is, however, neglected. It thus gives a first approximation to wave propagation in the ionosphere. In the last chapter the ray theory is extended to the case of a magnetic field.

Problems for each chapter are given, and the book finishes up with 300 very valuable references for more extensive research and with an index.

This book provides a good introduction to the whole field of electromagnetic wave propagation in the ionosphere. It is very comprehensive and may be considered a success in producing an introductory and reference tool for research workers in the field and as a text for an advanced university course on the topics, provided the reader or the student has had an introduction to electromagnetic theory. It is well suited both for engineers and physicists and can be recommended.

Cathode Processes in the Mercury Arc. By I. G. Kesaev. Transl. from Russian. 345 pp. Consultants Bureau, New York, 1964. $17.50.
Reviewed by Sanborn C. Brown, Massachusetts Institute of Technology.

Not infrequently when one has sent for a book by title alone one asks the question after reading it, "for what purpose was this book written?" Dr. Kesaev leaves no doubt in the mind of the reader as to why he wrote his book on "Cathode Processes in the Mercury Arc". He states in the preface, "At the present time in view of the extensive work being done to provide the national economy with new technology, it has become necessary to seek out new approaches and organize methods of investigating the arc discharge. These studies must be of the nature of a planned operation conducted according to a previously established broad program, and there must be a single guiding idea at the basis of the program to unite the individual aspects of the work . . . an attempt at just such a planned investigation of the cold arc . . . forms the basis of the present book."

Viewed as a collection of observations on cathode processes in the mercury arc, the book is successful in drawing together a vast amount of material. The difficulty with the presentation is that as much space is spent in reporting observations and explanations, which the author feels to be erroneous, as with those developments which he feels to be consistent with his view of the physics of this particular type of arc. The author leaves the reader in no doubt as to what he believes to be true, and it would be interesting to know if the blunt value judgments are a result of the translation or whether they appeared thus in the original Russian. Such statements as "in defiance of the elementary facts the authors neglect the effect of magnetic field on the motion of the electrons . . .", or "in attempting to substantiate his absurd arc theory, Smith called for help from the energy balance equation . . ." add a certain spice to an otherwise pedantic volume, but certainly it is not considered gracious journalism in a technical book.

The volume is advertised as having a foreword by Jerome Rothstein, which is in fact, only one page long but does highlight part of the problem with this work when Dr. Rothstein writes "One can raise an occasional eyebrow over the neglect of some references or about a few impressions given by the text with respect to historical priorities, and it is possible to disagree with the author occasionally in his assessment of previous work. . . ." About the only editorial comment which Rothstein has made is to be found in a single reference to his own work which he disagrees with: "The author errs in classing Rothstein's assumption with . . . ." This reviewer feels that many of the authors of referenced papers may object to Dr. Kesaev's evaluation of their work.

Technically the book is hastily done. It is a photo offset reproduction from a typed script using unjustified margins. The typography is poor with many typographical errors uncorrected, and in the cited literature, even books published in Germany and the United States are referred to only in their Russian translation.

The book is quite useless as a text since one must read it from cover to cover to find the logical presentation of the subject matter. It comes to little use for the research worker since the author quite correctly states in his own conclusion "The present work is only one of several parts of the investigation of the cold arc so that it would be premature to use these data to arrive at any conclusion concerning the mechanism of the cold cathode arc."

Torques and Attitude Sensing in Earth Satellites. S. Fred Singer, ed. 261 pp. Academic, New York, 1964. $9.75.
Reviewed by R. E. Street, University of Washington.

Some of the sixteen papers contained in this volume were first presented at the second Robert H. Goddard Memorial Symposium of the American Astronautical Society. Most of them are concerned with the important problem of determining what are the torques acting upon earth satellites and their relative magnitudes, while the last three papers, by Wark, Lunde, and Conrath, respectively, are concerned with horizon sensing by weather satellites.

No body is completely rigid, and because of this even spin-stabilized satellites will end up tumbling about their axis of maximum moment of inertia. The dynamics and control of this phenomenon is the subject of the first paper, by Reiter and Thomson. Since the earth's gravitational field is not uniform, there is a torque on nonspherical bodies called the gravity-gradient torque. This is the subject of three papers, the first, by Fischell, covering a passive type of gravity-gradient stabilization. The second, by DeLisle et al., discusses the use of gyrostabilizers to achieve internal dissipation and damping as well as control of the orientation, and the third, by Roberson, is a proof of some basic theorems concerning the torque on a body in a generalized gravitational field.

