

trostatic and magnetic lenses were used in the early (circa 1930-32) electron microscopes by M. Knoll, R. Ruska, R. Rüdenberg and others.<sup>3</sup> To assert that modern electron microscopes (or early x-ray tubes, for that matter) are or were dependent on particle accelerators is quite misleading, rather like describing a television tube or vidicon or electrostatic dust precipitator as a "particle accelerator."

None of this, of course, detracts from the main thrust of Leiss' thesis.

### References

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2. M. M. Freundlich, *Science* **142**, 185 (1963).
3. J. G. Trump, "Accelerators, Van de Graaff," in *The Encyclopedia of Physics*, 2nd Edition, R. M. Besancon, Editor. New York, 1974, p. 13. Or R. J. Van de Graaff, R. J. Trump, and W. W. Buechner, *Rept. Progr. Phys.* **11**, 1 (1948).

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8/81

The account given by James Leiss in July prompts the following historical remarks as a guide to future public policy in the field of accelerator development.

The thousand-odd accelerators now in use in the semiconductor industry for ion implantation, to which Leiss referred, were the product entirely of the private sector, working with very limited resources. The first model of an implanter for use on a production line was made to the specifications of Mostek Corp. by Accelerators, Inc., a very small company in Austin, Texas, in 1971-72. Some of the technical problems were formidable, such as production of large ion currents using highly corrosive compounds of boron and phosphorus, and the delivery of high-current ion beams to large areas of semiconductor with excellent uniformity. The scientific staff of Accelerators, Inc., recognizing the seriousness of the problems and the national significance of what it was doing, sought support from the National Science Foundation. Eventually the problems were solved, but not a cent of support was obtained from the NSF despite the billions spent on accelerator development by it and other federal agencies.

Leiss also refers to the application of accelerators to cancer treatment and cites "studies of accelerator configurations which might be suitable for location in hospitals." It is pertinent to observe that the NSF, DOE and the National Cancer Institute have recog-

nized the need for a hospital-compatible neutron generator for cancer treatment for fifteen years, but none has yet been developed. Development grants and contracts have been repeatedly awarded, but have been invariably made to public-sector agencies without open competition. We still do not have a machine that meets specifications. Yet a design initially proposed by Accelerators, Inc., and fully described in the literature,<sup>1</sup> has been repeatedly refused support by public agencies without a single technical objection ever having been given to justify rejection of the proposal.

There is no doubt that a good deal has been achieved with the billions of federal dollars spent on accelerator development and research in the last fifty years. But considering the above-cited experiences, it is far from obvious that the federal effort has been cost-effective and in accordance with traditional standards of openness and free competition in the market-place of ideas. A critical study of the management of federally funded accelerator programs seems amply warranted.

### References

1. L. Cranberg, *Int. J. Radiation Oncology Biol. Phys.*, **3** (1977) 393, and *British Journal of Radiology*, **53** (1980) 262.

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8/81

### Weapons scientists

I was very pleased to see that you published a letter from Glenn Stumpff (May, page 102) in which he defended his position as a scientist involved in the development of weapons systems. All too often the debate on military research is weakened by the reluctance of those involved to make their views public. Whether this is the result of their habitual involvement with secrecy or lack of interest, I don't know. I assume it is not because they fear that their case is weak.

However, my pleasure at seeing his letter will not prevent me from pointing out that his argument is full of holes and commenting on one failure in particular, especially since Donald McNeill also omits mention of it in his reply. Stumpff's letter could have been written (changing names of countries here and there) equally well by a Russian weapons scientist. This is important because it draws attention to the fact that Stumpff is a part of a weapons-producing system. This system incorporates the US government, the US military structure, its industrial system, its scientists and its intelligence agencies; in addition it includes the Russian government, the Russian mili-

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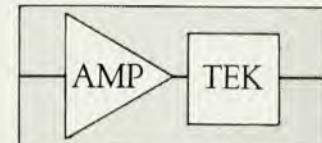
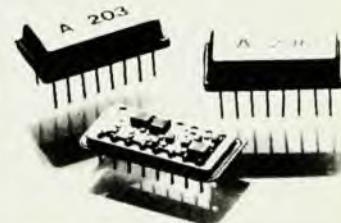
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tary structure, its industrial system, its scientists and its intelligence agencies. To a lesser extent the corresponding bodies of other nations are also involved.

This system has the overriding characteristic that it is producing a continued growth in armaments, particularly weapons of mass destruction; it is characterized by positive feedback (a vicious circle, if you prefer). It should be noted that, in positive feedback systems, growth occurs until something malfunctions. In this case, malfunction almost inevitably means nuclear war and the resultant destruction of civilization.

Stumpff may function well as a cog in the system (and his letter is the sort of response that suggests that he does) but he would do well to take a look at the system as a whole and see if he can't find a way to break the feedback loop rather than reinforce it. Weapons scientists have too often played an important role in opposing arms control initiatives and the *promotion* of weapons systems whose principal effect was to give the spiral another push forward.

