was not felt to be providing suitable services and how the Mermin and Wilson "remedy from within" for any deficiencies might have been or might be implemented.

E. R. PIKE
Honorary Editor
J Phys A: Mathematics and General
Royal Signals and Radar Establishment
12/2/76 *Great Malvern, UK*

International agreement

I read with interest the letter of Jay S. Huebner (May 1976, page 9) suggesting that the last page of articles be incorporated in references. There lies, in my modest opinion, a much more Herculean task ahead for the AIP: international standardization. As you are well aware, there are small, but irritating and useless, differences in the way articles are referenced. For instance, British journals and SIAM journals use alphabetic reference systems, *Physica* puts the year after the volume rather than at the end of the sequence. I am sure that every editorial board has a logical justification for its choice, and who would dare to ask the Royal Society to change its archaic ways? Not me! Nevertheless, life would be easier on the author and his faithful typist if there would be an international agreement. The book publishers appear to have come to some kind of international system.

PAUL H. E. MEIJER
The Catholic University of America
12/13/76 *Washington, D.C.*

Physics of technology

The letter "Teaching the physics of high fidelity" by Kenneth Johnson et al (November, page 9) brings attention to what is indeed a powerful and successful teaching technique. High fidelity is a fertile technological system for motivating the learning of a broad spectrum of physics topics.

But there are other systems that can also serve. In fact, one might simply offer a course titled "The Physics of Technological Systems," or more generally, "The Physics of Technology," and utilize a variety of technological devices determined by the particular student interests and career goals.

In fact, such a program and course materials already exist. The Physics of Technology program was recently developed under a grant from the NSF and is now available from the McGraw-Hill Book Company. The materials consist of a series of 27 laboratory-based modules, each centered on a technological device.

The following is a list of the modules available, along with their physics-topic emphasis:

The Analytical Balance (measurement, errors and mechanical equilibrium)
Automobile Collisions (momentum and energy)
The Electric Fan (rotational motion)
The Pile Driver (kinematics, work and energy)
The Stroboscope (measurement of motion)
The Torque Wrench (forces, torques and elasticity)
Hydraulic Devices (hydraulics and equilibrium)
The Loudspeaker (sound and wave motion)
The Guitar (sound and wave motion)
The Pressure Cooker (thermal properties of matter)
The Power Transistor (temperature and heat transfer)
The Toaster (heat and energy)
The Cathode Ray Tube (electric fields and forces)
The Multimeter (electrical measurement)
The Automobile Ignition System (electricity and magnetism)
The Solenoid (electricity and magnetism)
The Transformer (alternating currents and the magnetic properties of matter)
The Slide Projector (geometrical and physical optics)
The Binoculars (geometrical and physical optics)
The Camera (optics and photographic measurements)
The Spectrophotometer (spectral properties of light)
Photodetectors (interaction of light and matter)
The Incandescent Lamp (current electricity and photometry)
The Fluorescent Lamp (atomic physics and atomic spectra)
The Laser (modern optics and quantum mechanics)
The Geiger Counter (radioactivity and nuclear physics)
The Cloud Chamber (radioactivity and supersaturated vapors)

The modules are generally divided into three sections, each section representing about one week's class and laboratory work. Thus, an instructor (or student) can select from the library of 27 modules approximately four or five to comprise a one-semester course. The modules include well developed laboratory instructions that guide the student through various experiments to determine the quantitative behavior of the technological system. The results are then used to develop the relevant physical concepts and laws that account for them. Thus, the laboratory experiences are an integral part of the learning process and are not used simply to verify statements made in a lecture.

Further, the laboratory apparatus is a familiar real-life device, not a specially made device that a student will not see anywhere else again. Contemporary measuring instrumentation (thermistors, photocells, amplifiers, oscilloscopes and so on) is used to measure the device behavior. Most of the devices can be purchased from local retailers and at a cost that is small compared to conventional laboratory equipment. Equipment kits are also available, however, from Thornton Associates (37 Beaver Street, Waltham, Mass.) for those whose purchasing procedures encourage that mode.

The Physics of Technology program was designed originally with an engineering and engineering-technology audience in mind. This accounts for the more technical nature of some of the devices employed. However, many of the modules have been found appealing to less technical audiences and have produced favorable reports comparable to those described by Johnson et al.

This general approach represents a significant alternative to the conventional teaching practice. Instead of stating general laws of physics and later showing how they operate in specific instances, this approach starts with the quantitative behavior of a specific and familiar system and uses this to develop the relevant general laws.

It also places the physical device and laboratory experience in a central role. For students in the "concrete" phase of Piagetian development, these may well be essential ingredients to the learning of physics. And it may not be a bad method for teaching physics majors either!

JOHN W. MCWANE
Technical Curriculum Development Project
Massachusetts Institute of Technology
12/13/76 *Cambridge, Mass.*

Newton and de Broglie

In the year 1693 Isaac Newton suffered a personal crisis. He wrote odd letters to friends and experienced severe irritability and insomnia. Profound students of this great inventor of physical and mathematical theories have speculated that Newton's illness was purely emotional. Others have said that vitamin deficiency may have been a contributing factor.

Having studied and contemplated this uncharacteristic breakdown of Newton's it has occurred to me that he may have suffered from mercury poisoning. Newton was a lifelong alchemist. He joked that his hair turned gray prematurely as a result of working with quicksilver. He was engaged in just such work with mercury at the time of his crisis in 1693. I am making a concentrated investigation of this possibility. I would like to communicate with people concerned with the biography of Newton, and with mercury toxicity.