omitting transistor circuits from the article on electrometers and amplifiers and thereby implying that they are too modern an innovation to be included in this category. In fact, too much of this book seems to give inordinate attention to what is venerable and not as much as one would desire to what is modern and in current use.

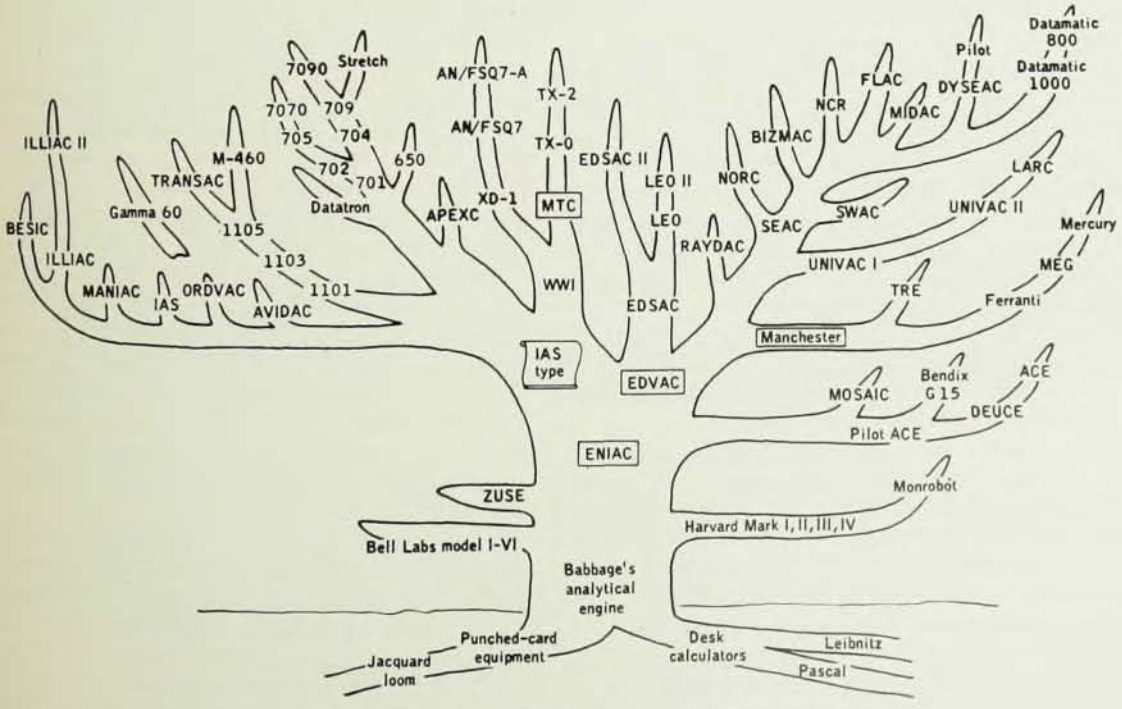
Some of the articles are well written, well diagrammed, and well referenced. It is, therefore, unfortunate that their aims, objectives, and modernity are not consistent and that they have been included in the same volume. Since one must judge this book on the basis of a compendium and not on any one or two individual contributions, this reviewer is left with the impression that one can do better elsewhere.

Programming and Utilizing Digital Computers. By Robert Steven Ledley. 568 pp. McGraw-Hill, New York, 1962. $12.50. *Reviewed by Peter L. Balise, University of Washington.*

ONE of the questions in science and engineering education today is how best to introduce machine computation. This reviewer favors making it a part of other courses, rather than a special course on computer techniques. But Dr. Ledley's work shows how digital-computer programming can be taught with the emphasis on analysis that is appropriate in college courses. He does this by avoiding details which can be learned from manuals and by devoting attention to fundamental subjects like Boolean algebra, mathematical optimization, and numerical analysis. Yet there are so many specific examples (and over 500 problems) that the text is eminently practical.

Essentially, it is a modernized version of the author's earlier *Digital Computer and Control Engineering*, with a considerable shift in emphasis. The last half of the older volume, logical design of computer circuitry, is eliminated except for an introductory treatment of logic independent of its application to electronic circuits. Parts 1 and 2 of the older volume, quite detailed discussions of machine-language programming and data processing, are almost completely retained, with revisions. The very significant new material concerns automatic-programming languages, particularly ALGOL and COBOL, for whose general acceptance the author argues effectively as a solution to the "tower of Babel" problem in computer languages. Student motivation is enhanced by a chapter that gives an appreciation of how the machine actually handles interpretive and compiling routines. Another stimulating chapter, somewhat apologetically titled "Programming to Achieve Intelligence", gives good introductions to accomplishing deductive and inductive inference and creativity by computers, with brief examples of language translation, medical diagnosis, proving geometric theorems, and musical composition.

