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Command Classified Symposium on Aerospace and Electronics Systems." (The advance program for this meeting, printed in an IEEE publication along with a Security Clearance Form, describes a session on precision guided weapons whose effectiveness has "been demonstrated in Southeast Asia.")

This is an opportune time to examine the circumstances surrounding the Indochina War, the possibilities of continued (or renewed) U.S. involvement, and the likelihood of similar episodes occurring elsewhere. In the light of such an examination, responsible professionals employed on military projects should carefully consider whether such activity is consonant with their own moral principles. Major emotional barriers to such an appraisal by many Americans stem from the implicit beliefs that: (a) Our country is always in the right. (b) Its current opponent has essentially the character and intentions of Hitler's Germany.

These premises, which cannot be sustained by any serious study of history, inspire many angry denunciations of those who criticize Government policies.

Consider instead the following:

1. The regimes that the U.S. has backed in Vietnam, ranging from Bao Dai (under the French) through Thieu, have consistently represented the interests of a corrupt and cruel minority; none ever commanded significant popular support.

2. U.S. intervention has never had any legal or moral basis.

3. This intervention has involved the deception of the people of the United States and has caused enormous harm to the people of Indochina.

It would be futile to attempt to validate these points in a brief note, and so I urge the reader to make his own study. (The references at the end of this letter might be a useful starting point.)

All Americans should inform themselves on this subject. There is a special obligation on the part of those engaged in war-related work. Albert Speer wrote, "being in a position to know and nevertheless shunning knowledge creates direct responsibility."

Stephen H. Unger  
Columbia University  
New York, N. Y.

#### BIBLIOGRAPHY

Kahin and Lewis, *The United States and Vietnam* (2nd ed.). New York: Dial, 1969.

*The Pentagon Papers*. Boston: Beacon, 1971.

Zinn, *Vietnam: The Logic of Withdrawal*. Boston: Beacon, 1967.

Ellsberg, *Papers on the War*. New York: Simon and Shuster, 1972.

#### Battery prospects

I should like to add to the list of comments in Forum following J. T. Salihi's article on electric cars (July 1972, pp. 43-47). The two fundamental issues involved

are the technological feasibility of a battery of the required characteristics and the economics of its manufacture. Similar problems arise in connection with the following issues: (1) the expected shift toward electricity as the predominant form in which energy is consumed<sup>1</sup>; (2) the possible emergence of large-scale generation of electricity by solar energy conversion<sup>1</sup>; (3) the need for large-energy-capacity batteries for electric power substations (in 10- to 20-MW blocks) to provide local peaking capability with minimal effects on air quality.<sup>2</sup>

It is evident from the examples that research and development aimed at increasing the energy capacity, decreasing the cost, increasing the reliability and lifetime, etc., of secondary batteries is socially very relevant. From this point of view it is necessary to take a closer look at the fundamental principles upon which future research and development may be based.

A very important fact is that present batteries are very far from the fundamental limitations imposed by thermodynamics—their specific energies (Wh/kg) are five to ten times less than the theoretical values.<sup>3</sup> Even when allowance is made for the weight of the electrolyte, cell housings, etc., there is still a large margin for increasing the specific energy, which is one of the most significant parameters of a battery.

Other limitations may be associated with the kinetics of various processes (e.g., conduction and electrode reactions) occurring in the battery. However, one can visualize various ways, at least in principle, by which conduction, even in solids, can be increased (e.g., by using single crystals, thin films, membranes) and electrode reactions can be accelerated, made more reversible, etc. This, in turn, would result in a lower operating temperature, better charging and discharging behavior, increased lifetime, etc. The point is that the present kinetical limitations are surmountable since they are not fundamental in nature.

In short, the parameters of a future high-capacity battery, as set forth, for instance, in the Salihi article, do not seem to be unrealistic. What is required is, perhaps, the infusion of more new ideas, concepts, and techniques into the old field of batteries. I think that a large-scale effort based upon a multidisciplinary approach (electrochemistry, solid-state physics and chemistry, electrical engineering, surface chemistry, etc.) could lead to the solution of the problems mentioned. (The transformation of the old crystal detector into modern semiconductor diodes, with a time lag of about 40 years, provides an interesting example for the possibility of such a revitalization.)

