

letters

dependent upon them. We need them in order to compete. This, I think, is the real dilemma that animates the American Physical Society's discovery of applied physics: if the universities can no longer absorb our issue, we will tailor our issue for other ends. The alternative, which is unthinkable, would be to do without all those students.

To see just how deep the dilemma is (and why applied physics is not the solution) consider for a moment that alternative. The PhD production rate needed for a stable physics population would be about three per university professor per lifetime—one to replace him (or her) when he (she) retires, the other two to go into nonreproductive jobs (industry, government laboratories, four year colleges, etc.). Assuming that by means of a resolute effort we could increase by a substantial factor the number of our (applied) physics graduates wanted by industry, that equilibrium ratio might increase, say, from three to four. That result would have no serious effect on the fundamental dilemma. The rate that we must decrease from is an average roughly fifteen PhD's per professor per career. What is needed is not curriculum reform, but a fundamental change in the system of academic research.

Even if we were willing to change the system, one might reasonably ask, what are we to do with the hordes of bright-eyed students who present themselves at our doorsteps each year, faces shining with the eager desire to learn physics? The question is a complex one that needs to be studied, although parts of the answer are easy to see. Graduate school is, after all, a kind of job. If the assistantships dry up, so will much of that eager desire. In any case, the point is that the system must change; that much is predictable from the inexorable mathematics of exponential growth. The only questions are, how? Into what? At the expense of whom? Those are questions we will not even begin to ask ourselves until we admit that change there must be.

Nevertheless, the education of students in applied physics is a worthy goal in its own right. I have avoided setting out in detail Caltech's curriculum in Applied Physics because it need not be copied. Each institution, deciding to initiate such a program, ought to build it (as Caltech did) around the particular predilections and strengths of its own faculty. However, on the basis of our experience, perhaps I can offer some suggestions for what ought not to be done.

Applied physics ought not to be presented offhandedly, as a sideline, by people who are physicists and would rather be doing pure physics. Here the matter of professorial titles enters. Applied physics students need Applied Physics professors whom they can copy,

with whom they can identify, by observing whose behavior they can learn what an applied physicist is and what one does. Otherwise applied physics just becomes second class physics, and the students we turn out will be neither very happy nor very good. The other side of this argument is that we are very good at training pure physics students (even if we train too many of them) and that kind of education should remain available and untampered with, both for the benefit of the students who remain dedicated to it, and for the future of our discipline.

To conclude then, let us by all means create the new discipline of applied physics. On intellectual, scientific and technological grounds it is more than justified. And let us face up squarely to the dilemma that disturbs all of us in the profession of academic physics. But let us not deceive ourselves into thinking that the first will resolve the second.

References

1. D. L. Goodstein, *States of Matter*, Prentice-Hall, Englewood Cliffs, New Jersey, (1975).
2. D. J. de Solla Price, *Little Science, Big Science*, Columbia University Press, New York, (1963).

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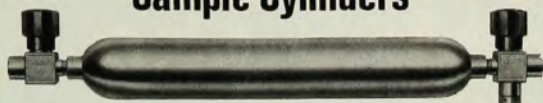
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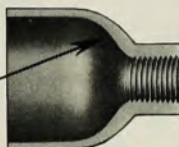
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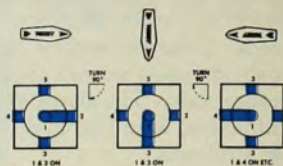
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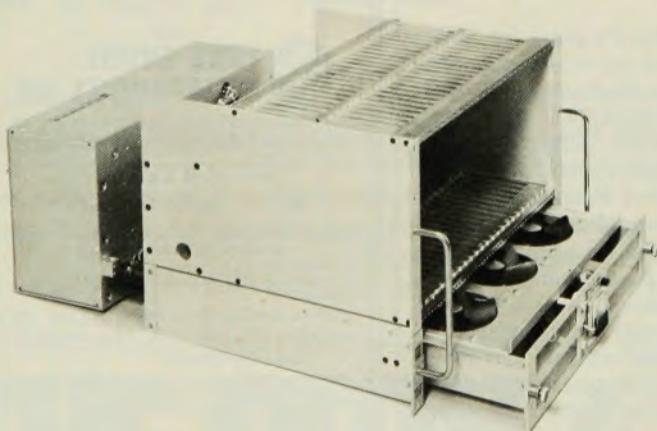
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