

The book concludes with a treatment of a linear viscoelastic material and lists some thermodynamic restrictions for the relaxation function.

Some of the proofs presented by Day are amazing in their ingenuity, and, although the book deals with a complex subject, it is so well written that every single argument can easily be followed by the careful reader.

The very fact that Day chose to present two different approaches to a thermodynamic constitutive theory makes it clear that that theory is not complete at the present day. And indeed, while the simple equations of state of classical thermodynamics have been replaced by functional relations of sophisticated generality, the second law in the form of various inequalities sticks out as what an archeologist would call a "typological relic" from the thermostatics of Clausius; but perhaps I am prejudiced on that subject, since in my research I have made it my concern to investigate the consequences of more general entropy inequalities.

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Introduction to Newton's 'Principia'

I. Bernard Cohen

380 pp. Harvard U.P.,
Cambridge, Mass., 1971. \$30.00

In the tribal folklore of physics, no saint has a bigger halo than Newton's. As it should be with true believers, physicists are loth to come to grips with the sweat and sin, the deviations from the path to Olympus, of their tutelary Herakles. Thus it is no surprise that while any interested person who seeks Augustine, Shakespeare, or Goethe need only go to any university library to find a complete, precise, and abundantly annotated edition containing every single word or figure set on paper by those authors and today preserved, until recently the scholar who would study the works of Newton was compelled to rely largely on the tiny fraction of his work that had been published, a fraction selected by a mixture of prejudice and caprice. Even now, those to whom Newton's native language in science, which was Latin, is inaccessible can consult his masterpiece, the *Principia*, only through a translation notorious for its blunders at critical passages.

This strange contrast results from the natural preference of the masses and the "educated" for great entertainers over great enlighteners. The ill

wind of abundant cheap publication, however, has blown good to Newtonian scholars by making possible the publication, now in progress, of *The Mathematical Papers of Isaac Newton*, Cambridge U. P., superbly edited by D. T. Whiteside, the four volumes going through 1684 now standing in print. In addition there are now four volumes of the *Correspondence of Isaac Newton*, through 1709, variously and irregularly edited by a committee, so that the responsibility for random spots of ignorance or national prejudice could be made anonymous. These eight massive volumes, difficult to penetrate, form today the best introduction for the serious student of Newton's thought.

The introduction presently under review is of a different kind. Of course, any introduction is made, not passively, but to someone. The quickest inspection of the work shows that I. Bernard Cohen makes no attempt to speak to any who would follow the brilliantly inventive, perplexing, lacunary, often fallacious and sometimes even contradictory mixture of guesswork and icy mathematics in Newton's treatise. Indeed, the content is mentioned only here and there, in passing.

Rather, this introduction, as the appearance of the late Alexander Koyré's name on the flyleaf might suggest, is a contribution to the "new" history of science: the story of the circumstances, rather than the content, of scientific discovery. As such, it is a work of great erudition. The reader is led through the preliminary manuscripts, the writing and publishing of the first text, and all the revisions, both those that did appear in the second and third editions and those that were withheld.

In the task Cohen set himself, he has succeeded perfectly, and the present volume will surely stand henceforth as the definitive textual criticism of the *Principia*.

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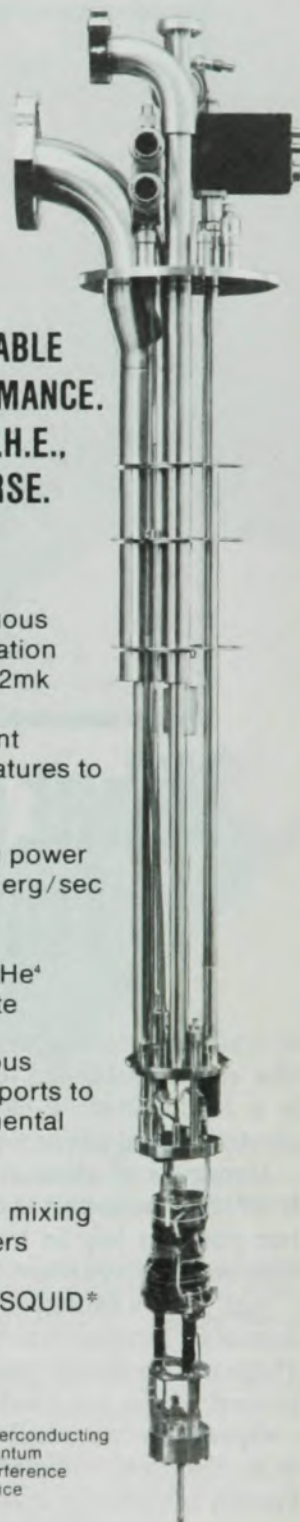
The Crystal Chemistry and Physics of Metals and Alloys

W. B. Pearson

806 pp. Wiley, New York, 1972. \$34.95

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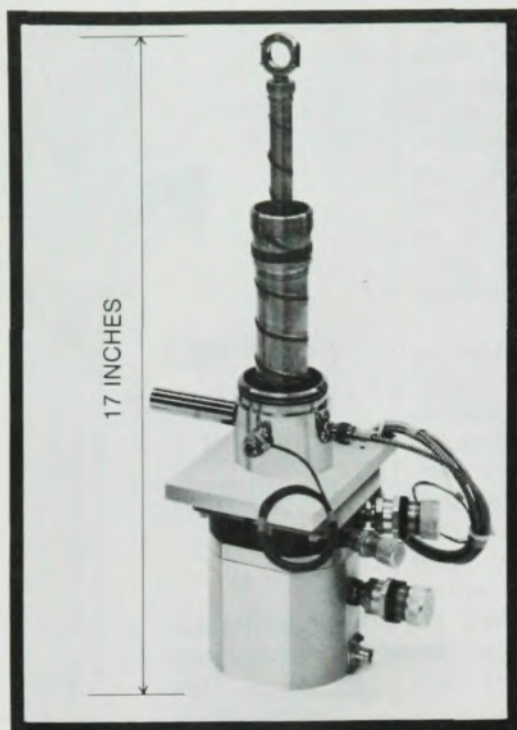


