relate; others try the spiral method, where the principles are reviewed in the light of the principles of the calculus. With others the calculus is not studied as a separate subject and mechanics is handled by laboratory methods. In general the calculus is studied later than is the practice in our country and the whole plan of procedure is not outlined as definitely as with us. The case is worse in the private schools of similar kind. Undoubtedly the situation calls for instructors of ability to handle the applied mathematics—or to side-step its problems with agility.

The subject matter during the first half year must necessarily be quite elementary, and there are evidences of ingenious ways of dodging the rigors of the calculus. On the other hand there are equally ingenious demonstrations of a "near calculus" which in the nature of things must always arise in actual engineering problems. Definitions, approximations, experiments, mensurations, rules, formulas, instruments, models—all are used. Most excellent aids—all of them; but should they be first aids?

Examinations are given at the end of the course. These are partly oral, partly written. They are in charge of special committees of school officials and other dignitaries, including the instructors. The typical examination papers shown seem to be not at all as difficult as the average semester examinations on similar work in our technical schools.

A chapter on texts in use, their strong and weak points, is given. A list of reference works and journals is included. Slide rules, planimeters and models used in teaching are discussed. Typical methods of handling fundamental principles naturally calling for the calculus without its aid are illustrated. Graphical methods with special reference to graphic statics receive much encouragement.

Descriptive geometry here, as in our technical schools, aims to develop the students' power to see space relations. The curriculum seems not to include the mathematical treatment of the subject which so many critics have declared desirable. ERNEST W. PONZER.

Astronomy, A Popular Handbook. By HAROLD JACOBY. The Macmillan Company. xi + 435 pages.

THIS book has a broader purpose than its title would seem to indicate. It is intended to be suitable not only for the

general reader, but also for elementary college classes. As the author himself points out in the preface, these two purposes appear to be contradictory. While the general reader requires a treatment devoid of all mathematics, the college student should gain the additional insight into the subject made possible by the occasional use of algebra and geometry. The plan by which the author has met the difficulty is simple and natural. He has made the body of the text free of all mathematics, and has placed in an appendix such algebra and geometry as is used. Throughout the book it is apparent that he has aimed to make the presentation easy and attractive. The mathematical notes themselves are not at all difficult, and could certainly be mastered by any college student.

Although the author's clear and easy style of writing has enabled him to produce a book that is indeed interesting, it seems to me that upon certain questions he has given undue prominence to his own opinions, with a marked exclusion of many important facts. This is particularly unfortunate in a book intended largely for the general reader. The layman is apt to take the writer's words as those of an authority, and he, furthermore, has no way to know that he has read only a small side of a question. I refer to Professor Jacoby's treatment of the markings on Mars. In the discussion of this subject the book is in marked contrast to some of the excellent texts in general use, in which the strongest evidence in favor of, as well as against the canals, is plainly stated, and in which special emphasis is not placed on the writer's views. That Professor Jacoby's ideas concerning the canals are decided, and are emphatically expressed, is shown by the following statement, page 231: "We conclude that neither by visual nor by photographic evidence has the existence of an artificial network of markings been proven, or even rendered highly probable. Therefore the time has not yet come when we shall have to inquire whether geometric lines indicate the presence of intelligent inhabitants; that time will arrive if the lines themselves are ever shown to possess a real or even a highly probable existence." I do not think that I misunderstand the writer. It is true that the first sentence contains the word *artificial*; but the final statement leaves no doubt that it is the existence, not the origin of the lines, that the author is aiming at.

Professor Jacoby's treatment of the Martian question, and

the character of the arguments that he advances, have already been considered at length by Mr. E. C. Slipher.* Mr. Slipher is an experienced observer, and has studied the planet under the most excellent conditions. I refer the reader to his paper for a fuller discussion than is given here. In view of the weight that might attach to a book by Professor Jacoby, it seems to me proper, however, to call attention in this place to some of the opinions that he advances.

It would seem that Professor Jacoby is an ultra-sceptic on the Martian question. As Mr. Slipher points out, he doubts even the universally accepted behavior of the polar caps. We read, page 225: "The polar spots *seem* to increase in the Martian winter season, and to diminish in the summer. *If so*, they may be ice caps, etc."† Small wonder then that he refuses to accept the existence of canals if there still lurks with him doubt concerning the behavior of the polar spots. If the agreement of observers since the time of Herschel is not sufficient to allow him to hold a more positive opinion regarding the caps, it is hard to imagine what form of proof he would require of the fainter markings.

As is the case with all those that deny the existence of canals, Professor Jacoby defends his position by advancing an illusion theory. In so doing he states certain views to which I do not think that observers, or scientists in general, will subscribe. On page 229 we find the following statements regarding the effect of training and experience in observing: "This theory explains why highly experienced observers see so much more than beginners. They think they are training the eye, so as to increase its powers, while in reality they may only be training that slight imperfection of the imagination which tends to increase details thought to be visible. . . .Nothing more strongly increases the powers of the imagination—of seeing the unseen—than the knowledge that others have already made the observation. We are very prone to 'see' what we are told by others is visible: we think we see what we desire and hope to see; do what we will, we cannot prevent this." It is not by advancing such theories that the Martian question will be settled. The decision lies with those who have observed the planet continuously under the best conditions that can be found; and the testimony of most of these is in strong

* "The Martian markings," in *Popular Astronomy*, March, 1914.
† The italics are mine.

agreement, both as to the character and extent of the markings. I imagine that Professor Jacoby regards all the details that he himself sees on Mars as real, and not the product of his imagination, even though some of them might not be seen by others, less experienced than himself.

It seems to me very unfortunate that statements, such as those quoted above, should be made in a popular book by a professor of astronomy. They are in no way calculated to increase the confidence of the public in the value of astronomic study. Perhaps the writer did not mean them to be as far-reaching as they seem. Doubtless he merely overstated himself in a moment of temporary enthusiasm on the Martian question; for we find a few pages later the following quotation from Herschel: "I determined to accept nothing on faith, but to see with my own eyes what others had seen before me." Or was this quotation given to discredit Herschel's work?—plainly he had the avowed purpose to "see" what he was "told by others was visible."

I shall mention an instance in which the author puts particular value in negative evidence. Professor Campbell's observations are taken as conclusive that water vapor does not exist on Mars. Why make no mention even of the fact that Mr. Very's measures of Dr. V. M. Slipher's spectrograms, without exception, show that water vapor is present? They were made with the best of instruments and under the most favorable conditions.

It is significant that the book contains no copy of any of the many beautiful drawings of Mars that show the canals. Was it not safe to gratify the natural curiosity of the reader, and allow him to see how so many have pictured those strange products of their imagination?

K. P. WILLIAMS.

NOTES.

THE annual meeting of the American Mathematical Society will be held in New York City on January 1–2, 1915. At this meeting President E. B. VAN VLECK will deliver his Presidential Address, on "The role of the point set theory in geometry and dynamics." The Chicago meeting of the Society will be held on December 28–29. Section A of the