Simple figures very clearly illustrate such topics as iteration and optimization. Too often, in this reviewer's opinion, authors seem to feel that the mathematical essence of a subject is irrevocably prejudiced by a graphical representation. In its clarity and coverage, Dr. Ledley's text is suitable for a variety of courses;



The evolutionary tree of digital computers (from the book *Programming and Utilizing Digital Computers*).

amply indexed, it should also be of some interest to computer users.

Advances in Geophysics, Volume 9. H. E. Landsberg and J. Van Mieghem, eds. 374 pp. Academic Press Inc., New York, 1962. $14.50. *Reviewed by E. J. Öpik, University of Maryland.*

THE collection of monographic reviews of the *Advances* is assuming encyclopedic dimensions—if this term is applicable to the rapidly changing front line of modern research. The six contributions of the present volume represent among themselves a balanced entity, covering almost the entire spectrum of geophysics from the earth's deep interior to radiation belts.

The discussion by Stauder of the focal mechanism of earthquakes shows that strike-slip faulting (horizontal displacement) predominates over dip-slip, and that earthquakes with tensional and compressional motions on the fault are equally frequent. This is at variance with expectations based on existing theories of mountain building. A gigantic "thrust southward of the whole of Eurasia" is suspected.

The possibility of interchange of matter between the mantle and crust of the earth, with lateral inhomogeneities of density, is considered by K. L. Cook. Seismometric data on wave velocities in their relation to petrographic composition are lucidly presented. The mid-oceanic ridge system, a continuous world-encircling extension of the Mid-Atlantic Ridge, is apparently connected with strike-slip faults; there the "mantle-crust mix" may take place through upwelling of basaltic magma. The role of island arcs and continental rift systems is discussed, together with geothermic heat-flow data. The "mix" area is estimated to cover at least 10 percent of the earth's surface. The subject has far-reaching implications regarding the evolution of the earth and other planets.

A short essay by Sheppard considers the general circulation of the atmosphere "as a budgetary exercise" involving transfer processes of heat, momentum, and water vapor. Ingenious dimensional models are developed which, however, are failing in application and lead ultimately toward empiricism.

In another review of a more practical nature, J. P. Lodge describes laboratory methods for the determination of concentration, size distribution, and composition of aerosols; no results are quoted.

Charged particles of solar and cosmic-ray origin are trapped in the geomagnetic field, where they spiral along the magnetic lines of force, back and forth from one hemisphere to the other, being reflected from certain mirror points. This is an observational fact, apparent in the radiation belts, this newest addition to the geophysical domain. The trapping of protons originating from cosmic-ray albedo neutrons was first described by Singer. However, the more important mechanism of cooperative trapping of solar protons is not well understood; it is to be accepted as a fact. As a consequence of magnetic field gradients, the trapped particles drift in a longitudinal direction, creating a westward current. This, and other mutual interactions or perturbations between trapped particles and the geomagnetic field are the subject of a detailed cooperative study by Apel, Singer, and Wentworth. A model of the outer, or main radiation belt is proposed, and the theoretical predictions are compared with the experimental data. There is qualitative and also quantitative agreement. The physical and mathematical basis of the theory is given, so that the essay may serve as a first introduction into the theory of the magnetosphere.

The most extensive contribution, "Celestial Geodesy" by Kaula, is a little textbook covering everything, from the celestial mechanics of the motion of artificial satellites to methods of observation, including those of the moon, all with the purpose of obtaining precise geodetic coordinates. Final new results for the earth's radius, flattening, gravity, etc., are quoted.

Ample bibliographical lists add to the value of the volume which is a precious addition to any geophysical, astronomical, geological, physical, or geodetic library.

Thermodynamique (5th ed.). By A. Kastler and R. Vichniewsky. Cours de Physique Générale, edited by G. Bruhat. 822 pp. Masson, Paris, 1962. Paperbound 72 NF, clothbound 82 NF. *Reviewed by J. H. Van Vleck, Harvard University.*

IT would not be fair to say that this impressive volume of over 800 pages and almost 300 figures is simply a new edition of Bruhat's *Thermodynamique*. It is almost twice the size of the fourth edition, which was written in 1947 by Prof. Bruhat himself. The present volume is largely the work of Prof. Kastler, with the collaboration of R. Vichniewsky. Although some paragraphs are lifted verbatim from the earlier edition, by and large the treatment is different, and the scope is widened to include statistical mechanics and the quantum-mechanical foundations of thermodynamics.

The volume is written in the French tradition of lucidity and care. The writers have taken pains, especially in the early part of the book, to introduce the basic concepts gradually and thoroughly. As the author says in the preface, the thermodynamic scale of temperature is introduced without first introducing the concept of a perfect gas in order to avoid the impression too often given that such a gas is indispensable to the understanding of such a scale.

The first 150 pages are devoted to fundamental concepts and thermodynamic relations (in connection with which, incidentally, reference might have been made to the existence of Bridgman's very useful "A Condensed Collection of Thermodynamic Formulas"). Then come about 300 pages on "Applications des Principes". There is considerable stress placed on the Nernst heat theorem and chemical thermodynamics.