teorite ages, with links toward cosmogony; of cometary orbits; of the physics and structure of comets and their parts, and their probable origin; of "ordinary" meteors as observed by optical and radio methods, the physics of their interaction with the terrestrial atmosphere, their origin and links with comets. Abundant plates, figures, and tables illustrate the text. Undoubtedly, the opinions of different experts on the same subject would not always agree, and there are many points which could have been given a different presentation. It is therefore gratifying to note the high percentage of the text which can be marked as commonly accepted by the leading authorities. At the same time, it contains material which is unusual and unorthodox, yet not in contradiction with the laws of nature.

The task of the editors was not easy, and slips are inevitable, especially in translations. As an example, on p. 216, in Krinov's article it is stated that the Tunguska meteorite could have been *overtaking the earth;* to be observable, in such a case this object should have passed right through the earth to emerge in Siberia at the moment of observation, and would then be moving in the wrong direction. In Krinov's original Russian text (*Meteoritika,* Moscow 1955; cf. p. 105) it is correctly said that the object could have been *overtaken by the earth.*

The volume is a fundamental contribution to our knowledge of the minor members of the solar system, of lasting value to serve as a handbook for years to come.

Précis d'Electromagnétisme théorique. By Paul Poincelot. 456 pp. Dunod, Paris, 1963. Paper 76 F.
Reviewed by Howard H. C. Chang, Stanford Research Institute.

In the preface of his celebrated opus, *Dictionary of the English Language,* the irascible Dr. Samuel Johnson noted with trepidation that "Every other author may aspire to praise; the lexicographer can only hope to escape reproach." This melancholy observation applies equally well to writers of handbooks and Baedekers. To escape censure the author must satisfy three stringent requirements: (a) the handbook must be accurate, exhaustive and modern. (b) The material must be imaginatively arranged and readily accessible. (c) The price must be reasonable. In all three scores, the present volume, which is best described as *A Handbook of Classical Electricity and Magnetism* (circa 1940), is woefully unsatisfactory and not worth the serious attention of engineers and physicists.

To be sure, the grave sins of this work are not sins of commission but sins of omission. The most damaging statement that can be made against it is that it could have been written in 1940 by Jeans. Thus the following important modern topics are not treated at all or treated very superficially: waves in anisotropic and inhomogeneous media, electromagnetic fluctuations, magnetohydrodynamics, radiation by moving charges, collisions between charged particles, energy loss, bremsstrahlung, method of virtual quanta, radiative beta processes, radiation damping, self-fields of a particle, scattering and radiation by bound systems, dispersion, obstacles in wave guides, variational methods for waveguide discontinuities, surface wave guides, artificial dielectrics, integral transform and function-theoretic techniques, and the powerful and elegant Green's-function techniques. It would, of course, be unreasonable to expect that he would treat all these topics in depth, but to omit them entirely opens this handbook to the serious charge of being obsolete. Instead, the author dissipates his energy on elementary and standard material found in such venerable classics as *Classical Electricity and Magnetism* by Abraham and Becker. Like most French works in electromagnetic theory, an inordinate amount of space is devoted to tensor calculus. Surely, such topics as tensor densities and Christoffel symbols should be eschewed in a book on electromagnetic theory.

Poincelot's references are principally to French books, which is well and good. Apparently he has not bothered to read the English books in this field except Stratton, which appeared in 1941! Thus, he makes no mention of the two fine books in EM theory in the Landau-Lifshitz series (*Physics Today,* Oct. 1961, p. 48), *Classical Electricity and Magnetism* by Panofsky and Phillips, *Classical Electrodynamics* by Jackson (*Physics Today,* Nov. 1962, p. 62), and *Field Theory of Guided Waves* by Collins (*Physics Today,* Sept. 1961, p. 50). If he has not read these fine books, he is guilty of an inexcusable laxity, and if he has, it is difficult to understand why he failed to cull material from them.

While it is a truism that "An author never finishes a book, he merely abandons it", the conscientious author will not abandon his book before he has prepared a detailed and useful index. The fact that this handbook has no index is enough to deter anybody considering its purchase from doing so.