The combination of great social need and inherent possibility for very significant technological and economic advances puts battery R&D in a rather unique and, in my opinion, promising po-



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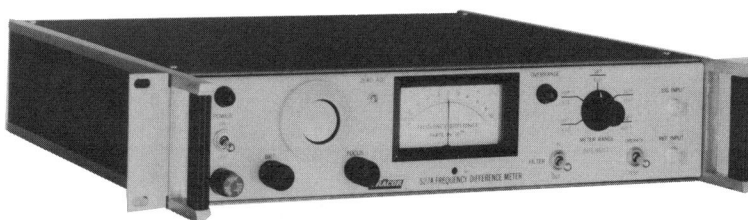
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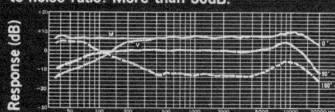




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sition. This fact should be recognized by everybody concerned with the future supply and distribution of energy as well as with the quality of our environment.

Akos G. Revesz  
COMSAT Laboratories  
Clarksburg, Md.

1. Concluding article of a series of survey articles on energy problems, *Science*, vol. 179, p. 174, 1973.

2. Meese, W. G., remarks on a new approach to R&D by the electric power industry, *IEEE Power Engineering Soc. News-letter*, p. 7, June 1972.

3. Cairns, E. J., and Shimotake, H., *Science*, vol. 164, p. 1347, 1969.

## Solid-state kazoo

In regard to memorabilia of the early days of transistors, I am surprised that no one has mentioned Bardeen's "kazoo."

Early in 1950, I was privileged to attend a seminar on transistor technology at the U.S. Air Force Watson Laboratories in Eatontown, N.J. As I recall, Shockley and Bardeen each conducted part of the discussion. The discussion was excellent in that it unified the somewhat fragmented information available from the literature at the time. However, the picture indelibly imprinted on my memory was Dr. Bardeen's demonstration of a four-tone audio oscillator.

This point-contact transistor oscillator was contained in a small, hand-held box. It was powered by a battery that Dr. Bardeen manufactured on the spot. The battery was made up of a silver coin (quarter, I believe), which clamped a piece of blotter to a second electrode. Dr. Bardeen prepared the blotter paper for its role by wetting it in his mouth. With this as sole power source, Bardeen rendered a clearly audible "How Dry I Am."

Dale Ashcroft  
Ward Leonard Electric Co., Inc.  
Mount Vernon, N. Y.

## More on the transistor

As an extension of the background of the article, "How the Transistor Emerged" (Jan., pp. 24-33), I commend to *Spectrum's* readers the article, "The Twenty Lost Years of Solid-State Physics," by Theodore L. Thomas. Published in the March 1965 issue of *Analogs*, it describes the issuance of several patents to a Julius Edgar Lilienfeld of Brooklyn, N.Y., in the 1930s.

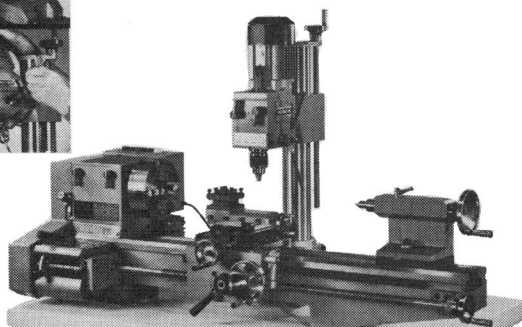
Dr. Lilienfeld claims, in Patent 1 745 175, "The method of controlling the flow of an electric current in an electrically conducting medium of minute thickness, which comprises subjecting the same to an electrostatic influence to impede the flow of said current by maintaining at an intermediate point in proximity thereto a potential in excess of the particular potential prevailing at that point."

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