said and done, the "dodge" is nothing more or less than the Calculus itself,

though it is dressed up so as to look like a piece of commonplace Algebra or Trigonometry.

It is a matter of the greatest surprise that Bow's notation for force-diagrams of framed structures has not been universally adopted in foreign text-books. The confusion produced by the multiplication of arrow heads in the bars of the roof truss on p. 204 seems almost hopeless. The stress-diagram as given by Stephan for this roof is here reproduced, and for comparison the same diagram with Bow's notation. Comment seems superfluous. The struts and

Roof Truss with Stress-diagram.—Bow's Notation.

ties are distinguished by positive and negative signs placed beside the bars of the frame. Stephan, on the other hand, uses thick lines in the force-diagram to denote the struts. If the force-diagram is actually to be used for the measurement of the stresses, this can only lead to faulty results. There would not be the same objection to indicating the corresponding bars of the frame-diagram by thick lines, and, in some ways, this is preferable to using the more usual positive and negative signs. This, however, might be criticised on the score that a bar might be a strut for one system of loading and a tie for another system.

About 200 examples are worked out in the text, many of them showing a pleasing originality and freshness which is sadly to seek in our ordinary school text-books. Nearly all the examples are accompanied by clear diagrams, in which the direction of the acting forces and, in many cases, also the linear dimensions and angles are also given. These diagrams are invaluable: they make mistakes arising from ambiguous or cumbrous expression in the wording of the question almost impossible.

On page 221 is given a graphical Time-table for the trains that run between Furstenwalde and Guben by way of Frankfort (on the Oder), a distance of about 80 kilometres. It is well known that these graphical time-tables are largely employed in railway offices for interpolating special trains and for many other purposes. A great deal of information and instruction may be obtained from the inspection of such a time-table.

The book is one which it is a delight to handle and read, as the print is large and the diagrams excellent. We look forward to the second part, which is to treat of the Mechanics of Liquids, with considerable interest.

R. M. MILNE.

Über eine zeitgemässe Umgestaltung des Mathematischen Unterrichts an den höheren Schulen. By F. KLEIN. Pp. 82. 1904. (Teubner.)

This is a set of five addresses delivered at the Easter vacation course for mathematical and physical schoolmasters at Göttingen in 1904, supplemented by