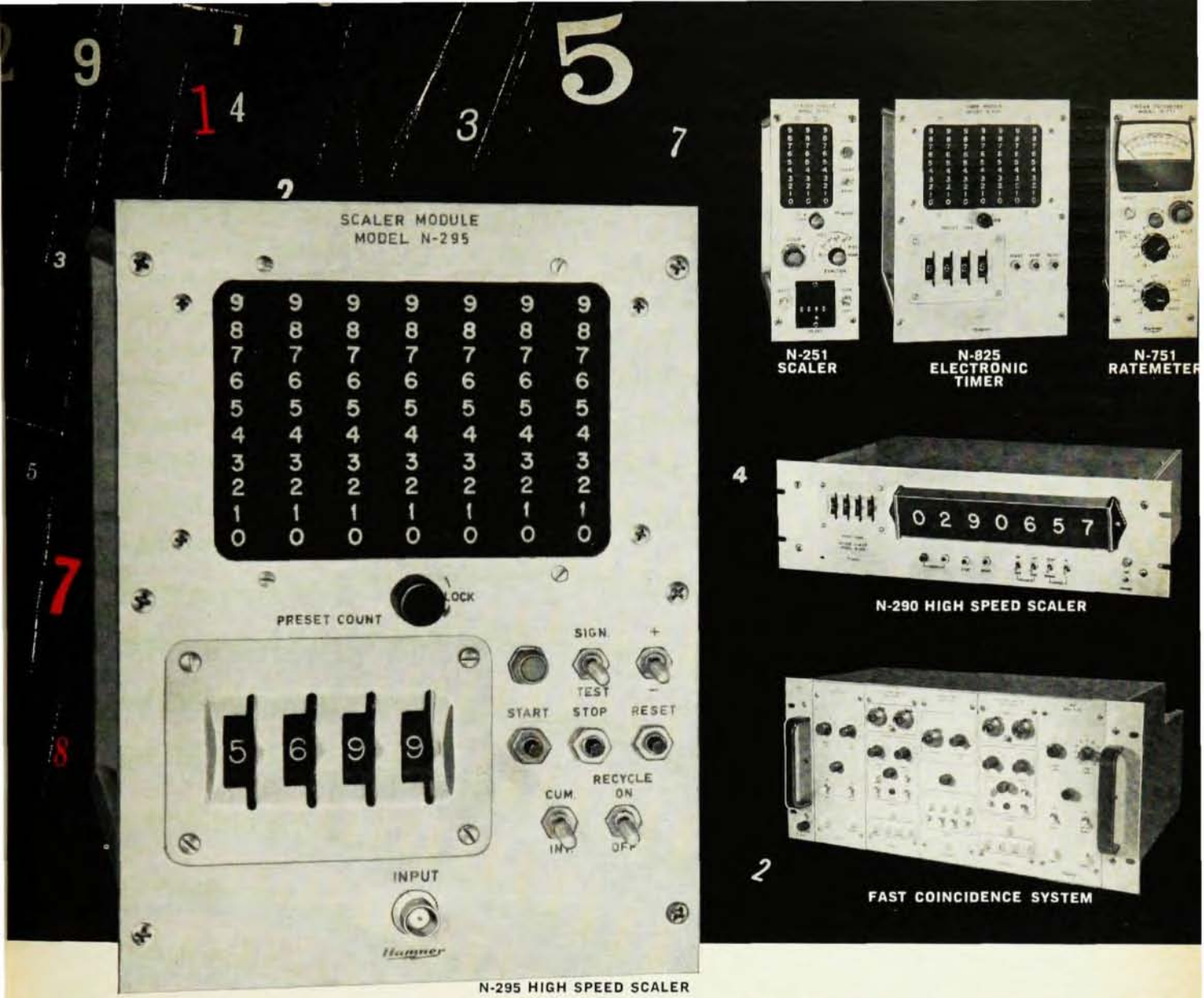
Finally, $15.25 is an exorbitant price for this potboiler. The same material and much more is available in Jackson for $11.25 and in Panofsky and Phillips for $12.50.

The Natural Philosopher, Vol. 1. A Series of Volumes Containing Papers Devoted to the History of Physics and to the Influence of Physics on Human Thought and Affairs through the Ages. 155 pp. Blaisdell, New York, 1963. Cloth $2.95, paper $1.95.
Reviewed by L. Marton, National Bureau of Standards.

My curiosity was aroused when I saw a new publication entitled *The Natural Philosopher.* It is easy to cover a multitude of sins under that title, but it is less easy to do justice to a fine, old, and time-honored concept. I am happy to report that the attempt is reasonably successful.

The relatively slim volume purports to be first of a series and contains four articles. The first and longest part is by Robert E. Beardsley on "Radiation Control" and is, in my opinion, the weakest part of the volume. Although it is a well-documented and exhaustive treatment of its subject, it does not fit too well the announced purpose of the series ("a series of volumes containing papers devoted to the history of physics and to the influence of physics on human thought and affairs through the ages"), and it does not match too well with the remaining three contributions, which are fine illustrations of what can be done in "natural philosophy".

The second paper, by Martin J.