A paper by Evans calculates the torques due to aerodynamic and radiation pressures. This is followed by two papers by Singer and Lyttleton on the Coulomb forces and torques with special consideration of the West Ford needle experiment, giving an explanation for its failure that also includes internal energy dissipation. The next three papers consider the effect of the geomagnetic field on the angular motion of a satellite. After a short review by Wil-

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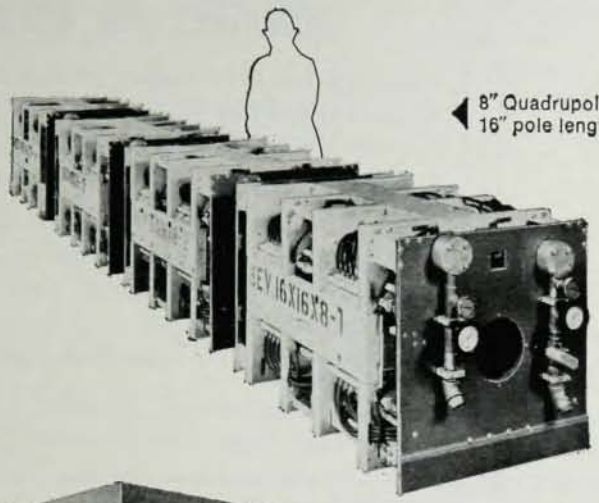

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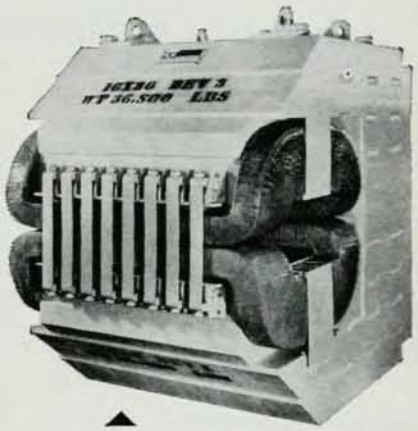

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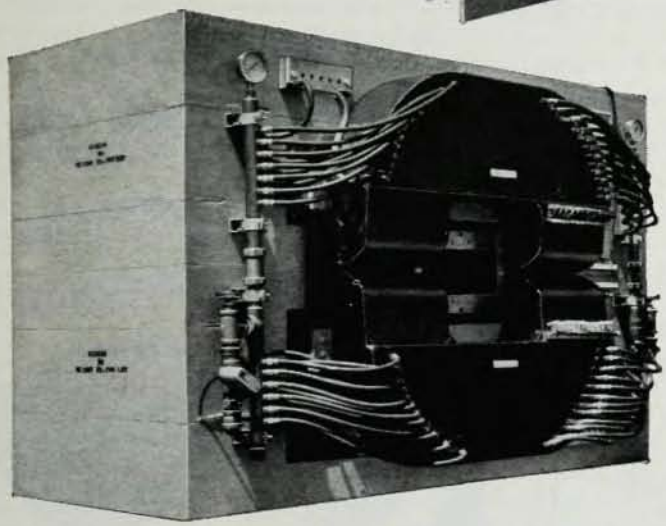

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son, Hecht and Nanger describe the method of magnetic attitude control used in the Tiros satellite, and McElvain presents a technique for using the geomagnetic field to remove the satellite's angular momentum. A paper by Williams considers the torque and attitude sensing problem for spin-stabilized synchronous satellites and how it was solved for the Syncom satellite. Two papers by Colombo and Naumann analyze the observed angular motions of the Explorer XI satellite.

As is true of many such collections of review articles, the ones contained in this volume do not go into sufficient detail to be anywhere near self-contained. The reader will have to turn to the references given. Some of these are company and contractual documents of limited circulation. However, on the whole the book does present an introduction to the scientific basis of attitude control, which is so important for many satellites, especially the orbiting astronomical observatory.