In short, to use technical terminology, what Stumpff is doing is choosing not to see the wood for the trees.

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**THE AUTHOR COMMENTS:** J. A. Eades claims that my argument is full of holes but yet doesn't say what these holes are. I assume this is not because he fears that his case is weak. My letter was simply trying to point out to certain apparently unaware people that, along with every other individual, I have a fundamental right to defend myself against a perceived threat. If Eades doesn't perceive the same threat that I do then he is under no obligation to worry about it. Yes, Dr. Eades, I understand that you're perceiving what you think is another threat. I'm perceiving it too. (I don't think that there's anyone in a position at all similar to mine that doesn't perceive it!) We weapons scientists aren't as naive or stupid as the rest of the world seems to think.) The course that we are on is not entirely pleasant, to say the least, but I don't see any desirable and possible alternatives. However, if you in fact do have a viable alternative, rather than some half thought-out placebo, most of us are willing to listen!

Eades mentions that my Russian counterpart could have written a letter similar to my own. While I understand the point he was really trying to make, his statement is technically quite irrelevant. Although my Russian counterpart could defend his right to do what

he does, would he actually ever have a need to? I think it's quite clear that the Soviet government itself does a more than adequate job of defending the Russian scientists' right to build weapons. Just think Dr. Eades! Forget the abstract logical inventions and just consider the question: Could you or McNeill have written your respective letters (and not been penalized for it) if you were both Soviet residents? Eades' opening sentences indicate to me that he cherishes his freedom to challenge my right to do what I do. It's ironic, but I work to increase his chances of always having that freedom—and for that all I get is to be accused of being a monster who must obviously want to destroy the world! To return to what I think was Eades' real point, very simply, if my Russian counterpart really believe that I'm a threat to him then he is obligated to defend himself in whatever manner he feels is best. To do anything less would be immoral. (This of course assumes that Russian scientists actually have a free choice as to whether or not they want to help their government's war machine.)

Eades contends that I am part of a weapons-producing system. That's a rather simplistic point of view, but he has a right to it if he finds it useful. However, his assertion that Russian scientists are part of the *same* system is not only absurd but completely useless as well. Such a gross oversimplification will do nothing at all to slow, let alone end, the so-called "arms race"; it only indicates how little Eades understands the problem. I don't think that the US and the Soviet Union have any mutual and compatible objectives at all, let alone one involving the world's destruction—as Eades seems to believe.

Given that I am not a part of the Russian weapons-producing system, it appears impossible for me to do anything to break the "positive feedback loop" mentioned by Eades. However, I will reiterate my previous letter's closing statement and say that when the Russian scientists stop building weapons so will I, but not before; I simply do not trust that the Soviet government will allow my Russian counterpart to stop. The only option that I can see right now is to go on as I am and hope that the loop breaks down on their side first. Yes, Dr. Eades, I realize that it's a very real possibility that this breakdown may involve the rest of the world—that, in spite of our efforts, a nuclear war may still result. I simply and earnestly hope that such an event does not occur. Even if we fail and it does, I do not consider a nuclear war the worst thing that could possibly occur; having to live like Andrei Sakharov is worse. (As far as I'm concerned, Sakharov is more thoroughly destroyed than any nuclear weapon

could ever harm me!)

I hope that this letter discourages Eades from his view that I'm simply a cog in a system. (Although, I have to agree; I do function rather well at what I do.) I think I am sufficiently, if not fully, aware of what I am doing and the possible consequences. I do not remember ever having made a choice "not to see the wood for the trees." In fact, whether or not Eades ever made such a choice, I am forced to turn his charge back on himself. I think Eades is in fact the one that's lost in the woods.

GLENN H. STUMPF II

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6/81

## Weapons-research funding

"State and Society" in April (page 55) apparently gave only a partial listing of "physics-related" research funding by the DOE. Conspicuously absent from the list of allocations was the massive DOE funding of nuclear and laser weapons research, which employs thousands of physicists. PHYSICS TODAY has discussed direct military (OMR) funding of physics research in previous issues.

One wonders by what measure are these DOE weapons projects distinguished from energy research or OMR projects by the editorial policy of PHYSICS TODAY. The DOE weapons projects are clearly as "related" to physics, no less basic than the fission and fusion energy research discussed in the article.

It cannot be that the intent of the sponsor is a factor, because the basic missions of the DOE and the OMR's with respect to military research may be presumed identical. Nor can the intent of the funded institution with respect to the purposes of its research enter, because several institutions accept DOE weapons funds along with OMR or non-military DOE funds.

It seems as if those who are fast to the white whale of weapons research are not to be remembered—an editorial policy which may mislead student readers about the nature of career opportunities in some fields of physics. It would be interesting to learn how it is that OMR-funded researchers are exempt from the taboo.

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5/81

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## Correction

November page 235—C. B. Duke and J. C. Johnson were inadvertently dropped from the list of members of the AIP Governing Board's Executive Committee.