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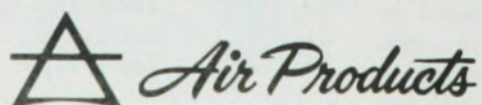
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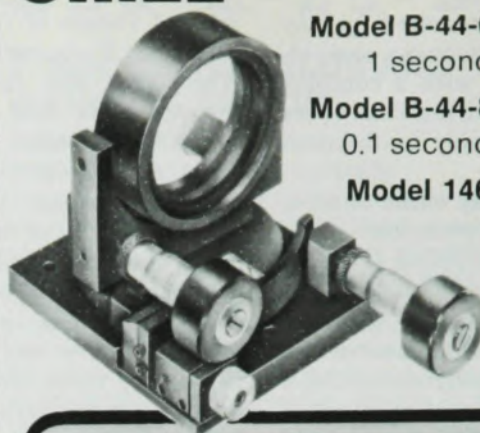
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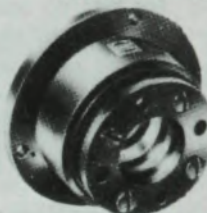
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formation, to develop empirical rules for the occurrence of structural types and to uncover the physical reasons underlying such rules. His survey of *The Crystal Chemistry and Physics of Metals and Alloys* is therefore uniquely authoritative and comprehensive. This is no glib summary of the field—it runs to some 800 pages with 600 illustrations. It is at once a personal statement and a reference work that may prove indispensable.

The title is perhaps a little misleading. The author is mostly preoccupied with crystal structure *per se*. It is nature's endless variations on simple geometric themes that fascinate him, and he has little to say on the consequences of structure for other properties. Moreover, the passages that deal with fundamental theories of cohesion and structure are brief and apologetic. Pearson sees the deficiencies of early theories, which he recounts, in part, for historical reasons, and he so mistrusts most recent theories as to omit them entirely. In other fields such an omission might be a glaring fault, but in this one the few small successes of theory pale into insignificance before the mass of unexplained observations. Indeed, there has, in the past, been a tendency for metallurgists to snatch too eagerly at the few crumbs of insight that fell from the solid-state theorists' table. For instance, H. Jones's classic (1937) papers¹ on phase boundaries in noble-metal alloys have been reverentially cited and elaborated upon since their publication. They drew one immediate skeptical comment from a Mr Bucknall,² in the pages of the *Proceedings of the Physical Society*, who said that, while he looked "forward eagerly to the time when a sound generalized theory of alloys will have been developed by application of wave mechanical principles," he saw a real danger of oversimplification on the one hand and unjustified generalization on the other. However, for the next generation of metallurgists the prevailing mood was optimism and a ready acceptance of promising but unfulfilled theories.

Pearson's empiricism, although unsophisticated, is in the solid and sensible tradition of Hume-Rothery. Like a 19th-century botanist, he patiently gathers his data and then lets the facts, suitably arranged, speak for themselves. It is a pity that, in pursuing his single-minded approach, he neglected to devote much attention to phase equilibrium. Since the occurrence of an expected crystal structure may only just be frustrated by the existence of a slightly more favorable rival, the complete analysis of phase diagrams and their interpolation by computer methods³ must surely be essential to the eventual achievement of a more complete understanding of alloy structures. In this connection, it

should be noted that he does give a review of *metastable* phases, whose production (for example by rapid cooling) is a relatively modern and theoretically stimulating development.

Solid-state theorists who wish to improve their poor collective batting average in the area of theory of crystal structures may find in this book a fortunate opportunity to meet nature halfway. However, it will not be easy for the uninitiated to dip into its pages. Pearson has chosen to adopt, for his primary description of metallic structures, a method based on the visualization of a given structure as a stacking of layers of atoms, and relegates atomic coordination to a secondary role. This point of view, while not novel, is certainly unorthodox when applied over the whole field. It remains to be seen whether it becomes more widely appreciated.

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1. H. Jones, *Proc. Phys. Soc. (London)* **49**, 243 and 250 (1937).
2. *Ibid.*, page 263.
3. See for example L. Kaufmann, H. Bernstein, *Computer Calculation of Phase Diagrams*, Academic, New York (1970).

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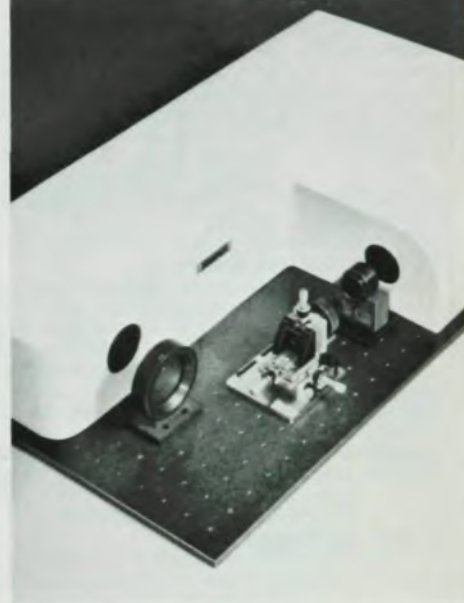
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