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Klein, on "Planck, Entropy and Quanta, 1901-1906", contains a very lucid treatment of the inception of the quantum theory. It is the author's thesis that: "If there is a single concept that unifies the long and fruitful scientific career of Max Planck, it is the concept of entropy." He goes on to show that, before 1900, Planck "attributed universal validity to the second law of thermodynamics" and had no use for Boltzmann's discovery of a relationship between entropy and probability. Between the years 1901 and 1906 Planck changed his views in this respect quite radically: "Within two years after his second paper on quanta, Planck had not only accepted Boltzmann's statistical interpretation of entropy as a useful idea, but had begun to build it into the very basis of his own thought." Another important aspect of this interesting paper is to show that whereas Boltzmann apparently had never attributed any deep significance to the proportionality constant k, relating entropy and probability, and never attempted to estimate its numerical value, Planck recognized immediately its importance and universality. He calculated its numerical value, and in this respect it is interesting to note that Planck's calculations of the numerical values of several fundamental constants were way ahead of their time. The "precision" of his calculations "was not to be attained by direct measurement for almost a decade". This excellent paper is very much worth reading, not only by the historically minded but by all those who wish to have a deeper insight into the fundamental concept of quantum theory.

A new translation of the Preface to Lavoisier's "General introduction to Chemistry" (1787) constitutes the third paper of the volume. It may not be known to physicists in general that Lavoisier was the one who established the currently used nomenclature in chemistry. Until his time, chemical terms were derived from inventions of the alchemist, and by the end of the 18th century, with increasing knowledge of chemistry, the proliferation of very odd terms made life for the chemist very hard. Lavoisier was the first to point out forcefully, in words borrowed from Father Candillac, that "we cannot think without words; that language provides us with a precise means of analysis; that a calculus is a language as well as a tool of analysis when it is entirely simple, precise, and capable of expressing efficiently what it sets out to express; and that the art of reasoning is basically the use of a properly constructed language". The whole "Preface" in the present printing is about a dozen pages long, and the second half of it is perhaps less interesting, but the first part is masterly writing, and the translator and editors of the volume are to be thanked for bringing it to our attention.

The last contribution is by William Alexander Kay and is entitled "Recollections of Rutherford". Kay was Lord Rutherford's laboratory assistant when he was Longworthy Professor of Physics at the University of Manchester. About seven years ago, Samuel Devons persuaded Kay (who was then nearly eighty years old) "to recount his personal recollections of Rutherford and his work along side him. These were recorded on tape, but . . . the diction was not always clear and Kay's attention wandered from subject to subject". The result of the transcription is much what could be expected from recollections of a very old man. The account is quite rambling and very disconnected. Some of the comments and interpretations added by Dr. Devons are very useful in making the recollections a useful addition to the growing lore upon Rutherford, and many who have known him personally will no doubt enjoy reading them.

Radio Astronomy. By J. L. Steinberg and J. Lequeux. Transl. from 1960 French ed. by R. N. Bracewell. 260 pp. McGraw-Hill, New York, 1963. $9.95.
Reviewed by H. J. Hagger, Albiswerk Zürich, Switzerland.

The young science of radio astronomy dates back to Jansky's observation of the background noise in short-wave communications and Reber's research in the VHF radiation of the sky; however, the astronomer's interest in electromagnetic radiation from space was aroused by van de Hulst's prediction of the neutral hydrogen line from interstellar matter and from experimental observation of this radiation. This book, written by two French radio astronomers and translated by a well-known US radio astronomer, is an excellent introduction to the field, stating the facts in detail, telling about the difficulties of interpretation of the experimental data, showing how useful radio astronomy can be as a supplementary tool to the classical, i.e., optical, observation techniques, and how powerful an instrument mankind is given to explore deep space.

The authors start with the role the atmosphere plays in radio observations, the description of thermal radiation of hot bodies, and the general properties and problems of simple radio telescopes, mentioning also the experimental tricks used to isolate radio sources from the noisy background. The fourth chapter is devoted entirely to interferometers and to the method of obtaining higher resolution power either by using multielement arrays or by a refined analysis technique. The experimental investigation of the important neutral hydrogen line is the subject of the next chapter. In Chapter 6, the mechanisms of emission of radio waves are dealt with, and here not only thermal emission is considered, but also plasma oscillations, gyromagnetic emission, interaction processes of charged particles with high magnetic fields (synchrotron effect), and Cerenkov radiation are taken into account for explaining experimental data. In Chapter 7, the radio spectrum of the sun is analyzed in detail, showing the relationship between optical observations and radio measurements. Thermal and nonthermal radiation from the solar system is the subject of the next chapter, and here facts and their probable explanation are given. Before the authors review the radio sources of our own galaxy, they trace a radio map of the Milky Way, showing how well radio astronomy is able to draw a picture of the physical events in our galaxy. Investigation of thermal radiation, of the hydrogen line, and of nonthermal radiation from our galactic system has filled the gaps of optical astronomy. In the last chapter, extragalactic sources are considered, radio sources which can give light to the better understanding