

letters

less money in the bank, into investments, etc. Take alternative (a): For example, which is more important to a child—luxurious surroundings and all the material possessions he could desire, or ample time with his father? Considering alternative (b), why should a man necessarily expect nowadays to be the sole or even the primary breadwinner of his family? With regard to alternative (c), I expect that there are a great many physicists who are so well paid that they could live just as comfortably on $\frac{3}{4}$ or $\frac{2}{3}$ of their present full-time salaries.

It is a tragedy that so many physicists are being forced out of their profession by the scarcity of full-time jobs. The situation could be partially alleviated if permanent part-time positions were made available and if people were encouraged to make use of them. At the same time our profession would become more flexible; the choice would exist for those who want it. Why should one be expected to work either full time or not at all? It makes no sense, both in physics and in many other professions. Finally, physics itself would surely benefit if more physicists were allowed to participate in their profession.

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Physics-related jobs

I would like to expand on a statement made by Arnold Strassenburg (October, page 23) which I believe to be the key issue at the heart of getting more physicists into physics-related problems. Strassenburg states that "many industrial laboratories prefer graduate engineers to physicists largely because they are more experienced in coping with practical problems and more willing to attack them . . . The main problem is one of attitude."

It is the attitude of both the professors and students in graduate physics departments that becomes their own worst enemy.

As a physicist with a background in theoretical solid-state physics who has worked primarily on industrial development projects, I remember an instance in which I visited my former university and told a former professor of theoretical particle physics about work I was doing on the spectral reflectance of hair, skin, wigs and beards. He laughed at me as though I were joking, and yet this research was related to 45 million dollars in other R&D.

I personally do not feel that my background or training was lacking in the pursuit of industrial problems. What was lacking was a proper atti-

tude towards industrial research. I must say that I had to fight with my own inner feelings about applied research for four years before I came to peace with myself.

These inner feelings arise, in general, from a notion among physics professors that research in physics for knowledge itself is the ultimate achievement for physicists. This of course arises from their enthusiasm for the subject (for which they cannot be blamed) and rubs off on their students. However, physics is not a closed system, and some physicists must interact with the outside world.

Engineering graduates are instilled with a different mental set. They are trained from the beginning to think of themselves not so much as electrical or mechanical engineers, but rather as *problem solvers*. Their allegiance lies not as much with the discipline itself as with the company they work for and the current problem they are working on. Physics graduates, on the other hand, have the same basic tools to solve problems, but usually their allegiance is to the field itself; because they have unconsciously been brainwashed into believing that applied research is somehow "dirty," they shun it.

Simply changing curricula to a more interdisciplinary nature cannot be the total answer to the physicist's job problems. Restructuring a curriculum to meet the needs of a fast-paced society is a little like setting up a new Maginot line. A good solid foundation in the *fundamentals* of physics and mathematics and the *desire* to solve applied problems is really what one needs.

Armed with this solid foundation and an ability to read and think all physicists can become "problem solvers." They already have the tools and where there is a will there is a way!

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In the thoughtful and interesting article by Arnold Strassenburg there appeared a table of enrollment in physics-related courses offered by physics departments from "Survey of Enrollments and Degrees in Physics," AIP Publication R-151.9.

I was surprised to find that the enrollment in courses concerning issues of science and religion was reported to be zero. I am unaware of the survey sources from which this information was obtained, but it certainly did not include The Cleveland State University.

