A TEXT-BOOK OF FIELD ASTRONOMY FOR ENGINEERS

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A text-book of field astronomy for engineers by George C. Comstock

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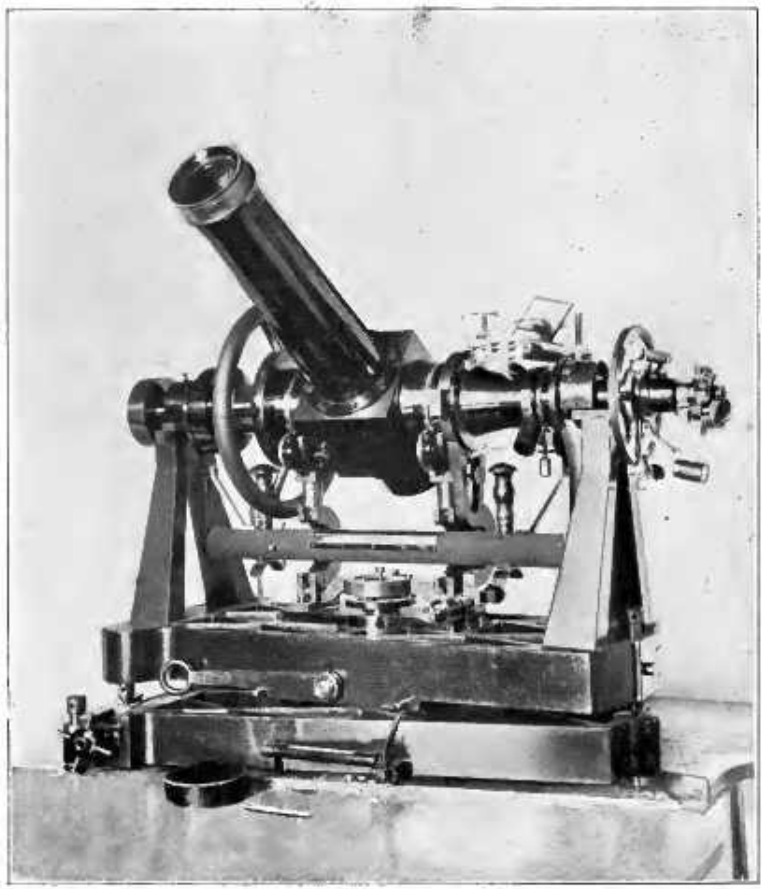

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OF

FIELD ASTRONOMY

FOR ENGINEERS.

BY

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PREFACE.

THE present work is not designed for professional students of astronomy, but for another and larger class found in technical colleges. For many years it has been the author's duty to teach to students of engineering the elements of practical astronomy, and the experience thus acquired has gradually produced the unconventional views that find expression in the present text and which, to the author's mind, are justified by the following considerations:

In the engineering curriculum, work in astronomy is a part of a course of technical and professional training of students who have no purpose to become astronomers. Under these circumstances it seems the duty of the instructor to select for presentation those parts of astronomical practice most closely related to the work of the future engineer and, with reference to the narrow limits of time allotted the subject, to keep in the background many collateral matters that are of primary interest and importance to the student of astronomy as a science.

The parts of astronomical practice most pertinent to

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engineering instruction seem to the author to be (*a*) Training in the art of numerical computation; (*b*) Training in the accurate use of such typical instruments of precision as the sextant and the theodolite, with special reference to the elimination of their errors from the results of observation; (*c*) Determinations of time, latitude, and azimuth, with portable instruments, as furnishing subject-matter through which *a* and *b* may be conveniently realized. If this work is to be done during the single semester usually allowed for the subject, the time given to its theoretical side, spherical astronomy, must be reduced to the minimum amount compatible with the student's intelligent use of his apparatus and formulæ, and in the present work this pruning of the theoretical side has been carried to an extent that would be unpardonable in the training of an astronomer, but which appears necessary and proper in this case.

Since many engineering students acquire from the mathematical curriculum little or no knowledge of spherical trigonometry and its numerical applications, the first chapter of the work is devoted to a brief presentation of the elements of this subject with special reference to its astronomical uses and to the student's acquisition of good habits in the conduct of numerical work. The astronomical problems presented in the following chapters are those that have been indicated by experience as best adapted to the author's own pupils, and while many of the methods given for their solution are not contained in the current text-books, in every case these are either methods in use in the best geodetic surveys,

or such as have been repeatedly tested with students and found well suited to their use. These methods are classified in the text as rough, approximate, and precise, with respect to their precision and the corresponding amount of time and labor required for their application, and the student is advised not to use the refined and laborious methods when only a rough result is required.

As a rule, in the development of formulæ no attempt has been made to deal with the general case when the solution of a particular case would suffice for the problem in hand; e.g., the earth's compression is ignored in treating of the effect of parallax, since its influence is vanishingly small in the great majority of cases that the student will ever encounter, and cases in which this influence is of sensible amount should be avoided by the instructor. A more serious omission, but one required by the general plan of the work, is found in the theory of the transit instrument, Chapter IX, where broken transits, thread intervals, curvature of a star's apparent path, flexure, etc., are passed by without treatment or even suggestion. They are not required for the beginnings of work with a transit instrument, and therefore constitute a part of more advanced study than is here contemplated. As a partial guide to such study there is given upon a subsequent page a list of references to works that may be consulted with profit by the student who seeks a more complete knowledge of the processes of practical astronomy.

The adopted notation follows, with only slight deviations, that of Chauvenet, to whose elaborate treatise

upon Spherical and Practical Astronomy the author is under obligations that are common to every present-day writer upon those subjects. His thanks are also due to many of his former pupils, and in particular to Dr. S. D. Townley and Dr. Joel Stebbins, who have read and criticised portions of his manuscript.