The Mechanics of Aerosols. By N. A. Fuchs. Translated from Russian by R. E. Daisley and Marina Fuchs. Translation edited by C. N. Davies. 408 pp. (Pergamon, Oxford), Macmillan, New York, 1964. $17.50.
Reviewed by M. E. Straumanis, University of Missouri at Rolla.

Mechanics of Aerosols appeared first in Russian in 1955. When it was decided to translate the book into English, progress in aerosols was so rapid that parts of it became obsolete and the author was unable to correct the text. Instead he wrote, as it is said in the "Foreword to the English Edition," an addendum for this edition, covering the work published between 1954 and 1960 (in Russian the addendum appeared in 1961). However, the reviewer could not find the addendum in the book, although there are references for the period, including some of 1961.

The book is not a textbook. It is written for those who already have some knowledge about aerosols, their properties, and production, and who wish to broaden their knowledge with the intention of understanding the behavior of aerosol particles. The expression "Mechanics of Aerosols" as mentioned in the "Foreword", is used for the first time in this book and is only one, but an important, section of aerosol science. "Mechanics of Aerosols" is involved, e.g., in studies of the motion of droplets under various conditions (including electric fields), in the determination of the electronic charge, Avogadro's number, in condensation processes (Wilson's cloud chamber), Brownian motion, the absorption of sound waves, etc.

To give an example of how the author treats the material, Chapter 2 (of the eight chapters of the book) "Steady Rectilinear Motion of Aerosol Particles" (pp. 21–69) may be mentioned. In this chapter are the paragraphs: Resistance of a gas to the motion of very small particles; Stokes formula; Resistance of a gas to particles of a size comparable with the mean free path; Experimental verification and accuracy of Stokes formula; Resistance of a medium beyond the Stokes region; The general nature of the motion of nonspherical particles and rotation of particles in shear flow; Resistance of a medium to the motion of nonspherical particles; The settlement of clouds of particles; The motion of an aerosol in a confined space; Motion of particles in vertical and horizontal fields and practical applications (with the subtitles on the elementary electric charge, measurement of charge and mobility, determination of particle size, apparent density, and shape factors of particles); Radiometric forces in aerosols, thermophoresis, photophoresis, and diffusiophoresis. The next chapters are on "Non-Uniform Rectilinear Motion," "Curvilinear Motion," etc. Each chapter is treated fairly exhaustively with all the necessary equations, and frequently including the derivations. The aim of the author of the book was to collect and to examine critically all the experimental material concerning the mechanics of aerosols, although in many cases great mathematical difficulties had to be overcome. The criticisms are, of course, from the viewpoint of the author. There are also sections with less mathematics like "Deposition of aerosols in the respiratory system", "The spread of highly dispersed aerosols in the atmosphere", "The detachment and transport of particles by wind". There are 886 references at the end of the book, 162 of them referring to Russian authors. There is also a name and a subject index. However, the latter is not very extensive.

There seem to be no misprints in the book; it is well arranged, contains about 90 figures and makes a very good impression. It can be recommended not only to physicists who are interested in the behavior of small particles and droplets under various conditions in a gas, but also to colloid chemists and to engineers of the respective branches, such as aeronautical engineers, hydrologists, etc.

Crystals: Their Role in Nature and in Science. By Charles Bunn. 286 pp. Academic Press, New York, 1964. Cloth $6.50; paper $3.45.
Reviewed by H. D. Keith, Bell Telephone Laboratories.

This is a book written for beginners; in the author's words, "for natural philosophers, whether laymen or science students . . . who may find it an agreeable preamble to formal studies." And, in a qualitative, descriptive style, it covers the subject remarkably fully for a book of its size.

The writing is leisurely but economical. For example, the book opens by explaining the distinction between what the layman thinks of as "crystal" and what the scientist means by the term: yet, fifty pages later we have already advanced beyond intermolecular forces and an atomistic description of nucleation and crystal growth (including the Frank mechanism), and are on our way to morphology, symmetry operations, crystal optics, and x-ray diffraction as a means of determining structures. These topics are all developed in simple language although basic concepts are not handled superficially. Causal relationships are highlighted, and the discussion of how different molecular shapes and different types of intermolecular interaction are reflected in the macroscopic characteristics of the crystals to which they give rise is particularly lucid. Illustrative material is frequently drawn from quite recent work, and the book is