For the past several quarters I have been teaching a physics course for non-

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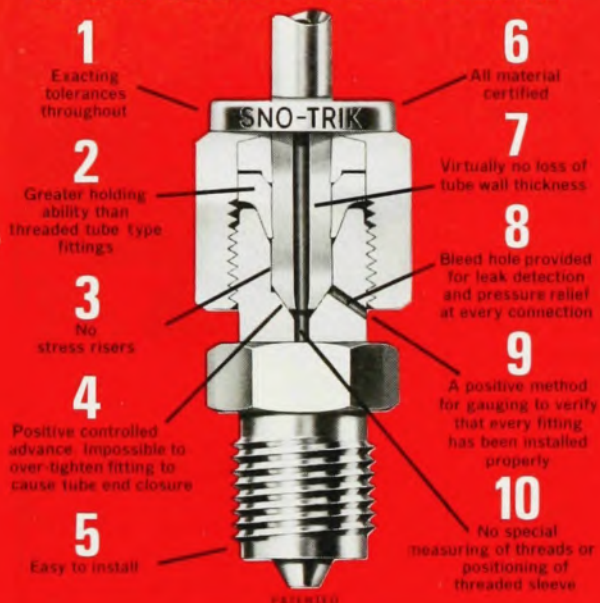
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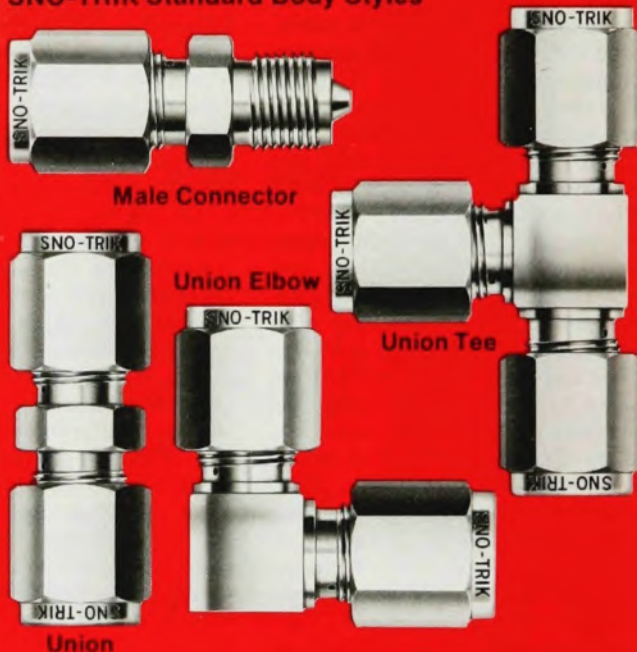
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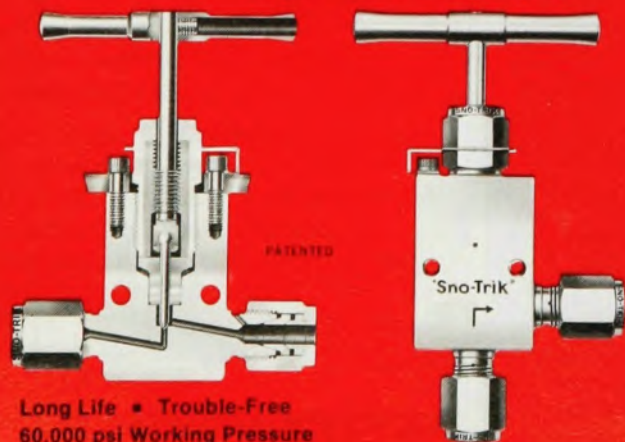
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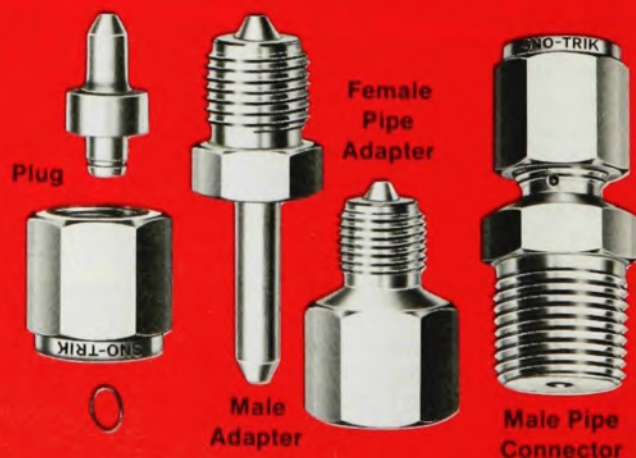
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science majors here entitled "Science and Religion," with what I feel to be quite gratifying results. As is well known, the strong tendency of late for young undergraduates to be turned off to the physical sciences has been complemented by an increasing interest in religious, philosophical and ethical themes. A religious and ethical approach to the study of physical reality (or God's creation if you will) has therefore become a quite natural and desirable path in our attempts to reach these students with the goal of having them understand not only the importance and relevancy of scientific research to their own lives, but also to make them cognizant of the on-going nature of our understanding of the physical world and the positive, personal implications of gaining a qualitative but sound understanding of the current worldview.

Using nonsecular, general concepts of "religion," "metaphysics," and so on as vehicles for the transmission of such knowledge in my own experience works pedagogically and works quite well. Using the motif of "determinism versus free-will" and an historical approach emphasizing the continuous interaction between physical and religious ideas, one can turn these students on to the implications of scientific discovery in particular to quantum mechanics, relativity, bootstraps and cosmology. Ironically, I have found that many of these students have gained a better qualitative understanding of modern physics than some of the physical-science majors.

If anyone else is exploring this approach to the propagation of physical science, I would be happy to enter into correspondence with him.

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Warm ocean?

Conrad Kopala's response (July, page 15) to Clarence Zener's vote for a "somewhat warmer ocean" deserves a rejoinder.

First, there is a vast difference between Kopala's assigning of an "implication" to Zener's statement, when it is more likely that it is an "inference" contributed by Kopala himself. As often happens, one man's inference is not necessarily another man's implication.

Second, there is a vast difference between the likelihood that "climate in the temperature (*sic*) zones would be warmer" and Kopala's abhorrence of hot weather. One need only reflect on the climates that would prevail along the US Atlantic coast and the Norway-Sweden peninsula if the Gulf Stream

were not to exert its stabilizing influence on the climates of both areas. Both areas are warmer; neither features "hot weather."

We know enough about the physics of water bodies as a heat sink to appreciate the thermostatic role oceans can play. It is more likely that a warmer ocean would reduce the extremes of heat and cold, narrowing the overall range by stabilizing fluctuations of temperature.

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Antimatter UFO's

In view of the large number of UFO's that have been reported recently it appears worth suggesting that some of the phenomena that have been designated as "flying saucers" could possibly be sightings of small specks of antimatter in the process of annihilation in the earth's atmosphere. A number of recently reported facts about electron-positron reactions indicates that such a possibility should not be automatically ruled out on the assumption that antimatter could not exist long enough to ever reach the earth's atmosphere.

Specifically, the existence of elastic scattering in some positron-electron collisions shows that not all direct collisions between matter and antimatter lead to a reaction. Added to this, the very small reaction cross sections of positrons with electrons makes it conceivable that actual atoms or molecules of antimatter (the properties of which are now unknown) could have a lifetime on the order of several minutes or more in the earth's atmosphere, and a very long lifetime in outer space. Also there appears to be, during the course of a series of annihilation reactions, an asymmetric formation of hadrons having significant momenta, which could result in the speck of antimatter undergoing gyrations comparable to Brownian motion while emitting enough photons to be visible over a considerable distance. A display of these characteristics could account for some unpublished photographs of objects purported to be "flying saucers."

Should the occurrence of such "UFO's" actually result from the intrusion of specks of antimatter into the earth's atmosphere, a study of the times and places where they have appeared might indicate regions of space where such specks are more prevalent, thus we could be better prepared for their appearance and better able to study their reactions in the atmosphere.

JACK EPSTEIN

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